



Coastline, Nauru

References

- Abram, N.J., McGregor, H.V., Gagan, M.K., Hantoro, W.S., and Suwargadi, B.W., (2009), Oscillations in the southern extent of the Indo-Pacific Warm Pool during the mid-Holocene: *Quaternary Science Reviews*, v. 28, p. 2794-2803.
- Adler, R.F., Huffman, G.J., Chang, A., Ferraro, R., Xie, P.P., Janowiak, J., Rudolf, B., Schneider, U., Curtis, S., Bolvin, D., Gruber, A., Susskind, J., Arkin, P., and Nelkin, E., (2003), The version-2 global precipitation climatology project (GPCP) monthly precipitation analysis (1979–present): *Journal of Hydrometeorology*, v. 4, p. 1147-1167.
- Alexander, L.V., Zhang, X., Peterson, T.C., Caesar, J., Gleason, B., Tank, A.M.G.K., Haylock, M., Collins, D., Trewin, B., Rahimzadeh, F., Tagipour, A., Kumar, K.R., Revadekar, J., Griffiths, G., Vincent, L., Stephenson, D.B., Burn, J., Aguilar, E., Brunet, M., Taylor, M., New, M., Zhai, P., Rusticucci, M., and Vazquez-Aguirre, J.L., (2006), Global observed changes in daily climate extremes of temperature and precipitation: *Journal of Geophysical Research-Atmospheres*, v. 111.
- Allen, M.S., (2006), New ideas about late Holocene climate variability in the central Pacific: *Current Anthropology*, 47, 521-35.
- Alley, R.B., Clark, P.U., Huybrechts, P. And Joughin, I., (2005), Ice-sheet and sea-level changes: *Science*, v. 310, p. 456-460
- Anderson, A., Chappell, J., Gagan, M.K., and Grove, R., (2006), Prehistoric maritime migration in the Pacific islands: an hypothesis of ENSO forcing: *Holocene*, v. 16, p. 1-6.
- Anthony, K.R.N., Kline, D.I., Diaz-Pulido, G., Dove, S., and Hoegh-Guldberg, O., (2008), Ocean acidification causes bleaching and productivity loss in coral reef builders: Proceedings of the National Academy of Sciences of the United States of America, v. 105, p. 17442-17446.
- Antonov, J. I., R. A. Locarnini, T. P. Boyer, A. V. Mishonov, and H. E. Garcia, (2006), World Ocean Atlas 2005, Volume 2: Salinity. S. Levitus, (ed.) NOAA Atlas NESDIS 62, U.S. Government Printing Office, Washington, D.C., 182 pp.
- Ashok, K., Behera, S.K., Rao, S.A., Weng, H.Y., and Yamagata, T., (2007), El Nino Modoki and its possible teleconnection: *Journal of Geophysical Research-Oceans*, v. 112.
- Ashok, K., Guan, Z.Y., and Yamagata, T., (2001), Impact of the Indian Ocean Dipole on the relationship between the Indian monsoon rainfall and ENSO: *Geophysical Research Letters*, v. 28, p. 4499-4502.
- Ashok, K., and Yamagata, T., (2009), The El Nino with a difference: *Nature*, v. 461, p. 481-484.
- AS/NZS 1170.2:2002, (2002): *Structural design actions, Part 2: Wind actions*. Australian Standards/ New Zealand Standards.
- Barry, R.G., and Chorley, R.J., (1992), *Atmosphere, weather, and climate*: London ; New York, Routledge, xxi, 392 p. p.
- Bell, J.D., J.E. Johnson, and A.J Hobday, (eds.), (2011): *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*. Secretariat of the Pacific Community (SPC), Noumea, New Caledonia.
- Bender, M.A., Knutson, T.R., Tuleya, R.E., Sirutis, J.J., Vecchi, G.A., Garner, S.T., and Held, I.M., (2010), Modeled Impact of Anthropogenic Warming on the Frequency of Intense Atlantic Hurricanes: *Science*, v. 327, p. 454-458.
- Bengtsson, L., Bottger, H., and Kanamitsu, M., (1982), Simulation of Hurricane-Type Vortices in a General-Circulation Model: *Tellus*, v. 34, p. 440-457.
- Beranger, K., Barnier, B., Gulev, S., and Crepon, M., (2006), Comparing 20 years of precipitation estimates from different sources over the world ocean: *Ocean Dynamics*, v. 56, p. 104-138.
- Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley and A. Unnikrishnan, (2007): *Observations: Oceanic Climate Change and Sea Level*. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, US
- Birner, T., (2010), Recent widening of the tropical belt from global tropopause statistics: Sensitivities: *Journal of Geophysical Research-Atmospheres*, v. 115.
- Bister, M., and Emanuel, K.A., (1998), Dissipative heating and hurricane intensity: *Meteorology and Atmospheric Physics*, v. 65, p. 233-240.
- Black, E., Slingo, J., and Sperber, K.R., (2003), An observational study of the relationship between excessively strong short rains in coastal East Africa and Indian Ocean SST: *Monthly Weather Review*, v. 131, p. 74-94.
- Bosilovich, M.G., Chen, J.Y., Robertson, F.R., and Adler, R.F., (2008), Evaluation of global precipitation in reanalyses: *Journal of Applied Meteorology and Climatology*, v. 47, p. 2279-2299.
- Broccoli, A.J., and Manabe, S., (1990), Can Existing Climate Models Be Used to Study Anthropogenic Changes in Tropical Cyclone Climate: *Geophysical Research Letters*, v. 17, p. 1917-1920.

- Brohan, P., Kennedy, J.J., Harris, I., Tett, S.F.B., and Jones, P.D., (2006), Uncertainty estimates in regional and global observed temperature changes: A new data set from 1850: *Journal of Geophysical Research-Atmospheres*, v. 111.
- Brown, J. R., Moise, A. F. and Delage, F. P., (in press), Changes in the South Pacific Convergence Zone in IPCC AR4 future climate projections: *Climate Dynamics*, doi:10.1007/s00382-011-1192-0.
- Brown, J., Collins, M., Tudhope, A.W., and Toniazzo, T., (2008), Modelling mid-Holocene tropical climate and ENSO variability: towards constraining predictions of future change with palaeo-data: *Climate Dynamics*, v. 30, p. 19-36.
- Brown, J.R., Power, S.B., Delage, F.P., Colman, R.A., Moise, A.F., and Murphy, B.F., (2011), Evaluation of the South Pacific Convergence Zone in IPCC AR4 Climate Model Simulations of the Twentieth Century: *Journal of Climate*, v. 24, p. 1565-1582.
- Cai, W.J., and Cowan, T., (2007), Trends in Southern Hemisphere circulation in IPCC AR4 models over 1950-99: Ozone depletion versus greenhouse forcing: *Journal of Climate*, v. 20, p. 681-693.
- Cai, W., Cowan, T., and Sullivan, A., (2009a), Recent unprecedented skewness towards positive Indian Ocean Dipole occurrences and its impact on Australian rainfall: *Geophysical Research Letters*, v. 36.
- Cai, W., Shi, G., Cowan, T., Bi, D., and Ribbe, J., (2005), The response of the Southern Annular Mode, the East Australian Current, and the southern mid-latitude ocean circulation to global warming: *Geophysical Research Letters*, v. 32.
- Cai, W., Sullivan, A., and Cowan, T., (2009b), Climate change contributes to more frequent consecutive positive Indian Ocean Dipole events: *Geophysical Research Letters*, v. 36.
- Cai, W., Sullivan, A., and Cowan, T., (2009c), How rare are the 2006–2008 positive Indian Ocean Dipole events? An IPCC AR4 climate model perspective: *Geophysical Research Letters*, v. 36.
- Cai, W., Sullivan, A., Cowan, T., Ribbe, J., and Shi, G., (2011), Simulation of the Indian Ocean Dipole: A relevant criterion for selecting models for climate projections: *Geophysical Research Letters*, v. 38.
- Callaghan, D.P., Nielsen, P., Cartwright, N., Gourlay, M.R., and Baldock, T.E., (2006), Atoll lagoon flushing forced by waves: *Coastal Engineering*, v. 53, p. 691-704.
- Callaghan, J. and Power, S.B., (2010), Variability and decline in the number of severe tropical cyclones making land-fall over eastern Australia since the late nineteenth century: *Climate Dynamics*, v. 37, issue 3-4, p. 647-662.
- Camargo, S.J., Emanuel, K.A., and Sobel, A.H., (2007a), Use of a genesis potential index to diagnose ENSO effects on tropical cyclone genesis: *Journal of Climate*, v. 20, p. 4819-4834.
- Camargo, S.J., Sobel, A.H., Barnston, A.G., and Emanuel, K.A., (2007b), Tropical cyclone genesis potential index in climate models: *Tellus Series a-Dynamic Meteorology and Oceanography*, v. 59, p. 428-443.
- Camargo, S.J., and Zebiak, S.E., (2002), Improving the detection and tracking of tropical cyclones in atmospheric general circulation models: *Weather and Forecasting*, v. 17, p. 1152-1162.
- Cao, L., Klijn, N. and Gleeson, T. (2003), Modelling the effects of a temporary loss of export markets in case of a foot and mouth disease outbreak in Australia: preliminary results on costs to Australian beef producers and consumers: *Agribusiness Review*, v. 11, p.1-18.
- Cazenave, A., and Llovel, W., (2010), Contemporary Sea Level Rise: *Annual Review of Marine Science*, v. 2, p. 145-173.
- Chan, J.C.L., (1985), Tropical Cyclone Activity in the Northwest Pacific in Relation to the El-Nino Southern Oscillation Phenomenon: *Monthly Weather Review*, v. 113, p. 599-606.
- Chan, J.C.L., (2005), Interannual and interdecadal variations of tropical cyclone activity over the western North Pacific: *Meteorology and Atmospheric Physics*, v. 89, p. 143-152.
- Chan, J.C.L., (2006), Comment on “Changes in tropical cyclone number, duration, and intensity in a warming environment”: *Science*, v. 311.
- Chan, J.C.L., and Shi, J.E., (1996), Long-term trends and interannual variability in tropical cyclone activity over the western North Pacific: *Geophysical Research Letters*, v. 23, p. 2765-2767.
- Chao, B.F., Wu, Y.H. and Li, Y.S. (2008), Impact of Artificial Reservoir Water Impoundment on Global Sea Level. *Science*, 320, 212-214.
- Chen, F., and Dudhia, J., (2001), Coupling an advanced land surface-hydrology model with the Penn State-NCAR MM5 modeling system. Part II: Preliminary model validation: *Monthly Weather Review*, v. 129, p. 587-604.
- Chou, C., Neelin, J.D., Chen, C.A., and Tu, J.Y., (2009), Evaluating the “Rich-Get-Richer” Mechanism in Tropical Precipitation Change under Global Warming: *Journal of Climate*, v. 22, p. 1982-2005.
- Chowdhury, M.R., Chu, P.S., and Schroeder, T., (2007), ENSO and seasonal sea-level variability - A diagnostic discussion for the US-Affiliated Pacific Islands: *Theoretical and Applied Climatology*, v. 88, p. 213-224.
- Chowdhury, M. R., Chu, P.-S., Zhao, X. Schroeder, T.A. and Marra, J.J. (2010), Sea level extremes in the U.S.-Affiliated Pacific Islands – a coastal hazard scenario to aid in decision analyses. *J. Coast Conservation*, v. 14, p. 53-62.

- Christensen, J.H., Hewitson, B., Busuioac, A., Chen, A., Gao, X., Held, I., Jones, R., Kolli, R.K., Kwon, W.-T., Laprise, R., Magaña Rueda, V., Mearns, L., Menéndez, C.G., Räisänen, J., Rinke, A., Sarr, A. and Whetton, P., (2007), Regional Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Church J.A., Gregory J.M., Huybrechts P., Kuhn M., Lambeck K., Nhuan M.T., Qin D. & Woodworth P.L. (2001), Changes in Sea Level. In: *Climate Change 2001: The Scientific Basis. Contribution of Working Group 1 to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P. van der Linden, X. Dai, K. Maskell and C.I. Johnson, (eds.)], pp.639-694, Cambridge University Press, Cambridge.
- Church, J.A., Gregory, J.M., White, N.J., Platten, S.M., and Mitrovica, J.X., (2011), Understanding and Projecting Sea Level Change: *Oceanography*, v. 24, p. 130-143.
- Church, J.A., and White, N.J., (2006), A 20th century acceleration in global sea-level rise: *Geophysical Research Letters*, v. 33.
- Church, J. A. and N.J. White (in press), Sea-level rise from the late 19th to the early 21st Century. *Surveys in Geophysics*, doi:10.1007/s10712-011-9119-1.
- Church, J.A., White, N.J., Aarup, T., Wilson, W.S., Woodworth, P.L., Domingues, C.M., Hunter, J.R., and Lambeck, K., (2008), Understanding global sea levels: past, present and future: *Sustainability Science*, v. 3, p. 9-22.
- Church, J.A., White N.J. and Arblaster, J.M. (2005). Significant decadal-scale impact of volcanic eruptions on sea level and ocean heat content. *Nature*, v. 438, p. 74-77.
- Church, J.A., White, N.J., Coleman, R., Lambeck, K., and Mitrovica, J.X., (2004), Estimates of the regional distribution of sea level rise over the 1950–2000 period: *Journal of Climate*, v. 17, p. 2609-2625.
- Church, J.A., White, N.J., and Hunter, J.R., (2006), Sea-level rise at tropical Pacific and Indian Ocean islands: *Global and Planetary Change*, v. 53, p. 155-168.
- Church, J.A., P.L. Woodworth, T. Aarup and W. S. Wilson, (eds.), (2010): *Understanding Sea-level Rise and Variability*. Wiley-Blackwell Publishing, Chichester, UK. 427 pp.
- Clark, P.U., Mitrovica, J.X., Milne, G.A., and Tamisiea, M.E., (2002), Sea-level fingerprinting as a direct test for the source of global meltwater pulse 1A: *Science*, v. 295, p. 2438-2441.
- Cobb, K.M., Charles, C.D., Cheng, H., and Edwards, R.L., (2003), El Nino/Southern Oscillation and tropical Pacific climate during the last millennium: *Nature*, v. 424, p. 271-276.
- Cogley, J.G., (2009), Geodetic and direct mass-balance measurements: comparison and joint analysis: *Annals of Glaciology*, v. 50, p. 96-100.
- Coles, S., Bawa, J., Trenner, L., and Dorazio, P., (2001), An introduction to statistical modeling of extreme values: London, Springer, ix, 208 p.
- Collins, M., An, S.I., Cai, W.J., Ganachaud, A., Guilyardi, E., Jin, F.F., Jochum, M., Lengaigne, M., Power, S., Timmermann, A., Vecchi, G., and Wittenberg, A., (2010), The impact of global warming on the tropical Pacific ocean and El Nino: *Nature Geoscience*, v. 3, p. 391-397.
- Cook, E.R., Palmer, J.G., and D'Arrigo, R.D., (2002), Evidence for a 'Medieval Warm Period' in a 1,100 year tree-ring reconstruction of past austral summer temperatures in New Zealand: *Geophysical Research Letters*, v. 29.
- Corney S.P., Katzfey, J.J., McGregor, J.L., Grose, M.R., Bennett, J.C., White, C.J., Holz, G.K., Gaynor, S.M., and Bindoff N.L., (2010), Climate Futures for Tasmania: climate modelling technical report, Antarctic Climate and Ecosystems Cooperative Research Centre, Hobart.
- Cravatte, S., Delcroix, T., Zhang, D.X., McPhaden, M., and Leloup, J., (2009), Observed freshening and warming of the western Pacific Warm Pool: *Climate Dynamics*, v. 33, p. 565-589.
- Crimp, S., Howden, M., Laing, A., Gaydon, D. Gartmann, A., Brown, P. and Nelson, R. (2009), Managing future agricultural production in a variable and changing climate. In the proceedings of the *International Scientific Congress on Climate Change – Global Risks, Challenges and Decisions*, Copenhagen 2009, 10–12 March, p. 328-332.
- Curry, J.A., Webster, P.J., and Holland, G.J., (2006), Mixing politics and science in testing the hypothesis that greenhouse warming is causing a global increase in hurricane intensity: *Bulletin of the American Meteorological Society*, v. 87, p. 1025-1037.
- Dai, A., (2006), Precipitation characteristics in eighteen coupled climate models: *Journal of Climate*, v. 19, p. 4605-4630.
- D'Arrigo, R., Cook, E.R., Wilson, R.J., Allan, R., and Mann, M.E., (2005), On the variability of ENSO over the past six centuries: *Geophysical Research Letters*, v. 32.
- D'Arrigo, R., and Smerdon, J.E., (2008), Tropical climate influences on drought variability over Java, Indonesia: *Geophysical Research Letters*, v. 35.

- Davidson, N.E., McBride, J.L., and McAvaney, B.J., (1983), The Onset of the Australian Monsoon during Winter Monex - Synoptic Aspects: *Monthly Weather Review*, v. 111, p. 496-516.
- De Szoeke, S.P., and Xie, S.P., (2008), The tropical eastern Pacific seasonal cycle: Assessment of errors and mechanisms in IPCC AR4 coupled ocean - Atmosphere general circulation models: *Journal of Climate*, v. 21, p. 2573-2590.
- Dee, D.P., Uppala, S.M., Simmons, A.J., Berrisford, P., Poli, P., Kobayashi, S., Andrae, U., Balmaseda, M.A., Balsamo, G., Bauer, P., Bechtold, P., Beljaars, A.C.M., van de Berg, L., Bidlot, J., Bormann, N., Delsol, C., Dragani, R., Fuentes, M., Geer, A.J., Haimberger, L., Healy, S.B., Hersbach, H., Holm, E.V., Isaksen, I., Kallberg, P., Kohler, M., Matricardi, M., McNally, A.P., Monge-Sanz, B.M., Morcrette, J.J., Park, B.K., Peubey, C., de Rosnay, P., Tavolato, C., Thepaut, J.N., and Vitart, F., (2011), The ERA-Interim reanalysis: configuration and performance of the data assimilation system: *Quarterly Journal of the Royal Meteorological Society*, v. 137, p. 553-597.
- Delcroix, T., Henin, C., Porte, V. and Arkin, P., (1996), Precipitation and sea surface salinity in the tropical Pacific. *Deep Sea Research*, v. 43, p. 1123-1141.
- Denman, K.L., G. Brasseur, A. Chidthaisong, P. Ciais, P. Cox, R.E. Dickinson, D. Hauglustaine, C. Heinze, E. Holland, D. Jacob, U. Lohmann, S. Ramachandran, P.L. da Silva Dias, S.C. Wofsy, and X. Zhang, (2007): Couplings Between Changes in the Climate System and Biogeochemistry. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Deser, C., Phillips, A.S. and Alexander, M.A. (2010). Twentieth century tropical sea surface temperature trends revisited. *Geophysical Research Letters*, v. 37.
- DiNezio, P.N., Clement, A.C., Vecchi, G.A., Soden, B.J., and Kirtman, B.P., (2009), Climate Response of the Equatorial Pacific to Global Warming: *Journal of Climate*, v. 22, p. 4873-4892.
- Domingues, C.M., Church, J.A., White, N.J., Gleckler, P.J., Wijffels, S.E., Barker, P.M., and Dunn, J.R., (2008), Improved estimates of upper-ocean warming and multi-decadal sea-level rise: *Nature*, v. 453, p. 1090-1096.
- Dommenget, D., (2010), An objective analysis of the observed spatial structure of the tropical Indian Ocean SST variability. *Climate Dynamics*, v. 36, issue 11-21, p. 2129-2145
- Donnelly, J.P., Cleary, P., Newby, P., and Ettinger, R., (2004), Coupling instrumental and geological records of sea-level change: Evidence from southern New England of an increase in the rate of sea-level rise in the late 19th century: *Geophysical Research Letters*, v. 31.
- Dore, J.E., Lukas, R., Sadler, D.W., Church, M.J. and Karl, D.M. (2009), Physical and biogeochemical modulation of ocean acidification in the central North Pacific. *Proceedings of the National Academy of Sciences of the United States of America*, v. 106, p. 12235-12240.
- Dunkerton, T.J., Montgomery, M.T., and Wang, Z., (2009), Tropical cyclogenesis in a tropical wave critical layer: easterly waves: *Atmospheric Chemistry and Physics*, v. 9, p. 5587-5646.
- Dunn, J.R., and Ridgway, K.R., (2002), Mapping ocean properties in regions of complex topography: *Deep-Sea Research Part I-Oceanographic Research Papers*, v. 49, p. 591-604.
- Durack, P.J., and Wijffels, S.E., (2010), Fifty-Year Trends in Global Ocean Salinities and Their Relationship to Broad-Scale Warming: *Journal of Climate*, v. 23, p. 4342-4362.
- Emanuel, K.A., and Nolan, D.S., (2004), Tropical cyclone activity and global climate: *Bulletin of the American Meteorological Society*, v. 85, p. 666-667.
- Etheridge, D.M., Steele, L.P., Langenfelds, R.L., Francey, R.J., Barnola, J.M., and Morgan, V.I., (1996), Natural and anthropogenic changes in atmospheric CO₂ over the last 1000 years from air in Antarctic ice and firn: *Journal of Geophysical Research-Atmospheres*, v. 101, p. 4115-4128.
- Fabry, V.J., Seibel, B.A., Feely, R.A., and Orr, J.C., (2008), Impacts of ocean acidification on marine fauna and ecosystem processes: *ICES Journal of Marine Science*, v. 65, p. 414-432.
- Fedorov, A.V., and Philander, S.G., (2000), Is El Niño changing?: *Science*, v. 288, p. 1997-2002.
- Feely, R.A., Doney, S.C., and Cooley, S.R., (2009), Ocean Acidification: Present Conditions and Future Changes in a High-CO₂ World: *Oceanography*, v. 22, p. 36-47.
- Feely, R.A., Sabine, C.L., Lee, K., Berelson, W., Kleypas, J., Fabry, V.J., and Millero, F.J., (2004), Impact of anthropogenic CO₂ on the CaCO₃ system in the oceans: *Science*, v. 305, p. 362-366.
- Fettweis, X., (2007), Reconstruction of the 1979–2006 Greenland ice sheet surface mass balance using the regional climate model MAR: *The Cryosphere Discussions*, v. 1, (1), p. 123-168.
- Folland, C.K., Renwick, J.A., Salinger, M.J., and Mullan, A.B., (2002), Relative influences of the Interdecadal Pacific Oscillation and ENSO on the South Pacific Convergence Zone: *Geophysical Research Letters*, v. 29.

- Folland, C.K., Salinger, M.J., Jiang, N., and Rayner, N.A., (2003), Trends and variations in South Pacific island and ocean surface temperatures: *Journal of Climate*, v. 16, p. 2859-2874.
- Fowler, H.J., Blenkinsop, S., and Tebaldi, C., (2007), Linking climate change modelling to impacts studies: recent advances in downscaling techniques for hydrological modelling: *International Journal of Climatology*, v. 27, p. 1547-1578.
- Frauke, F., Rockel, B., von Storch, H., Winterfeldt, J., and Zahn, M., (2011), Regional climate models add value to global model data: *Bulletin of the American Meteorological Society*, doi: 10.1175/2011BAMS3061.1.
- Frich, P., Alexander, L.V., Della-Marta, P., Gleason, B., Haylock, M., Tank, A.M.G.K., and Peterson, T., (2002), Observed coherent changes in climatic extremes during the second half of the twentieth century: *Climate Research*, v. 19, p. 193-212.
- Friedlingstein, P., Houghton, R.A., Marland, G., Hackler, J., Boden, T.A., Conway, T.J., Canadell, J.G., Raupach, M.R., Ciais, P., and Le Quere, C., (2010), Update on CO₂ emissions: *Nature Geoscience*, v. 3, p. 811-812.
- Fyfe, J.C., Boer, G.J., and Flato, G.M., (1999), The Arctic and Antarctic oscillations and their projected changes under global warming: *Geophysical Research Letters*, v. 26, p. 1601-1604.
- Gagan, M.K., Hendy, E.J., Haberle, S.G., and Hantoro, W.S., (2004), Post-glacial evolution of the Indo-Pacific Warm Pool and El Nino-Southern Oscillation: *Quaternary International*, v. 118-119, p. 127-143.
- Ganachaud, A., Gourdeau, L., and Kessler, W., (2008), Bifurcation of the subtropical south equatorial current against New Caledonia in December 2004 from a hydrographic inverse box model: *Journal of Physical Oceanography*, v. 38, p. 2072-2084.
- Ganachaud, A., Sen Gupta, A., Orr, J., Wijffels, S., Ridgway, K., Hemer, M., Maes, C., Steinberg, C., Tribollet, A., Qiu, B., and Kruger, J., (2011), Observed and expected changes to the tropical Pacific Ocean, in *Vulnerability of Fisheries and Aquaculture in the Tropical Pacific to Climate Change*. Secretariat of the Pacific Community (SPC), Noumea, New Caledonia., edited by J. D. Bell, J. E. Johnson, and A. J. Hobday.
- Garcia, H. E., R. A. Locarnini, T. P. Boyer, and J. I. Antonov, (2006): *World Ocean Atlas 2005, Volume 4: Nutrients (phosphate, nitrate, silicate)*. S. Levitus, (ed.), NOAA Atlas NESDIS 64, U.S. Government Printing Office, Washington, D.C., 396 pp.
- Gehrels, W.R., Hayward, B., Newnham, R.M., and Southall, K.E., (2008), A 20th century acceleration of sea-level rise in New Zealand: *Geophysical Research Letters*, v. 35.
- Gehrels, W.R., Kirby, J.R., Prokoph, A., Newnham, R.M., Achterberg, E.P., Evans, H., Black, S., and Scott, D.B., (2005), Onset of recent rapid sea-level rise in the western Atlantic Ocean: *Quaternary Science Reviews*, v. 24, p. 2083-2100.
- Gehrels, W.R., Marshall, W.A., Gehrels, M.J., Larsen, G., Kirby, J.R., Eiriksson, J., Heinemeier, J., and Shimmield, T., (2006), Rapid sea-level rise in the North Atlantic Ocean since the first half of the nineteenth century: *Holocene*, v. 16, p. 949-965.
- Gergis, J.L., and Fowler, A.M., (2009), A history of ENSO events since AD 1525: implications for future climate change: *Climatic Change*, v. 92, p. 343-387.
- Gill, A.E., (1982), *Atmosphere-ocean dynamics*: New York, Academic Press, xv, 662 p. p.
- Gillett, N.P., Kell, T.D., and Jones, P.D., (2006), Regional climate impacts of the Southern Annular Mode: *Geophysical Research Letters*, v. 33.
- Gillett, N.P., and Thompson, D.W.J., (2003), Simulation of recent Southern Hemisphere climate change: *Science*, v. 302, p. 273-275.
- Gomez, N., Mitrovica, J.X., Huybers, P., and Clark, P.U., (2010), Sea level as a stabilizing factor for marine-ice-sheet grounding lines: *Nature Geoscience*, v. 3, p. 850-853.
- Gourdeau, L., Kessler, W.S., Davis, R.E., Sherman, J., Maes, C., and Kestenare, E., (2008), Zonal jets entering the coral sea: *Journal of Physical Oceanography*, v. 38, p. 715-725.
- Gouriou, Y., and Toole, J., (1993), Mean Circulation of the Upper Layers of the Western Equatorial Pacific-Ocean: *Journal of Geophysical Research-Oceans*, v. 98, p. 22495-22520.
- Gray, W. M., (1979), Hurricanes: Their formation structure and likely role in tropical circulation. In: *Meteorology over the tropical oceans*, D.B. Shaw, (ed.), Royal Meteorological Society, p. 155-218
- Gregory, J.M., and Huybrechts, P., (2006), Ice-sheet contributions to future sea-level change: *Philosophical Transactions of the Royal Society a-Mathematical Physical and Engineering Sciences*, v. 364, p. 1709-1731.
- Gregory, J.M, Lowe, J.A. and Tett, S.F.B., (2006). Simulated global-mean sea level changes over the last half-millennium. *Journal of Climate*, v. 19, issue 18, p. 4576-4591.
- Grell, G.A., J. Dudhia and D.R. Stauffer, (1994), A description of the fifth-generation Penn System/ NCAR Mesoscale Model (MM5). NCAR Technical Note NCAR/ TN-398+STR, 121 pp.

- Griffiths, G.M., Chambers, L.E., Haylock, M.R., Manton, M.J., Nicholls, N., Baek, H.J., Choi, Y., Della-Marta, P.M., Gosai, A., Iga, N., Lata, R., Laurent, V., Maitrepierre, L., Nakamigawa, H., Ouprasitwong, N., Solofa, D., Tahani, L., Thuy, D.T., Tibig, L., Trewin, B., VEDIAPAN, K., and Zhai, P., (2005), Change in mean temperature as a predictor of extreme temperature change in the Asia-Pacific region: *International Journal of Climatology*, v. 25, p. 1301-1330.
- Griffiths, G.M., Salinger, M.J., and Leleu, I., (2003), Trends in extreme daily rainfall across the South Pacific and relationship to the South Pacific Convergence Zone: *International Journal of Climatology*, v. 23, p. 847-869.
- Griffiths, M.L., Drysdale, R.N., Gagan, M.K., Zhao, J.X., Ayliffe, L.K., Hellstrom, J.C., Hantoro, W.S., Frisia, S., Feng, Y.X., Cartwright, I., Pierre, E.S., Fischer, M.J., and Suwargadi, B.W., (2009), Increasing Australian-Indonesian monsoon rainfall linked to early Holocene sea-level rise: *Nature Geoscience*, v. 2, p. 636-639.
- Grinsted, A., Moore, J.C., and Jevrejeva, S., (2010), Reconstructing sea level from paleo and projected temperatures 200 to 2100 ad: *Climate Dynamics*, v. 34, p. 461-472.
- Guan, Z.Y., and Yamagata, T., (2003), The unusual summer of 1994 in East Asia: IOD teleconnections: *Geophysical Research Letters*, v. 30.
- Guilyardi, E., Wittenberg, A., Fedorov, A., Collins, M., Wang, C.Z., Capotondi, A., van Oldenborgh, G.J., and Stockdale, T., (2009), Understanding El Nino in Ocean-Atmosphere General Circulation Models Progress and Challenges: *Bulletin of the American Meteorological Society*, v. 90, p. 325-340.
- Guinotte, J.M., Buddemeier, R.W., and Kleypas, J.A., (2003), Future coral reef habitat marginality: temporal and spatial effects of climate change in the Pacific basin: *Coral Reefs*, v. 22, p. 551-558.
- Guinotte, J.M., and Fabry, V.J., (2008), Ocean acidification and its potential effects on marine ecosystems: *Year in Ecology and Conservation Biology 2008*, v. 1134, p. 320-342.
- Guttman, N.B., (1989), Statistical Descriptors of Climate: *Bulletin of the American Meteorological Society*, v. 70, p. 602-607.
- HB 212-2002, (2002): *Design Wind Speeds for the Asia-Pacific Region*. Standards Australia International.
- Hall, T.M., and Jewson, S., (2007), Statistical modelling of North Atlantic tropical cyclone tracks: *Tellus Series a-Dynamic Meteorology and Oceanography*, v. 59, p. 486-498.
- Han, W.Q., Meehl, G.A., and Hu, A.X., (2006), Interpretation of tropical thermocline cooling in the Indian and Pacific oceans during recent decades: *Geophysical Research Letters*, v. 33.
- Hart, R.E., (2003), A cyclone phase space derived from thermal wind and thermal asymmetry: *Monthly Weather Review*, v. 131, p. 585-616.
- Hasegawa, T., and Hanawa, K., (2003), Decadal-scale variability of upper ocean heat content in the tropical Pacific: *Geophysical Research Letters*, v. 30.
- Haug, G.H., Hughen, K.A., Sigman, D.M., Peterson, L.C., and Rohl, U., (2001), Southward migration of the intertropical convergence zone through the Holocene: *Science*, v. 293, p. 1304-1308.
- Hautala, S.L., Sprintall, J., Potemra, J.T., Chong, J.C., Pandoe, W., Bray, N., and Ilahude, A.G., (2001), Velocity structure and transport of the Indonesian Throughflow in the major straits restricting flow into the Indian Ocean: *Journal of Geophysical Research-Oceans*, v. 106, p. 19527-19546.
- Hayes, S.P., Mangum, L.J., Picaut, J., Sumi, A., and Takeuchi, K., (1991), Toga-Tao - a Moored Array for Real-Time Measurements in the Tropical Pacific-Ocean: *Bulletin of the American Meteorological Society*, v. 72, p. 339-347.
- Hegerl, G.C., F. W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J.A. Marengo Orsini, N. Nicholls, J.E. Penner and P.A. Stott, (2007), Understanding and Attributing Climate Change. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Held, I.M., and Soden, B.J., (2006), Robust responses of the hydrological cycle to global warming: *Journal of Climate*, v. 19, p. 5686-5699.
- Hemer, M.A., Simmonds, I., and Keay, K., (2008), A classification of wave generation characteristics during large wave events on the Southern Australian margin: *Continental Shelf Research*, v. 28, p. 634-652.
- Hendon, H.H., and Liebmann, B., (1990a), A Composite Study of Onset of the Australian Summer Monsoon: *Journal of the Atmospheric Sciences*, v. 47, p. 2227-2240.
- Hendon, H.H., and Liebmann, B., (1990b), The Intraseasonal (30-50 Day) Oscillation of the Australian Summer Monsoon: *Journal of the Atmospheric Sciences*, v. 47, p. 2909-2923.
- Hendon, H.H., Thompson, D.W.J., and Wheeler, M.C., (2007), Australian rainfall and surface temperature variations associated with the Southern Hemisphere annular mode: *Journal of Climate*, v. 20, p. 2452-2467.

- Hoegh-Guldberg, O., Mumby, P.J., Hooten, A.J., Steneck, R.S., Greenfield, P., Gomez, E., Harvell, C.D., Sale, P.F., Edwards, A.J., Caldeira, K., Knowlton, N., Eakin, C.M., Iglesias-Prieto, R., Muthiga, N., Bradbury, R.H., Dubi, A., and Hatzioios, M.E., (2007), Coral reefs under rapid climate change and ocean acidification: *Science*, v. 318, p. 1737-1742.
- Holgate, S., Jevrejeva, S., Woodworth, P., and Brewer, S., (2007), Comment on "A semi-empirical approach to projecting future sea-level rise": *Science*, v. 317.
- Horton, R., Herweijer, C., Rosenzweig, C., Liu, J.P., Gornitz, V., and Ruane, A.C., (2008), Sea level rise projections for current generation CGCMs based on the semi-empirical method: *Geophysical Research Letters*, v. 35.
- Hosking, J.R.M., (1990), L-Moment - Analysis and Estimation of Distributions Using Linear-Combinations of Order-Statistics: *Journal of the Royal Statistical Society Series B-Methodological*, v. 52, p. 105-124.
- Houston, J. R. and Dean, R.G., (2011), Sea-Level Acceleration Based on U.S. Tide Gauges and Extensions of Previous Global-Gauge Analyses: *Journal of Coastal Research*, v. 27, p. 409-417.
- Hu, Y., and Fu, Q., (2007), Observed poleward expansion of the Hadley circulation since 1979: *Atmospheric Chemistry and Physics*, v. 7, p. 5229-5236.
- Huffman, G.J., Adler, R.F., Arkin, P., Chang, A., Ferraro, R., Gruber, A., Janowiak, J., McNab, A., Rudolf, B., and Schneider, U., (1997), The Global Precipitation Climatology Project (GPCP) Combined Precipitation Dataset: *Bulletin of the American Meteorological Society*, v. 78, p. 5-20.
- IPCC, (2000): *Emissions Scenarios. Special Report of the Intergovernmental Panel on Climate Change*. Nakicenovic, N., and R. Swart, (eds). Cambridge University Press, UK. 570 pp.
- IPCC, (2007): *Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Ayert, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.
- Irving D.B., Perkins S.E., Brown J.R., Sen Gupta A., Moise A.F., Murphy B.F., Muir L.C., Colman R.A., Power S.B., Delage F.P., Brown J.N., (in press), Evaluating global climate models for climate change projections in the Pacific island region, *Climate Research*, doi: 10.3354/cr01028
- Ishii, M., and Kimoto, M., (2009), Reevaluation of historical ocean heat content variations with time-varying XBT and MBT depth bias corrections: *Journal of Oceanography*, v. 65, p. 287-299.
- Izumo, T., (2005), The equatorial undercurrent, meridional overturning circulation, and their roles in mass and heat exchanges during El Nino events in the tropical Pacific ocean: *Ocean Dynamics*, v. 55, p. 110-123.
- Jansen, E., J. Overpeck, K.R. Briffa, J.-C. Duplessy, F. Joos, V. Masson-Delmotte, D. Olago, B. Otto-Bliesner, W.R. Peltier, S. Rahmstorf, R. Ramesh, D. Raynaud, D. Rind, O. Solomina, R. Villalba and D. Zhang, (2007): Palaeoclimate. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Jevrejeva, S., Grinsted, A., Moore, J.C., and Holgate, S., (2006), Nonlinear trends and multiyear cycles in sea level records: *Journal of Geophysical Research-Oceans*, v. 111.
- Jevrejeva, S., Moore, J. C., Grinsted, A. and Woodworth, P.L. (2008) Recent global sea level acceleration started over 200 years ago?, *Geophysical Research Letters*, v. 35.
- Jiang, H.Y., and Zipser, E.J., (2010), Contribution of Tropical Cyclones to the Global Precipitation from Eight Seasons of TRMM Data: Regional, Seasonal, and Interannual Variations: *Journal of Climate*, v. 23, p. 1526-1543.
- Johanson, C.M., and Fu, Q., (2009), Hadley Cell Widening: Model Simulations versus Observations: *Journal of Climate*, v. 22, p. 2713-2725.
- Johnson, G.C., Sloyan, B.M., Kessler, W.S., and McTaggart, K.E., (2002), Direct measurements of upper ocean currents and water properties across the tropical Pacific during the 1990s: *Progress in Oceanography*, v. 52, p. 31-61.
- Johnson, N.C., and Xie, S.P., (2010), Changes in the sea surface temperature threshold for tropical convection: *Nature Geoscience*, v. 3, p. 842-845.
- Jones, R.G., Noguer, M., Hassell, D.C. Hudson, D., Wilson, S.S., Jenkins, G.J., and Mitchell, J.F.B. (2004), Generating high resolution climate change scenarios using PRECIS. Met Office Hadley Centre, Exeter, UK, 40 pp.
- Joseph, R., and Nigam, S., (2006), ENSO evolution and teleconnections in IPCC's twentieth-century climate simulations: Realistic representation?: *Journal of Climate*, v. 19, p. 4360-4377.
- Joshi, M.M., Gregory J.M., Webb, M.J., Sexton, D.M.H. and Johns, T.C. (2007) Mechanisms for the land/sea warming contrast exhibited by simulations of climate change. *Climate Dynamics*, v. 30, p. 455-465.

- Joughin, I., Smith, B.E., and Holland, D.M., (2010), Sensitivity of 21st century sea level to ocean-induced thinning of Pine Island Glacier, Antarctica: *Geophysical Research Letters*, v. 37.
- Kalnay, E., Kanamitsu, M., Kistler, R., Collins, W., Deaven, D., Gandin, L., Iredell, M., Saha, S., White, G., Woollen, J., Zhu, Y., Chelliah, M., Ebisuzaki, W., Higgins, W., Janowiak, J., Mo, K.C., Ropelewski, C., Wang, J., Leetmaa, A., Reynolds, R., Jenne, R., and Joseph, D., (1996), The NCEP/NCAR 40-year reanalysis project: *Bulletin of the American Meteorological Society*, v. 77, p. 437-471.
- Kanamitsu, M. and DeHaan L., (2011), The added value index: A new metric to quantify the added value of regional models: *Journal of Geophysical Research*, v. 116.
- Kanamitsu, M., Ebisuzaki, W., Woollen, J., Yang, S.K., Hnilo, J.J., Fiorino, M., and Potter, G.L., (2002), Ncep-Doe Amip-li Reanalysis (R-2): *Bulletin of the American Meteorological Society*, v. 83, p. 1631-1643.
- Kaplan, A., Cane, M.A., Kushnir, Y., Clement, A.C., Blumenthal, M.B., and Rajagopalan, B., (1998), Analyses of global sea surface temperature 1856-1991: *Journal of Geophysical Research-Oceans*, v. 103, p. 18567-18589.
- Karl, T.R.; J.M. Melillo, T.C. Peterson, (eds.), (2009): *Global Climate Change Impacts in the United States*. Cambridge University Press. <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts>.
- Kaser, G., Cogley, J.G., Dyurgerov, M.B., Meier, M.F., and Ohmura, A., (2006), Mass balance of glaciers and ice caps: Consensus estimates for 1961–2004: *Geophysical Research Letters*, v. 33.
- Katsman, C.A., Sterl, A., Beersma, J.J., van den Brink, H.W., Church, J.A., Hazeleger, W., Kopp, R.E., Kroon, D., Kwadijk, J., Lammersen, R., Lowe, J., Oppenheimer, M., Plag, H.-P., Ridley, J., von Storch, H., Vaughan, D.G., Vellinga, P., Vermeersen, L.L.A., van de Wal, R.S.W. and Weisse, R., (in press). Exploring high-end scenarios for local sea level rise to develop flood protection strategies for a low-lying delta - the Netherlands as an example. *Climatic Change*, doi:10.1007/s10584-011-0037-5.
- Kemp, A.C., Horton, B.P., Culver, S.J., Corbett, D.R., van de Plassche, O., Gehrels, W.R., Douglas, B.C., and Parnell, A.C., (2009), Timing and magnitude of recent accelerated sea-level rise (North Carolina, United States): *Geology*, v. 37, p. 1035-1038.
- Keper, J., (2001), The dynamics of boundary layer jets within the tropical cyclone core. Part I: Linear theory: *Journal of the Atmospheric Sciences*, v. 58, p. 2469-2484.
- Kharin, V.V., Zwiers, F.W., and Zhang, X.B., (2005), Intercomparison of near-surface temperature and precipitation extremes in AMIP-2 simulations, reanalyses, and observations: *Journal of Climate*, v. 18, p. 5201-5223.
- Kharin, V.V., Zwiers, F.W., Zhang, X.B., and Hegerl, G.C., (2007), Changes in temperature and precipitation extremes in the IPCC ensemble of global coupled model simulations: *Journal of Climate*, v. 20, p. 1419-1444.
- Kidston, J., Renwick, J. A. and McGregor, J., (2009), Hemispheric-scale seasonality of the Southern Annular Mode and impacts on the climate of New Zealand: *Journal of Climate*, v. 22, p. 4759-4770.
- Kiem, A.S., Franks, S.W., and Kuczera, G., (2003), Multi-decadal variability of flood risk: *Geophysical Research Letters*, v. 30.
- Kiladis, G.N., Vonstorch, H., and Vanloon, H., (1989), Origin of the South-Pacific Convergence Zone: *Journal of Climate*, v. 2, p. 1185-1195.
- Kim, H.J., Wang, B., and Ding, Q.H., (2008), The Global Monsoon Variability Simulated by CMIP3 Coupled Climate Models: *Journal of Climate*, v. 21, p. 5271-5294.
- Klein Tank, A.M.G., Zwiers, F.W., and Zhang, X., (2009): *Guidelines on analysis of extremes in a changing climate in support of informed decisions for adaptation*. WMO Climate Data and Monitoring, WCDMP-No.72, 56 pp.
- Kleypas, J.A., McManus, J.W., and Menez, L.A.B., (1999), Environmental limits to coral reef development: Where do we draw the line?: *American Zoologist*, v. 39, p. 146-159.
- Knutson, T.R., McBride, J.L., Chan, J., Emanuel, K., Holland, G., Landsea, C., Held, I., Kossin, J.P., Srivastava, A.K., and Sugi, M., (2010), Tropical cyclones and climate change: *Nature Geoscience*, v. 3, p. 157-163.
- Knutti, R., Abramowitz, G., Collins, M., Eyring, V., Gleckler, P.J., Hewitson, B. and Mearns, L., (2010): Good Practice Guidance Paper on Assessing and Combining Multi Model Climate Projections. In: *Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Assessing and Combining Multi Model Climate Projections* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, and P.M. Midgley (eds.)]. IPCC Working Group I Technical Support Unit, University of Bern, Bern, Switzerland.
- Knutti, R., Furrer, R., Tebaldi, C., Cernak, J., and Meehl, G.A., (2010), Challenges in Combining Projections from Multiple Climate Models: *Journal of Climate*, v. 23, p. 2739-2758.

- Kokic, P., Crimp, S., and Howden, M., (2011), Forecasting climate variables using a mixed-effect state-space model: *Environmetrics*, v. 22, p. 409-419.
- Kokic, P., Nelson, R., Meinke, H., Potgieter, A., and Carter, J., (2007), From rainfall to farm incomes-transforming advice for Australian drought policy. I. Development and testing of a bioeconomic modelling system: *Australian Journal of Agricultural Research*, v. 58, p. 993-1003.
- Konikow, L.F., and Kendy, E., (2005), Groundwater depletion: A global problem: *Hydrogeology Journal*, v. 13, p. 317-320.
- Kopp, R.E., Simons, F.J., Mitrovica, J.X., Maloof, A.C., and Oppenheimer, M., (2009), Probabilistic assessment of sea level during the last interglacial stage: *Nature*, v. 462, p. 863-867.
- Krinner, G., Magand, O., Simmonds, I., Genthon, C., and Dufresne, J.L., (2007), Simulated Antarctic precipitation and surface mass balance at the end of the twentieth and twenty-first centuries: *Climate Dynamics*, v. 28, p. 215-230.
- Krishna, R., (2009), Brief history of the Fiji Meteorological Service, Information Sheet No.2. Climate Services Division, Fiji Meteorological Service.
- Kuleshov, Y., (2003), Tropical cyclone climatology for the Southern Hemisphere. Part I. Spatial and temporal profiles of tropical cyclones in the Southern Hemisphere. *Commonwealth of Australia, Bureau of Meteorology*. 20 pp.
- Kuleshov, Y., Fawcett, R., Qi, L., Trewin, B., Jones, D., McBride, J., and Ramsay, H., (2010), Trends in tropical cyclones in the South Indian Ocean and the South Pacific Ocean: *Journal of Geophysical Research-Atmospheres*, v. 115, p. -.
- Kuleshov, Y., Ming, F.C., Qi, L., Chouaibou, I., Hoareau, C., and Roux, F., (2009), Tropical cyclone genesis in the Southern Hemisphere and its relationship with the ENSO: *Annales Geophysicae*, v. 27, p. 2523-2538.
- Kumar, K.K., Rajagopalan, B., Hoerling, M., Bates, G., and Cane, M., (2006), Unraveling the mystery of Indian monsoon failure during El Nino: *Science*, v. 314, p. 115-119.
- Kummerow, C., Barnes, W., Kozu, T., Shiue, J., and Simpson, J., (1998), The Tropical Rainfall Measuring Mission (TRMM) sensor package: *Journal of Atmospheric and Oceanic Technology*, v. 15, p. 809-817.
- Kummerow, C., Simpson, J., Thiele, O., Barnes, W., Chang, A.T.C., Stocker, E., Adler, R.F., Hou, A., Kakar, R., Wentz, F., Ashcroft, P., Kozu, T., Hong, Y., Okamoto, K., Iguchi, T., Kuroiwa, H., Im, E., Haddad, Z., Huffman, G., Ferrier, B., Olson, W.S., Zipser, E., Smith, E.A., Wilhelm, T.T., North, G., Krishnamurti, T., and Nakamura, K., (2000), The status of the Tropical Rainfall Measuring Mission (TRMM) after two years in orbit: *Journal of Applied Meteorology*, v. 39, p. 1965-1982.
- Lal, M., McGregor, J.L., and Nguyen, K.C., (2008), Very high-resolution climate simulation over Fiji using a global variable-resolution model: *Climate Dynamics*, v. 30, p. 293-305.
- Lamb, M.F., Sabine, C.L., Feely, R.A., Wanninkhof, R., Key, R.M., Johnson, G.C., Millero, F.J., Lee, K., Peng, T.H., Kozyr, A., Bullister, J.L., Greeley, D., Byrne, R.H., Chipman, D.W., Dickson, A.G., Goyet, C., Guenther, P.R., Ishii, M., Johnson, K.M., Keeling, C.D., Ono, T., Shitashima, K., Tilbrook, B., Takahashi, T., Wallace, D.W.R., Watanabe, Y.W., Winn, C., and Wong, C.S., (2002), Consistency and synthesis of Pacific Ocean CO₂ survey data: *Deep-Sea Research Part II-Topical Studies in Oceanography*, v. 49, p. 21-58.
- Lambeck, K., Anzidei, M., Antonioli, F., Benini, A., and Esposito, A., (2004), Sea level in Roman time in the Central Mediterranean and implications for recent change: *Earth and Planetary Science Letters*, v. 224, p. 563-575.
- Lambeck, K., and Chappell, J., (2001), Sea level change through the last glacial cycle: *Science*, v. 292, p. 679-686.
- Landerer, F.W., Jungclaus, J.H., and Marotzke, J., (2007), Regional dynamic and steric sea level change in response to the IPCC-A1B scenario: *Journal of Physical Oceanography*, v. 37, p. 296-312.
- Landsea, C.W., Harper, B.A., Hoarau, K., and Knaff, J.A., (2006), Can we detect trends in extreme tropical cyclones?: *Science*, v. 313, p. 452-454.
- Langdon, C., and Atkinson, M.J., (2005), Effect of elevated pCO₂(2) on photosynthesis and calcification of corals and interactions with seasonal change in temperature/irradiance and nutrient enrichment: *Journal of Geophysical Research-Oceans*, v. 110.
- Le Quere, C., Raupach, M.R., Canadell, J.G., Marland, G., Bopp, L., Ciais, P., Conway, T.J., Doney, S.C., Feely, R.A., Foster, P., Friedlingstein, P., Gurney, K., Houghton, R.A., House, J.I., Huntingford, C., Levy, P.E., Lomas, M.R., Majkut, J., Metzl, N., Ometto, J.P., Peters, G.P., Prentice, I.C., Randerson, J.T., Running, S.W., Sarmiento, J.L., Schuster, U., Sitch, S., Takahashi, T., Viovy, N., van der Werf, G.R., and Woodward, F.I., (2009), Trends in the sources and sinks of carbon dioxide: *Nature Geoscience*, v. 2, p. 831-836.
- Leclercq, P.W., Oerlemans, J. and Cogley, J.G., (2011), Estimating the Glacier Contribution to Sea-Level Rise for the Period 1800-2005, *Surveys in Geophysics*, doi: 10.1007/s10712-011-9121-7.

- Lee, T., and McPhaden, M.J., (2010), Increasing intensity of El Nino in the central-equatorial Pacific: *Geophysical Research Letters*, v. 37.
- Lehodey, P., Bertignac, M., Hampton, J., Lewis, A., and Picaut, J., (1997), El Nino Southern Oscillation and tuna in the western Pacific: *Nature*, v. 389, p. 715-718.
- Leslie, L.M., Karoly, D.J., Leplastrier, M., and Buckley, B.W., (2007), Variability of tropical cyclones over the southwest Pacific Ocean using a high-resolution climate model: *Meteorology and Atmospheric Physics*, v. 97, p. 171-180.
- Lettenmaier, D.P., and Milly, P.C.D., (2009), Land waters and sea level: *Nature Geoscience*, v. 2, p. 452-454.
- Levitus, S., Antonov, J.I., Boyer, T.P., Locarnini, R.A., Garcia, H.E., and Mishonov, A.V., (2009), Global ocean heat content 1955–2008 in light of recently revealed instrumentation problems: *Geophysical Research Letters*, v. 36.
- Li, H.B., Sheffield, J., and Wood, E.F., (2010), Bias correction of monthly precipitation and temperature fields from Intergovernmental Panel on Climate Change AR4 models using equidistant quantile matching: *Journal of Geophysical Research-Atmospheres*, v. 115.
- Lloyd-Hughes, B., and Saunders, M.A., (2002), A drought climatology for Europe: *International Journal of Climatology*, v. 22, p. 1571-1592.
- Locarnini, R.A., Antonov, J.I., Garcia, H.E., and Levitus, S., (2006), World ocean atlas 2005, NOAA atlas NESDIS 61-64: National Oceanic and Atmospheric Administration., United States. National Environmental Satellite Data and Information Service and National Oceanographic Data Center (U.S.). Ocean Climate Laboratory, Silver Spring, MD, U.S. Dept. of Commerce.
- Lorrey, A., Fowler, A.M., and Salinger, J., (2007), Regional climate regime classification as a qualitative tool for interpreting multi-proxy palaeoclimate data spatial patterns: A New Zealand case study: *Palaeogeography Palaeoclimatology Palaeoecology*, v. 253, p. 407-433.
- Lorrey, A., Goodwin, I., Renwick, J. And Browning, S., (2011), Blocking circulation anomalies in the Tasman Sea region during the Medieval Climate Anomaly, *PAGES news*, vol 19, 1, 22-24.
- Lorrey, A.M., Vandergoes, M., Almond, P., Renwick, J.A., Stephens, T., Bostock, H., Mackintosh, A., Newnham, R., Williams, P.W., Ackerley, D. and Fowler, A.M., (in press), Palaeocirculation across New Zealand during the Last Glacial Maximum at ~21ka: *Quaternary Science Reviews*.
- Lorrey, A.M, Vandergoes, M., Renwick, J., Newnham, R., Ackerley, D., Bostock, H., Williams, P.W., King, D.N.T., Neil, H., Harper, S., Mackintosh, A., Goff, J., McFadgen, B., Martin, T. and Chappell, P., (2010), A Regional Climate Regime Classification synthesis for New Zealand covering three critical periods of the late Quaternary: the last 2000 years, the mid-Holocene, and the end of the Last Glacial Coldest Period. NIWA Client Report AKL2010-025 prepared for the University of Auckland. 231 pp.
- Lorrey, A., Williams, P., Salinger, J., Martin, T., Palmer, J., Fowler, A., Zhao, J.X., and Neil, H., (2008), Speleothem stable isotope records interpreted within a multi-proxy framework and implications for New Zealand palaeoclimate reconstruction: *Quaternary International*, v. 187, p. 52-75.
- Lowe, J. A. and Gregory, J.M. (2010). A sea of uncertainty. *Nature Reports Climate Change*, Published online: 6 April 2010, doi:10.1038/climate.2010.30.
- Lowe, J.A., and Gregory, J.M., (2006), Understanding projections of sea level rise in a Hadley Centre coupled climate model: *Journal of Geophysical Research-Oceans*, v. 111.
- Lu, J., Deser, C., and Reichler, T., (2009), Cause of the widening of the tropical belt since 1958: *Geophysical Research Letters*, v. 36.
- Mackey, D.J., O'Sullivan, J.E., and Watson, R.J., (2002), Iron in the western Pacific: a riverine or hydrothermal source for iron in the Equatorial Undercurrent?: *Deep-Sea Research Part I-Oceanographic Research Papers*, v. 49, p. 877-893.
- Madden, R.A., and Julian, P.R., (1994), Observations of the 40-50-Day Tropical Oscillation - a Review: *Monthly Weather Review*, v. 122, p. 814-837.
- Maes, C., Picaut, J., Kuroda, Y., and Ando, K., (2004), Characteristics of the convergence zone at the eastern edge of the Pacific warm pool: *Geophysical Research Letters*, v. 31.
- Mann, M.E., Bradley, R.S. and Hughes, M.K., (2000). Long-term variability in the El Nino Southern Oscillation and associated teleconnections. In: *El Nino and the Southern Oscillation: Multiscale Variability and its Impacts on Natural Ecosystems and Society* [Diaz, H.F., and V. Markgraf (eds.)]. Cambridge University Press, Cambridge, UK, 357-412.
- Mann, M.E., Zhang, Z.H., Rutherford, S., Bradley, R.S., Hughes, M.K., Shindell, D., Ammann, C., Faluvegi, G., and Ni, F.B., (2009), Global Signatures and Dynamical Origins of the Little Ice Age and Medieval Climate Anomaly: *Science*, v. 326, p. 1256-1260.

- Manning, M.R., Edmonds, J., Emori, S., Grubler, A., Hibbard, K., Joos, F., Kainuma, M., Keeling, R.F., Kram, T., Manning, A.C., Meinshausen, M., Moss, R., Nakicenovic, N., Riahi, K., Rose, S.K., Smith, S., Swart, R., and van Vuuren, D.P., (2010), Misrepresentation of the IPCC CO₂ emission scenarios: *Nature Geoscience*, v. 3, p. 376-377.
- Manton, M.J., Della-Marta, P.M., Haylock, M.R., Hennessy, K.J., Nicholls, N., Chambers, L.E., Collins, D.A., Daw, G., Finet, A., Gunawan, D., Inape, K., Isobe, H., Kestin, T.S., Lefale, P., Leyu, C.H., Lwin, T., Maitrepierre, L., Ouprasitwong, N., Page, C.M., Pahalad, J., Plummer, N., Salinger, M.J., Suppiah, R., Tran, V.L., Trewin, B., Tibig, I., and Yee, D., (2001), Trends in extreme daily rainfall and temperature in Southeast Asia and the South Pacific: 1961–1998: *International Journal of Climatology*, v. 21, p. 269-284.
- Mantua, N.J., and Hare, S.R., (2002), The Pacific decadal oscillation: *Journal of Oceanography*, v. 58, p. 35-44.
- Mantua, N.J., Hare, S.R., Zhang, Y., Wallace, J.M., and Francis, R.C., (1997), A Pacific interdecadal climate oscillation with impacts on salmon production: *Bulletin of the American Meteorological Society*, v. 78, p. 1069-1079.
- Manzello, D.P., Kleypas, J.A., Budd, D.A., Eakin, C.M., Glynn, P.W., and Langdon, C., (2008), Poorly cemented coral reefs of the eastern tropical Pacific: Possible insights into reef development in a high-CO₂ world: *Proceedings of the National Academy of Sciences of the United States of America*, v. 105, p. 10450-10455.
- Marshall, G.J., (2003), Trends in the southern annular mode from observations and reanalyses: *Journal of Climate*, v. 16, p. 4134-4143.
- Marti, O., Braconnot, P., Dufresne, J.L., Bellier, J., Benshila, R., Bony, S., Brockmann, P., Cadule, P., Caubel, A., Codron, F., de Noblet, N., Denvil, S., Fairhead, L., Fichefet, T., Foujols, M.A., Friedlingstein, P., Goosse, H., Grandpeix, J.Y., Guilyardi, E., Hourdin, F., Idelkadi, A., Kageyama, M., Krinner, G., Levy, C., Madec, G., Mignot, J., Musat, I., Swingedouw, D., and Talandier, C., (2010), Key features of the IPSL ocean atmosphere model and its sensitivity to atmospheric resolution: *Climate Dynamics*, v. 34, p. 1-26.
- Matthews, A.J., Hoskins, B.J., Slingo, J.M., and Blackburn, M., (1996), Development of convection along the SPCZ within a Madden-Julian oscillation: *Quarterly Journal of the Royal Meteorological Society*, v. 122, p. 669-688.
- Maximenko, N., Niiler, P., Rio, M.H., Melnichenko, O., Centurioni, L., Chambers, D., Zlotnicki, V., and Galperin, B., (2009), Mean Dynamic Topography of the Ocean Derived from Satellite and Drifting Buoy Data Using Three Different Techniques: *Journal of Atmospheric and Oceanic Technology*, v. 26, p. 1910-1919.
- McCarthy, J.J., O.F., Canziani, N.A., Leary, D.J., Dokken, and K.S. White, (eds). (2001): *Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press: Cambridge, UK.
- McGregor, H.V., and Gagan, M.K., (2004), Western Pacific coral delta O-18 records of anomalous Holocene variability in the El Nino-Southern Oscillation: *Geophysical Research Letters*, v. 31.
- McGregor, J.L., and Dix, M.R., (2008), An updated description of the Conformal-Cubic atmospheric model: *High Resolution Numerical Modelling of the Atmosphere and Ocean*, p. 51-75
- McGregor, S., Holbrook, N.J. and Power, S.B. (2007), Interdecadal sea surface temperature variability in the equatorial Pacific Ocean. Part I: the role of off- equatorial wind stresses and oceanic Rossby waves: *Journal of Climate*, v. 20, p. 2643-2658.
- McGregor, S., Timmermann, A., and Timm, O., (2010), A unified proxy for ENSO and PDO variability since 1650: *Climate of the Past*, v. 6, p. 1-17.
- McPhaden, M.J., and Zhang, D.X., (2004), Pacific Ocean circulation rebounds: *Geophysical Research Letters*, v. 31.
- Meehl, G.A., and Arblaster, J.M., (2003), Mechanisms for projected future changes in south Asian monsoon precipitation: *Climate Dynamics*, v. 21, p. 659-675.
- Meehl, G. A., Boer, G.J., Covey, C., Latif, M. and Stouffer, R.J., (2000), The Coupled Model Intercomparison Project (CMIP): *Bulletin of the American Meteorological Society*, v. 81, p. 313-318.
- Meehl, G.A., Covey, C., Delworth, T., Latif, M., McAvaney, B., Mitchell, J.F.B., Stouffer, R.J., and Taylor, K.E., (2007a), The WCRP CMIP3 multimodel dataset - A new era in climate change research: *Bulletin of the American Meteorological Society*, v. 88, p. 1383-1394.
- Meehl, G.A., Hu, A.X., and Santer, B.D., (2009), The Mid-1970s Climate Shift in the Pacific and the Relative Roles of Forced versus Inherent Decadal Variability: *Journal of Climate*, v. 22, p. 780-792.

- Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver and Z.-C. Zhao, (2007b): Global Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Menendez, M., and Woodworth, P.L., (2010), Changes in extreme high water levels based on a quasi-global tide-gauge data set: *Journal of Geophysical Research-Oceans*, v. 115.
- Merrifield, M.A., (2011), A shift in western tropical Pacific sea-level trends during the 1990s, *Journal of Climate*. (in press).
- Meure, C.M., Etheridge, D., Trudinger, C., Steele, P., Langenfelds, R., van Ommen, T., Smith, A., and Elkins, J., (2006), Law Dome CO₂, CH₄ and N₂O ice core records extended to 2000 years BP: *Geophysical Research Letters*, v. 33.
- Meyers, G., McIntosh, P., Pigot, L., and Pook, M., (2007), The years of El Nino, La Nina, and interactions with the tropical Indian ocean: *Journal of Climate*, v. 20, p. 2872-2880.
- Middleton, N., Thomas, D.S.G., and United Nations Environment Programme, (1997), World atlas of desertification: London, Arnold, x,182 p. p.
- Milne, G.A., Gehrels, W.R., Hughes, C.W., and Tamisiea, M.E., (2009), Identifying the causes of sea-level change: *Nature Geoscience*, v. 2, p. 471-478.
- Mimura, N., L. Nurse, R.F. McLean, J. Agard, L. Briguglio, P. Lefale, R. Payet and G. Sem, (2007): Small islands. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, (eds.), Cambridge University Press, Cambridge, UK, 687-716.
- Mitas, C.M., and Clement, A., (2005), Has the Hadley cell been strengthening in recent decades?: *Geophysical Research Letters*, v. 32.
- Mitas, C.M., and Clement, A., (2006), Recent behavior of the Hadley cell and tropical thermodynamics in climate models and reanalyses: *Geophysical Research Letters*, v. 33.
- Mitrovica, J.X., Gomez, N., and Clark, P.U., (2009), The Sea-Level Fingerprint of West Antarctic Collapse: *Science*, v. 323, p. 753.
- Mitrovica, J.X., Tamisiea, M.E., Davis, J.L., and Milne, G.A., (2001), Recent mass balance of polar ice sheets inferred from patterns of global sea-level change: *Nature*, v. 409, p. 1026-1029.
- Mochizuki, T., Ishii, M., Kimoto, M., Chikamoto, Y., Watanabe, M., Nozawa, T., Sakamoto, T.T., Shiogama, H., Awaji, T., Sugiura, N., Toyoda, T., Yasunaka, S., Tatebe, H., and Mori, M., (2010), Pacific decadal oscillation hindcasts relevant to near-term climate prediction: *Proceedings of the National Academy of Sciences of the United States of America*, v. 107, p. 1833-1837.
- Moise, A.F. and F.P. Delage, (in press). New climate model metrics based on object-orientated pattern matching of rainfall. *Journal of Geophysical Research*, v. 116, p. 2011 doi:10.1029/2010JD015318
- Morton, F.I., (1983), Operational estimates of areal evaporation and their significance to the science and practice of hydrology. *Journal of Hydrology*, v. 66 p. 1-76.
- Mucci, A., (1983), The Solubility of Calcite and Aragonite in Seawater at Various Salinities, Temperatures, and One Atmosphere Total Pressure: *American Journal of Science*, v. 283, p. 780-799.
- Munday, P.L., Dixon, D.L., McCormick, M.I., Meekan, M., Ferrari, M.C.O., and Chivers, D.P., (2010), Replenishment of fish populations is threatened by ocean acidification: *Proceedings of the National Academy of Sciences of the United States of America*, v. 107, p. 12930-12934.
- Munday, P.L., Donelson, J.M., Dixon, D.L. and Endo, G.G.K., (2009), Effects of ocean acidification on the early life history of a tropical marine fish: *Proceedings of the Royal Society B*, v. 276, p. 3275-3283.
- NASA Quick Scatterometer, (2000), QuikSCAT Science Data Product, User's Manual, Overview & Geophysical Data Products, Version 2.0-Draft, Jet Propulsion Laboratory, California Institute of Technology, Doc. D-18053, May 2000
- New, M., Hulme, M., and Jones, P., (1999), Representing twentieth-century space-time climate variability. Part I: Development of a 1961-90 mean monthly terrestrial climatology: *Journal of Climate*, v. 12, p. 829-856.
- Newman, M., Compo, G.P., and Alexander, M.A., (2003), ENSO-forced variability of the Pacific decadal oscillation: *Journal of Climate*, v. 16, p. 3853-3857.
- Nguyen, K. C., Katzfey, J. J., and McGregor J. L., (in press), Global 60 km simulations with CCAM: Evaluation over the tropics: *Climate Dynamics*, doi: 10.1007/s00382-011-1197-8.

- Nguyen, K.C., and Walsh, K.J.E., (2001), Interannual, decadal, and transient greenhouse simulation of tropical cyclone-like vortices in a regional climate model of the South Pacific: *Journal of Climate*, v. 14, p. 3043-3054.
- Nolan, D.S., (2007), What is the trigger for tropical cyclogenesis?: *Australian Meteorological Magazine*, v. 56, p. 241-266.
- Nunn, P.D., (2007), Climate, environment and society in the Pacific during the last millennium: *Developments in Earth & Environmental Sciences*, 6: Science Direct, (online service) Amsterdam, Netherlands ; Boston [Mass.], Elsevier, p. xiv, 302 p.
- Onogi, K., Tsitsui, J., Koide, H., Sakamoto, M., Kobayashi, S., Hatsushika, H., Matsumoto, T., Yamazaki, N., Kaalhor, H., Takahashi, K., Kadokura, S., Wada, K., Kato, K., Oyama, R., Ose, T., Mannoji, N., and Taira, R., (2007), The JRA-25 reanalysis: *Journal of the Meteorological Society of Japan*, v. 85, p. 369-432.
- Oort, A.H., and Yienger, J.J., (1996), Observed interannual variability in the Hadley circulation and its connection to ENSO: *Journal of Climate*, v. 9, p. 2751-2767.
- Pal, J.S., Giorgi, F., Bi, X.Q., Elguindi, N., Solomon, F., Gao, X.J., Rauscher, S.A., Francisco, R., Zakey, A., Winter, J., Ashfaq, M., Syed, F.S., Bell, J.L., Diffenbaugh, N.S., Karmacharya, J., Konare, A., Martinez, D., da Rocha, R.P., Sloan, L.C., and Steiner, A.L., (2007), Regional climate modeling for the developing world - The ICTP RegCM3 and RegCNET: *Bulletin of the American Meteorological Society*, v. 88, p. 1395.
- Pardaens, A.K., Gregory, J.M., and Lowe, J.A., (2011), A model study of factors influencing projected changes in regional sea level over the twenty-first century: *Climate Dynamics*, v. 36, p. 2015-2033.
- Parker, D., Folland, C., Scaife, A., Knight, J., Colman, A., Baines, P., and Dong, B.W., (2007), Decadal to multidecadal variability and the climate change background: *Journal of Geophysical Research-Atmospheres*, v. 112.
- Pauluis, O., and Garner, S., (2006), Sensitivity of radiative-convective equilibrium simulations to horizontal resolution: *Journal of the Atmospheric Sciences*, v. 63, p. 1910-1923.
- Perkins, S.E., (in press), Biases and model agreement in projections of climate extremes over the tropical Pacific: *Earth Interactions*, doi: 10.1175/2011EI395.1
- Perkins, S.E., Irving D.B., Brown J.R., Power, S.B., Moise, A.F., Colman, R.A. and Smith, I., (in press), CMIP3 ensemble climate projections over the western tropical Pacific based on model skill, *Climate Research*.
- Perkins, S.E., Pitman, A.J., Holbrook, N.J., and McAneney, J., (2007), Evaluation of the AR4 climate models' simulated daily maximum temperature, minimum temperature, and precipitation over Australia using probability density functions: *Journal of Climate*, v. 20, p. 4356-4376.
- Pfeffer, W.T., Harper, J.T., and O'Neel, S., (2008), Kinematic constraints on glacier contributions to 21st-century sea-level rise: *Science*, v. 321, p. 1340-1343.
- Philander, S.G., (1990), El Niño, La Niña, and the southern oscillation: San Diego, Academic Press, ix, 293 p. p.
- Philander, S.G., (2006) Our Affair with El Niño: How We Transformed an Enchanting Peruvian Current into a Global Climate Hazard. Princeton University Press, pp. 288.
- Phipps, S.J., and Brown, J.N., (2010), Understanding ENSO dynamics through the exploration of past climates: *IOP Conference Series: Earth and Environmental Science*, 9.
- Powell, M., Soukup, G., Cocke, S., Gulati, S., Morisseau-Leroy, N., Hamid, S., Dorst, N., and Axe, L., (2005), State of Florida hurricane loss projection model: Atmospheric science component: *Journal of Wind Engineering and Industrial Aerodynamics*, v. 93, p. 651-674.
- Power, S.B., (1995), Climate Drift in a Global Ocean General-Circulation Model: *Journal of Physical Oceanography*, v. 25, p. 1025-1036.
- Power, S., Casey, T., Folland, C., Colman, A., and Mehta, V., (1999), Inter-decadal modulation of the impact of ENSO on Australia: *Climate Dynamics*, v. 15, p. 319-324.
- Power, S., and Colman, R., (2006), Multi-year predictability in a coupled general circulation model: *Climate Dynamics*, v. 26, p. 247-272.
- Power, S., Haylock, M., Colman, R., and Wang, X.D., (2006), The predictability of interdecadal changes in ENSO activity and ENSO teleconnections: *Journal of Climate*, v. 19, p. 4755-4771.
- Power, S., and G. Kociuba, (in press), The impact of global warming on the Southern Oscillation Index. *Climate Dynamics*, doi:10.1007/s00382-010-0951-7.
- Power, S.B. and Kociuba, G. (2011), What caused the observed 20th century weakening of the Walker circulation? *Journal of Climate* (in press) doi: 10.1175/2011JCLI4101.1
- Power, S.B., and Smith, I.N., (2007), Weakening of the Walker Circulation and apparent dominance of El Niño both reach record levels, but has ENSO really changed?: *Geophysical Research Letters*, v. 34, issue 18.
- Power, S., Tseitkin, F., Mehta, V., Lavery, B., Torok, S., and Holbrook, N., (1999), Decadal climate variability in Australia during the twentieth century: *International Journal of Climatology*, v. 19, p. 169-184.

- Qiu, B., and Chen, S.M., (2006), Decadal variability in the large-scale sea surface height field of the South Pacific Ocean: Observations and causes: *Journal of Physical Oceanography*, v. 36, p. 1751-1762.
- Radic, V., and Hock, R., (2010), Regional and global volumes of glaciers derived from statistical upscaling of glacier inventory data: *Journal of Geophysical Research-Earth Surface*, v. 115, p. -. .
- Radic, V., and Hock, R., (2011), Regionally differentiated contribution of mountain glaciers and ice caps to future sea-level rise: *Nature Geoscience*, v. 4, p. 91-94.
- Rahmstorf, S., (2007), A semi-empirical approach to projecting future sea-level rise: *Science*, v. 315, p. 368-370.
- Rahmstorf, S., Cazenave, A., Church, J.A., Hansen, J.E., Keeling, R.F., Parker, D.E., and Somerville, R.C.J., (2007), Recent climate observations compared to projections: *Science*, v. 316, p. 709.
- Randall, D.A., R.A. Wood, S. Bony, R. Colman, T. Fichet, J. Fyfe, V. Kattsov, A. Pitman, J. Shukla, J. Srinivasan, R.J. Stouffer, A. Sumi and K.E. Taylor, 2007: Climate Models and Their Evaluation. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Rattan, S. P. and R. N. Sharma, (2005), Extreme value analysis of Fiji's wind record: *The South Pacific Journal of Natural Science*, 23.
- Raupach, M.R., and Canadell, J.G., (2010), Carbon and the Anthropocene: *Current Opinion in Environmental Sustainability*, v. 2, p. 210-218.
- Rayner, N.A., Brohan, P., Parker, D.E., Folland, C.K., Kennedy, J.J., Vanicek, M., Ansell, T.J., and Tett, S.F.B., (2006), Improved analyses of changes and uncertainties in sea surface temperature measured in situ since the mid-nineteenth century: The HadSST2 dataset: *Journal of Climate*, v. 19, p. 446-469.
- Rayner, N.A., Parker, D.E., Horton, E.B., Folland, C.K., Alexander, L.V., Rowell, D.P., Kent, E.C., and Kaplan, A., (2003), Global analyses of sea surface temperature, sea ice, and night marine air temperature since the late nineteenth century: *Journal of Geophysical Research-Atmospheres*, v. 108.
- Reynolds, R.W., (1988), A real-time global sea surface temperature analysis: *Journal of Climate*, v. 1, p. 75-86.
- Ridgway, K.R., Dunn, J.R., and Wilkin, J.L., (2002), Ocean interpolation by four-dimensional weighted least squares - application to the waters around Australasia: *Journal of Atmospheric and Oceanic Technology*, v. 19, p. 1357-1375.
- Rignot, E., Velicogna, I., van den Broeke, M.R., Monaghan, A., and Lenaerts, J., (2011), Acceleration of the contribution of the Greenland and Antarctic ice sheets to sea level rise: *Geophysical Research Letters*, v. 38.
- Rio, M.H., and Hernandez, F., (2004), A mean dynamic topography computed over the world ocean from altimetry, in situ measurements, and a geoid model: *Journal of Geophysical Research-Oceans*, v. 109.
- Rockel, B., Castro, C.L., Pielke, R.A., von Storch, H., and Leoncini, G., (2008), Dynamical downscaling: Assessment of model system dependent retained and added variability for two different regional climate models: *Journal of Geophysical Research-Atmospheres*, v. 113.
- Rodbell, D.T., Seltzer, G.O., Anderson, D.M., Abbott, M.B., Enfield, D.B., and Newman, J.H., (1999), An similar to 15,000-year record of El Nino-driven alluviation in southwestern Ecuador: *Science*, v. 283, p. 516-520.
- Roemmich, D., Gilson, J., Davis, R., Sutton, P., Wijffels, S., and Riser, S., (2007), Decadal spinup of the South Pacific subtropical gyre: *Journal of Physical Oceanography*, v. 37, p. 162-173.
- Rohling, E.J., Grant, K., Bolshaw, M., Roberts, A.P., Siddall, M., Hemleben, C., and Kucera, M., (2009), Antarctic temperature and global sea level closely coupled over the past five glacial cycles: *Nature Geoscience*, v. 2, p. 500-504.
- Rohling, E.J., Grant, K., Hemleben, C., Siddall, M., Hoogakker, B.A.A., Bolshaw, M., and Kucera, M., (2008), High rates of sea-level rise during the last interglacial period: *Nature Geoscience*, v. 1, p. 38-42.
- Rosenzweig, C., G. Casassa, D.J. Karoly, A. Imeson, C. Liu, A. Menzel, S. Rawlins, T.L. Root, B. Seguin, P. Tryjanowski, (2007): Assessment of observed changes and responses in natural and managed systems. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, (eds.), Cambridge University Press, Cambridge, UK, 79-131.
- Royer, J.F., Chauvin, F., Timbal, B., Araspin, P., and Grimal, D., (1998), A GCM study of the impact of greenhouse gas increase on the frequency of occurrence of tropical cyclones: *Climatic Change*, v. 38, p. 307-343.

- Sabine, C.L., Feely, R.A., Gruber, N., Key, R.M., Lee, K., Bullister, J.L., Wanninkhof, R., Wong, C.S., Wallace, D.W.R., Tilbrook, B., Millero, F.J., Peng, T.H., Kozyr, A., Ono, T., and Rios, A.F., (2004), The oceanic sink for anthropogenic CO₂: *Science*, v. 305, p. 367-371.
- Saenko, O.A., Fyfe, J.C., and England, M.H., (2005), On the response of the oceanic wind-driven circulation to atmospheric CO₂ increase: *Climate Dynamics*, v. 25, p. 415-426.
- Saji, N.H., Goswami, B.N., Vinayachandran, P.N., and Yamagata, T., (1999), A dipole mode in the tropical Indian Ocean: *Nature*, v. 401, p. 360-363.
- Salinger, M.J., (1995), Southwest Pacific Temperatures - Trends in Maximum and Minimum Temperatures: *Atmospheric Research*, v. 37, p. 87-99.
- Salinger, M.J., Renwick, J.A., and Mullan, A.B., (2001), Interdecadal Pacific Oscillation and South Pacific climate: *International Journal of Climatology*, v. 21, p. 1705-1721.
- Santer, B.D., Taylor, K.E., Gleckler, P.J., Bonfils, C., Barnett, T.P., Pierce, D.W., Wigley, T.M.L., Mears, C., Wentz, F.J., Bruggemann, W., Gillett, N.P., Klein, S.A., Solomon, S., Stott, P.A., and Wehner, M.F., (2009), Incorporating model quality information in climate change detection and attribution studies: *Proceedings of the National Academy of Sciences of the United States of America*, v. 106, p. 14778-14783.
- Schaefer, J.M., Denton, G.H., Kaplan, M., Putnam, A., Finkel, R.C., Barrell, D.J.A., Andersen, B.G., Schwartz, R., Mackintosh, A., Chinn, T., and Schluchter, C., (2009), High-Frequency Holocene Glacier Fluctuations in New Zealand Differ from the Northern Signature: *Science*, v. 324, p. 622-625.
- Schmith, T., Johansen, S., and Thejll, P., (2007), Comment on "A semi-empirical approach to projecting future sea-level rise": *Science*, v. 317.
- Secretariat of the Pacific Regional Environment Programme (SPREP), (2005), Pacific Islands Framework for Action on Climate Change 2006–2015, http://www.sprep.org/att/publication/000438_PI_Framework_for_Action_on_Climate_Change_2006_2015_FINAL.pdf.
- Seidel, D.J., Fu, Q., Randel, W.J., and Reichler, T.J., (2008), Widening of the tropical belt in a changing climate: *Nature Geoscience*, v. 1, p. 21-24.
- Seidel, D.J., and Randel, W.J., (2007), Recent widening of the tropical belt: Evidence from tropopause observations: *Journal of Geophysical Research-Atmospheres*, v. 112.
- Sen Gupta, A., and England, M.H., (2006), Coupled ocean-atmosphere-ice response to variations in the Southern Annular Mode: *Journal of Climate*, v. 19, p. 4457-4486.
- Sen Gupta, A., Santoso, A., Taschetto, A.S., Ummenhofer, C.C., Trevena, J., and England, M.H., (2009), Projected Changes to the Southern Hemisphere Ocean and Sea Ice in the IPCC AR4 Climate Models: *Journal of Climate*, v. 22, p. 3047-3078.
- Sherwood, S.C., Ingram, W., Tsushima, Y., Satoh, M., Roberts, M., Vidale, P.L., and O’Gorman, P.A., (2010), Relative humidity changes in a warmer climate: *Journal of Geophysical Research-Atmospheres*, v. 115.
- Shorten, G. G., S. Goosby, K. Granger, K. Lindsay, P. Naidu, S. Oliver, K. Stewart, V. Titov and G. Walker, (2003): Developing Risk-Management Options for Disasters in the Pacific Region. SOPAC Joint Contribution Report 147.
- Shorten, G. G., S. Schmall and S. Oliver, (2005): Building capacity to insure against disaster in Tuvalu. SOPAC Technical Report 380.
- Shulmeister, J., and Lees, B.G., (1995), Pollen Evidence from Tropical Australia for the Onset of an Enso-Dominated Climate at C 4000 Bp: *Holocene*, v. 5, p. 10-18.
- Silverman, J., Lazar, B., Cao, L., Caldeira, K., and Erez, J., (2009), Coral reefs may start dissolving when atmospheric CO₂ doubles: *Geophysical Research Letters*, v. 36.
- Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, M. G. Duda, X.-Y. Huang, W. Wang, and J. G. Powers (2008), A Description of the Advanced Research WRF Version 3, NCAR Technical Note, NCAR, Boulder, CO, USA
- Slangen, A., Katsman, C., van de Wal, R., Vermeersen, L., and Riva, R., (in press), Towards regional projections of twenty-first century sea-level change based on IPCC SRES scenarios. *Climate Dynamics*, doi:10.1007/s00382-011-1057-6
- Smith, I., and Chandler, E., (2010), Refining rainfall projections for the Murray Darling Basin of south-east Australia-the effect of sampling model results based on performance: *Climatic Change*, v. 102, p. 377-393.
- Smith, T.M., Reynolds, R.W., Peterson, T.C., and Lawrimore, J., (2008), Improvements to NOAA’s historical merged land-ocean surface temperature analysis (1880–2006): *Journal of Climate*, v. 21, p. 2283-2296.
- Smythe, S.M.B. 1864. Ten months in the Fiji Islands: With an introduction and appendix by Colonial W.J. Smythe, John Henry and James Parker, Oxford and London. Digital version available at Google books <http://books.google.com/>

- Song, J.J., Wang, Y.A., and Wu, L.G., (2010), Trend discrepancies among three best track data sets of western North Pacific tropical cyclones: *Journal of Geophysical Research-Atmospheres*, v. 115.
- Stanford, J. D., Heminway, R., Rohling, E. J., Challenor, P. G., Medina-Elizalde, M. and Lester, A. J., (2011). Sea-level probability for the last deglaciation: A statistical analysis of far-field records. *Global and Planetary Change*, (in press), doi:10.1016/j.gloplacha.2010.11.002
- Steiner, J.T., (1980): The Climate of the South-West Pacific Region, a review for pilots. New Zealand Meteorological Service Publication No. 166, Wellington, New Zealand, 35 pp.
- Storch, H.v., and Zwiers, F.W., (2001): Statistical analysis in climate research. Cambridge, UK ; New York, Cambridge University Press, x, 484 p.
- Stott, L., Cannariato, K., Thunell, R., Haug, G.H., Koutavas, A., and Lund, S., (2004), Decline of surface temperature and salinity in the western tropical Pacific Ocean in the Holocene epoch: *Nature*, v. 431, p. 56-59.
- Stott, P. A., Gillett, N. P., Hegerl, G. C., Karoly, D. J., Stone, D. A., Zhang, X. and Zwiers, F. (2010). Detection and attribution of climate change: a regional perspective. *Wiley Interdisciplinary Reviews: Climate Change*, v. 1, p. 192-211.
- Streten, N. A., and Zillman, J.W., (1984): Climate of the South Pacific Ocean. *World Survey of Climatology, Climates of the Oceans*. Vol. 15. Elsevier, 716 pp.
- Sun, Y., Solomon, S., Dai, A., and Portmann, R.W., (2006), How often does it rain?: *Journal of Climate*, v. 19, p. 916-934.
- Sverdrup, H.U., (1947), Wind-Driven Currents in a Baroclinic Ocean - with Application to the Equatorial Currents of the Eastern Pacific: *Proceedings of the National Academy of Sciences of the United States of America*, v. 33, p. 318-326.
- Takahashi, T., Sutherland, S.C. and Kozyr, A. (2010). Global Ocean Surface Water Partial Pressure of CO₂ Database: Measurements Performed During 1957–2009, (Version 2009). ORNL/CDIAC-152, NDP-088(V2009). Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, doi: 10.3334/CDIAC/otg.ndp088(V2009).
- Tanaka, H.L., Ishizaki, N., and Kitoh, A., (2004), Trend and interannual variability of Walker, monsoon and Hadley circulations defined by velocity potential in the upper troposphere: *Tellus Series a-Dynamic Meteorology and Oceanography*, v. 56, p. 250-269.
- Taschetto, A.S., and England, M.H., (2009), El Nino Modoki Impacts on Australian Rainfall: *Journal of Climate*, v. 22, p. 3167-3174.
- Taylor, K.E., Stouffer, R.J. and Meehl, G.A. (2009): A Summary of the CMIP5 Experiment Design. <http://www-pcmdi.llnl.gov/>
- Tebaldi, C., and Knutti, R., (2007), The use of the multi-model ensemble in probabilistic climate projections: *Philosophical Transactions of the Royal Society a-Mathematical Physical and Engineering Sciences*, v. 365, p. 2053-2075.
- Thatcher, M., and McGregor, J.L., (2009), Using a Scale-Selective Filter for Dynamical Downscaling with the Conformal Cubic Atmospheric Model: *Monthly Weather Review*, v. 137, p. 1742-1752.
- Thompson, C.S., (1986): The climate and weather of Tonga. New Zealand Weather Service Misc. Publ, 188(5), 60 pp.
- Thompson, D.W.J., and Solomon, S., (2002), Interpretation of recent Southern Hemisphere climate change: *Science*, v. 296, p. 895-899.
- Thompson, D.W.J., and Wallace, J.M., (2000), Annular modes in the extratropical circulation. Part I: Month-to-month variability: *Journal of Climate*, v. 13, p. 1000-1016.
- Timm, O., and Diaz, H.F., (2009), Synoptic-Statistical Approach to Regional Downscaling of IPCC Twenty-First-Century Climate Projections: Seasonal Rainfall over the Hawaiian Islands: *Journal of Climate*, v. 22, p. 4261-4280.
- Timmermann, A., McGregor, S., and Jin, F.F., (2010), Wind Effects on Past and Future Regional Sea Level Trends in the Southern Indo-Pacific: *Journal of Climate*, v. 23, p. 4429-4437.
- Tolman, H. L., (2002): User manual and system documentation of WAVEWATCH-III version 2.22. http://polar.ncep.noaa.gov/mmap/papers/tn222/MMAB_222.pdf, NOAA / NWS / NCEP / OMB technical note 222, 133 pp.
- Tomczak, M. and Godfrey, J.S., (2003): Regional Oceanography: an Introduction. 2nd improved edition. Daya Publishing House, Delhi. 390p.
- Trenberth, K.E., (1976), Spatial and Temporal Variations of Southern Oscillation: *Quarterly Journal of the Royal Meteorological Society*, v. 102, p. 639-653.

- Trenberth, K.E., P.D. Jones, P. Ambenje, R. Bojariu, D. Easterling, A. Klein Tank, D. Parker, F. Rahimzadeh, J.A. Renwick, M. Rusticucci, B. Soden and P. Zhai, (2007): Observations: Surface and Atmospheric Climate Change. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Tudhope, A.W., Chilcott, C.P., McCulloch, M.T., Cook, E.R., Chappell, J., Ellam, R.M., Lea, D.W., Lough, J.M., and Shimmield, G.B., (2001), Variability in the El Nino - Southern oscillation through a glacial-interglacial cycle: *Science*, v. 291, p. 1511-1517.
- Turner, G. (1861). Nineteen years in Polynesia: missionary life, travels, and researches in the islands of the Pacific, John Snow, London. Digital version available at Google books <http://books.google.com/>
- Ummenhofer, C.C., Sen Gupta, A. and England, M.H., (2009), Causes of late Twentieth-Century trends in New Zealand Precipitation: *Journal of Climate*, v. 22, p. 3-19.
- Uppala, S.M., Kallberg, P.W., Simmons, A.J., Andrae, U., Bechtold, V.D., Fiorino, M., Gibson, J.K., Haseler, J., Hernandez, A., Kelly, G.A., Li, X., Onogi, K., Saarinen, S., Sokka, N., Allan, R.P., Andersson, E., Arpe, K., Balmaseda, M.A., Beljaars, A.C.M., Van De Berg, L., Bidlot, J., Bormann, N., Caires, S., Chevallier, F., Dethof, A., Dragosavac, M., Fisher, M., Fuentes, M., Hagemann, S., Holm, E., Hoskins, B.J., Isaksen, I., Janssen, P.A.E.M., Jenne, R., McNally, A.P., Mahfouf, J.F., Morcrette, J.J., Rayner, N.A., Saunders, R.W., Simon, P., Sterl, A., Trenberth, K.E., Untch, A., Vasiljevic, D., Viterbo, P., and Woollen, J., (2005), The ERA-40 re-analysis: *Quarterly Journal of the Royal Meteorological Society*, v. 131, p. 2961-3012.
- van Oldenborgh, G. J., S. Philip, and M. Collins, (2005), El Niño in a changing climate: A multi-model study. *Ocean Science*, v. 1, p. 81-95.
- Vecchi, G.A., and Soden, B.J., (2007a), Effect of remote sea surface temperature change on tropical cyclone potential intensity: *Nature*, v. 450, p. 1066-1070.
- Vecchi, G.A., and Soden, B.J., (2007b), Global warming and the weakening of the tropical circulation: *Journal of Climate*, v. 20, p. 4316-4340.
- Vecchi, G.A., Soden, B.J., Wittenberg, A.T., Held, I.M., Leetmaa, A., and Harrison, M.J., (2006), Weakening of tropical Pacific atmospheric circulation due to anthropogenic forcing: *Nature*, v. 441, p. 73-76.
- Velicogna, I., (2009), Increasing rates of ice mass loss from the Greenland and Antarctic ice sheets revealed by GRACE: *Geophysical Research Letters*, v. 36.
- Vellinga, P., Katsman, C., Sterl, A., Beersma, J., Hazeleger, W., Church, J., Kopp, R., Kroon, D., Oppenheimer, M., Plag, H-P., Rahmstorf, S., Lowe, J., Ridley, J., Storch, H. v., Vaughan, D., van de Wal, R., Weisse, R., Kwadijk, J., Lammersen, R. and Marinova, N., (2009): Exploring high-end climate change scenarios for flood protection of the Netherlands. KNMI Scientific report WR 2009-05, De Bilt, Netherlands.(available from <http://www.knmi.nl/bibliotheek/knmipubWR/WR2009-05.pdf>).
- Verdon, D.C., Wyatt, A.M., Kiem, A.S., and Franks, S.W., (2005), Multi-decadal variability of rainfall and streamflow across eastern Australia: *Regional Hydrological Impacts of Climatic Change - Hydroclimatic Variability*, v. 296, p. 42-52.
- Vermeer, M., and Rahmstorf, S., (2009), Global sea level linked to global temperature: *Proceedings of the National Academy of Sciences of the United States of America*, v. 106, p. 21527-21532.
- Vincent, D.G., (1994), The South-Pacific Convergence Zone (SPCZ) - a Review: *Monthly Weather Review*, v. 122, p. 1949-1970.
- Vincent, E.M., Lengaigne, M., Menkes, C.E., Jourdain, N.C., Marchesiello, P., and Madec, G., (2011), Interannual variability of the South Pacific Convergence Zone and implications for tropical cyclone genesis: *Climate Dynamics*, v. 36, p. 1881-1896.
- Wada, Y., van Beek, L.P.H., van Kempen, C.M., Reckman, J.W.T.M., Vasak, S., and Bierkens, M.F.P., (2010), Global depletion of groundwater resources: *Geophysical Research Letters*, v. 37.
- Waliser, D.E., and Gautier, C., (1993), A Satellite-Derived Climatology of the ITCZ: *Journal of Climate*, v. 6, p. 2162-2174.

- Walsh, K.J.E., Fiorino, M., Landsea, C.W., and McInnes, K.L., (2007), Objectively determined resolution-dependent threshold criteria for the detection of tropical cyclones in climate models and reanalyses: *Journal of Climate*, v. 20, p. 2307-2314.
- Walsh, K., and Watterson, I.G., (1997), Tropical cyclone-like vortices in a limited area model: Comparison with observed climatology: *Journal of Climate*, v. 10, p. 2240-2259.
- Wang, B., (ed.), (2006): The Asian Monsoon. Springer Praxis Publishing, New York, pp. 797.
- Wang, B., Ding, Q.H., Fu, X.H., Kang, I.S., Jin, K., Shukla, J., and Doblas-Reyes, F., (2005), Fundamental challenge in simulation and prediction of summer monsoon rainfall: *Geophysical Research Letters*, v. 32.
- Wang, G., and Hendon, H.H., (2007), Sensitivity of Australian rainfall to inter-El Nino variations: *Journal of Climate*, v. 20, p. 4211-4226.
- Wang, H.L., Skamarock, W.C., and Feingold, G., (2009), Evaluation of Scalar Advection Schemes in the Advanced Research WRF Model Using Large-Eddy Simulations of Aerosol-Cloud Interactions: *Monthly Weather Review*, v. 137, p. 2547-2558.
- Wang, S.S., Trishchenko, A.P., Khlopenkov, K.V., and Davidson, A., (2006), Comparison of International Panel on Climate Change Fourth Assessment Report climate model simulations of surface albedo with satellite products over northern latitudes: *Journal of Geophysical Research-Atmospheres*, v. 111.
- Wang, X.L.L., (2008), Accounting for autocorrelation in detecting mean shifts in climate data series using the penalized maximal t or F test: *Journal of Applied Meteorology and Climatology*, v. 47, p. 2423-2444.
- Wang, X.L.L., (2008), Penalized maximal F test for detecting undocumented mean shift without trend change: *Journal of Atmospheric and Oceanic Technology*, v. 25, p. 368-384.
- Wang, X.L.L., Chen, H.F., Wu, Y.H., Feng, Y., and Pu, Q.A., (2010), New Techniques for the Detection and Adjustment of Shifts in Daily Precipitation Data Series: *Journal of Applied Meteorology and Climatology*, v. 49, p. 2416-2436.
- Wang, X.L.L., Wen, Q.H., and Wu, Y.H., (2007), Penalized maximal t test for detecting undocumented mean change in climate data series: *Journal of Applied Meteorology and Climatology*, v. 46, p. 916-931.
- Wang, Z., and Chang, C.P., (2008), Mechanism of the asymmetric monsoon transition as simulated in an AGCM: *Journal of Climate*, v. 21, p. 1829-1836.
- Webb, D.J., (2000), Evidence for shallow zonal jets in the South Equatorial Current region of the southwest Pacific: *Journal of Physical Oceanography*, v. 30, p. 706-720.
- Webster, P.J., Holland, G.J., Curry, J.A., and Chang, H.R., (2005), Changes in tropical cyclone number, duration, and intensity in a warming environment: *Science*, v. 309, p. 1844-1846.
- Webster, P.J., Moore, A.M., Loschnigg, J.P., and Leben, R.R., (1999), Coupled ocean-atmosphere dynamics in the Indian Ocean during 1997-98: *Nature*, v. 401, p. 356-360.
- Weigel, A.P., Knutti, R., Liniger, M.A., and Appenzeller, C., (2010), Risks of Model Weighting in Multimodel Climate Projections: *Journal of Climate*, v. 23, p. 4175-4191.
- Weng, H.Y., Ashok, K., Behera, S.K., Rao, S.A., and Yamagata, T., (2007), Impacts of recent El Nino Modoki on dry/wet conditions in the Pacific rim during boreal summer: *Climate Dynamics*, v. 29, p. 113-129.
- Wheeler, M.C. and J.L. McBride, (2005): *Intraseasonal Variability in the Atmosphere-Ocean Climate System*. Lau, W.K.M. and D. E. Waliser (eds), Praxis Publishing, pages 125-173.
- Wilby, R.L., Troni, J., Biot, Y., Tedd, L., Hewitson, B.C., Smith, D.M., and Sutton, R.T., (2009), A review of climate risk information for adaptation and development planning: *International Journal of Climatology*, v. 29, p. 1193-1215.
- Wongbusarakum, S., (2009): Climate-related socioeconomic assessment in American Samoa. Pacific Regional Integrated Science and Assessment (RISA) Program, East-West Center, Hawaii.
- Woodroffe, C.D., Beech, M.R., and Gagan, M.K., (2003), Mid-late Holocene El Nino variability in the equatorial Pacific from coral microatolls: *Geophysical Research Letters*, v. 30.
- Woodworth, P.L., (1990), A Search for Accelerations in Records of European Mean Sea-Level: *International Journal of Climatology*, v. 10, p. 129-143.
- Woodworth, P. and Blackman, D., (2004), Evidence for systematic changes in extreme high waters since the mid-1970s: *Journal of Climate*, v. 17, p. 1190-1197.
- Woodworth, P.L., Menéndez, M. and Gehrels, W.R., (2011), Evidence for century-timescale acceleration in mean sea levels and for recent changes in extreme sea levels: *Surveys in Geophysics*, (in press), doi:10.1007/s10712-011-9112-8
- Woodworth, P.L., and Player, R., (2003), The permanent service for mean sea level: An update to the 21st century: *Journal of Coastal Research*, v. 19, p. 287-295.
- Woodworth, P.L., White, N.J., Jevrejeva, S., Holgate, S.J., Church, J.A., and Gehrels, W.R., (2009), Evidence for the accelerations of sea level on multi-decade and century timescales: *International Journal of Climatology*, v. 29, p. 777-789.

- World Meteorological Organization, (1984): Technical Regulations, Vol. I. WMO Publication No. 49. Geneva, Switzerland.
- Wyrski, K., (1989), Some thoughts about the West Pacific Warm Pool. in: Picaut, J., R. Lucas and T. Delcroix, (eds.), Proceedings of Western Pacific International Meeting and Workshop on TOGA COARE, 99-109.
- Wyrwoll, K.H., and Miller, G.H., (2001), Initiation of the Australian summer monsoon 14,000 years ago: *Quaternary International*, v. 83-5, p. 119-128.
- Xie, P.P., and Arkin, P.A., (1997), Global precipitation: A 17-year monthly analysis based on gauge observations, satellite estimates, and numerical model outputs: *Bulletin of the American Meteorological Society*, v. 78, p. 2539-2558.
- Xie, S.P., Deser, C., Vecchi, G.A., Ma, J., Teng, H.Y., and Wittenberg, A.T., (2010), Global Warming Pattern Formation: Sea Surface Temperature and Rainfall: *Journal of Climate*, v. 23, p. 966-986.
- Yeh, S.W., Kug, J.S., Dewitte, B., Kwon, M.H., Kirtman, B.P., and Jin, F.F., (2009), El Nino in a changing climate: *Nature*, v. 462, p. 511.
- Yin, J.J., Griffies, S.M., and Stouffer, R.J., (2010), Spatial Variability of Sea Level Rise in Twenty-First Century Projections: *Journal of Climate*, v. 23, p. 4585-4607.
- Yu, L.S., and Rienecker, M.M., (1999), Mechanisms for the Indian Ocean warming during the 1997-98 El Nino: *Geophysical Research Letters*, v. 26, p. 735-738.
- Zhang, M.H., and Song, H., (2006), Evidence of deceleration of atmospheric vertical overturning circulation over the tropical Pacific: *Geophysical Research Letters*, v. 33.
- Zheng, X.T., Xie, S.P., Vecchi, G.A., Liu, Q.Y., and Hafner, J., (2010), Indian Ocean Dipole Response to Global Warming: Analysis of Ocean-Atmospheric Feedbacks in a Coupled Model: *Journal of Climate*, v. 23, p. 1240-1253.



Federated States of Micronesia

Glossary

A

Anthropogenic

Resulting from or produced by human beings.

Anthropogenic emissions

Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities, including the burning of fossil fuels, deforestation, land-use changes, livestock, fertilisation, etc.

Anthropogenic forcing

– see also **Forcing**

A **forcing** that is caused by human activities including changes in greenhouse gas and aerosol concentrations and land-use changes.

Anomaly

In climate science, a deviation from the normal value of a variable. It is usually the deviation of a variable from the average value at a specific place and time.

Aragonite saturation state – see also **Ocean acidification**

Aragonite is a form of calcium carbonate that makes up the shells and skeletons of key organisms in reef ecosystems, including reef-building corals. The saturation state of aragonite in seawater (known as Ω) is a measure of the potential for the mineral to form or to dissolve. When the $\Omega = 1$, the seawater is in equilibrium with respect to aragonite, so aragonite does not dissolve or precipitate. When $\Omega > 1$ seawater is supersaturated with respect to aragonite and aragonite will precipitate, and when $\Omega < 1$ aragonite will dissolve. Aragonite saturation states above about 4 are considered optimal conditions for healthy coral reef ecosystems, with values below 3.5 becoming increasingly marginal for supporting healthy coral reef growth.

Attribution

Attribution is the process of identifying the most likely causes for the detected changes in the **climate**.

B

Bias – see **Model bias**

C

Carbon cycle

The term used to describe the flow of carbon (in various forms, e.g. as carbon dioxide) through the atmosphere, ocean, terrestrial biosphere and lithosphere.

Climate

Climate in a wider sense is the state, including a statistical description, of the climate system. Climate in a narrow sense is usually defined as the average weather, (or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities), over a period of time ranging from months to thousands or millions of years. The relevant quantities are most often surface variables such as temperature, precipitation and wind. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. In various parts of this publication different averaging periods, such as a period of 20 years, are also used.

Climate change – see also **Climate variability**

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or **external forcings**, or to persistent **anthropogenic** changes in the composition of the atmosphere or in land use.

This definition is the same as the one used by the Intergovernmental Panel on Climate Change and differs from that used by the United Nations Framework Convention on Climate Change which makes a distinction between climate change attributable to human activities and **climate variability** attributable to natural causes.

Climate model – see **Global climate model**

Climate model drift – see **Model drift**

Climate projection

A projection of the response of the climate system to emission or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasise that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realised and are therefore subject to substantial uncertainty.

Climate variability – see also **Patterns of variability**

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or **anthropogenic** external forcing (external variability).

Climatology

The description and scientific study of **climate**.

CMIP3

Coupled Model Intercomparison Project (Phase 3) is a set of climate model experiments from 17 groups in 12 countries with 24 models. Climate model output from simulations of the past, present and future climate was collected by Program for Climate Model Diagnosis and Intercomparison at Lawrence Livermore National Laboratory in the US, during 2005 and 2006. The resulting CMIP3 dataset was used to inform the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

CMIP5

The fifth phase of the Coupled Model Intercomparison Project (CMIP5). In September 2008, 20 climate modelling groups from around the world, agreed to develop a new set of coordinated climate model experiments which will provide a wider range of emissions scenarios, and improved models and simulations for the 5th Assessment Report of the Intergovernmental Panel on Climate Change.

Cold Tongue – see **Equatorial Cold Tongue**

Convection

Vertical motion driven by buoyancy forces arising from static instability, usually caused by near surface warming in the case of the atmosphere, and by near-surface cooling or increases in salinity in the case of the ocean.

Convergence

In meteorology where winds flow from different directions toward each other, thus meeting at one point or along one line. Similarly, in oceanography, where water currents flow toward each other and meet. Horizontal convergence usually forces vertical motion to occur, such as **convection**.

Coriolis Effect

Air or water that is in motion is deflected to the right (of the direction of flow) in the Northern Hemisphere and to the left (of the direction of flow) in the Southern Hemisphere as a result of the rotation of the Earth. The Coriolis Effect is largest at the poles and diminishes to zero at the equator.

D

Downscaling

Downscaling refers to techniques that derive small-scale (at a single location or region) information from data on larger spatial scales, such as **Global Climate Model** output. Two main methods are generally applied: **dynamical downscaling** (using fine-resolution global or regional climate models) and **statistical downscaling** (using statistical relationships).

Dynamical downscaling

Dynamical downscaling uses a finer resolution atmospheric climate model, driven by large-scale data from a **global climate model** to derive local or regional scale information. The fine resolution model provides better representation of topography and land/sea boundaries. This method is computationally intensive and the results are

strongly dependent on the choice of both the global climate model and the atmospheric model.

Statistical downscaling

Statistical downscaling techniques develop statistical relationships that link the large-scale climate variables with local-scale or regional climate variables. This technique maintains important information regarding locally observed historical trends and variability, while also introducing important aspects of change from the **global climate models**.

Driver (of climate change)

Any natural or human-induced factor that directly or indirectly causes a change.

Dynamic response (of ice sheets)

Rapid disintegration of ice sheets through dynamic processes.

E

Ekman Currents

Wind driven currents in the upper few tens of metres of the ocean that flow at 90 degrees to the right of the wind direction in the Northern Hemisphere and to the left in the Southern Hemisphere.

El Niño – see also **El Niño-Southern Oscillation**, **La Niña**

This is the warm phase of the **El Niño-Southern Oscillation**. El Niño events occur on average once every two to seven years. They are associated with basin-wide warming of the tropical Pacific Ocean east of the dateline and a weakening of the **Walker Circulation**.

Canonical El Niño – see also **El Niño**, **La Niña**, **El Niño Modoki**

This is characterised by warming of waters in the central and eastern Pacific Ocean and cooling in a horse-shoe pattern in the western Pacific Ocean.

El Niño Modoki

El Niño Modoki, also called the Central Pacific El Niño, is a recurring pattern of variability in the tropical Pacific, in which the maximum warming occurs in the central tropical Pacific rather than in the east. This represents a variation on the **Canonical El Niño**.

ENSO Modoki Index (EMI)

This is the difference between the sea-surface temperature anomalies averaged over the central equatorial Pacific and the out-of-phase variations in the far eastern and far western Pacific.

El Niño-Southern Oscillation (ENSO) – see also **El Niño**, **La Niña**

The term **El Niño** was initially used to describe a warm-water current that periodically flows along the coast of Ecuador and Perú, disrupting the local fishery. It has since become identified with a basin-wide warming of the tropical Pacific Ocean east of the dateline. This oceanic event is associated with a fluctuation of a global-scale tropical and subtropical surface pressure pattern called the Southern Oscillation. This naturally occurring coupled atmosphere-ocean phenomenon, with time scales of approximately two to seven years, is known as the El Niño-Southern Oscillation (ENSO). The state of ENSO is often measured by the **Southern Oscillation Index (SOI)** and sea-surface temperatures in the central and eastern equatorial Pacific.

During an ENSO event, the prevailing **trade winds** weaken, reducing upwelling and altering ocean currents such that the sea-surface temperatures warm, further weakening the **trade winds**. This event has a great impact on the wind, sea-surface temperature and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world. The cold phase of ENSO is called **La Niña**.

Ensemble

An ensemble refers to a group of model simulations used for **climate projections**. It may refer either to a group of simulations from different models; or to a group of simulations run on the same model but using slightly different starting conditions.

Equatorial Cold Tongue

This is a region of relatively cool surface water in the equatorial eastern Pacific Ocean and along the west coast of South America.

Equinox

The times of the year when the Sun crosses the plane of the Earth's equator, occurring around March 21 and September 22 and making the length of night and day approximately equal all over the Earth.

Evapotranspiration – see **Potential evapotranspiration**

External forcing – see **Forcing**

Extreme weather event

An event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of the observed **probability density function**.

F

Flux adjustment

In order to prevent **drift** in climate simulations older climate models and a minority of the **CMIP3** models use flux adjustment. Flux adjustment involves making small corrections to heat, freshwater and momentum transfers between ocean and atmosphere models, in order to make sure that the climate remains relatively stable.

Forcing – see also **Anthropogenic forcing**, **Natural forcing**

An agent that causes a change in the climate system. **External forcing** refers to agents outside the climate system, such as changes in greenhouse gases or solar variations. **Internal forcing** refers to natural climate variations, such as the Interdecadal Pacific Oscillation. **Radiative forcing** refers specifically to external forcings that change the net radiation at the tropopause.

G

Global Climate Model (GCM)

This is a numerical representation of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. Coupled Atmosphere-Ocean General Circulation Models provide a representation of the climate system that is near the most comprehensive end of the spectrum currently available. There is an evolution towards more complex models with interactive chemistry and biology.

Global surface temperature

The global surface temperature is an estimate of the global mean surface air temperature. However, for changes over time, only anomalies, as departures from a climatology, are used, most commonly based on the area-weighted global average of the sea-surface temperature **anomaly** and land surface air temperature **anomaly**.

Gridded data – see also **Reanalysis**

A set of climate data that are given for the same time or average period on a regular grid in space. Data at each grid point represent the average value over a grid box whose size is determined by the spacing between the grid points (also called the grid resolution). **Global climate model** and **reanalysis** data are produced as gridded data.

H

Hadley Circulation

The major vertical movement of heated equatorial air and its north-south transfer into the mid latitudes, first proposed by George Hadley in 1735 as an explanation for the **trade winds**. It consists of the equatorward movement of the **trade winds** between about latitude 30° and the equator in each hemisphere, with rising wind components near the equator, poleward flow aloft, and, finally, descending components at about latitude 30° again.

Halosteric – see also Steric

Sea-level changes induced by changes in water density are called **steric**. Density changes induced by salinity changes are called halosteric.

Holocene

The last 12 000 years of geological time.

Homogenisation

Observed climate variables sometimes show sudden shifts in the average values or variability. Not all of these shifts are caused by real changes in climate. Non-climate related shifts can be due to changes in instrumentation, observation site, surrounding environment and observation practices, or other factors.

Homogenous – see also

Homogenisation

Climate data homogenisation aims to adjust data if necessary, so that all variations in the data series are caused by real changes in the climate, and not due to changes in the way the data have been recorded.

Humidity – see Relative humidity

I

Ice discharge (dynamical)

Discharge of ice from ice sheets or ice caps caused by the dynamics of the ice sheet or ice cap (e.g. in the form of glacier flow, ice streams and calving icebergs) rather than by melt or runoff.

Ice sheet mass balance

– see **Mass balance**

Indian Ocean Dipole (IOD)

The Indian Ocean Dipole (IOD) is a coupled ocean and atmosphere phenomenon in the equatorial Indian Ocean that affects the climate of countries that surround the Indian Ocean basin, particularly rainfall. The IOD is commonly measured by the **Indian Ocean Dipole (IOD) Index**.

Indian Ocean Dipole (IOD) Index

The IOD index measures the difference in sea-surface temperatures between the western tropical Indian Ocean (50°E to 70°E and 10°S to 10°N) and the eastern tropical Indian Ocean (90°E to 110°E and 10°S to 0°S).

Index

A number representing a measure of a particular feature of the climate system at a given time, varying with time and used as some measure of variability.

Indices – see Index

Insolation

The amount of solar radiation reaching the Earth at a given location in a given time.

Interannual

From year to year.

Interdecadal Pacific Oscillation

(IPO) – see also **Pacific**

Decadal Oscillation (PDO)

The Interdecadal Pacific Oscillation (IPO) is a natural recurring pattern of variability in tropical Pacific Ocean sea-surface temperatures occurring on periods of about 15 years and longer. While defined differently the IPO and PDO (**Pacific Decadal Oscillation**) describe essentially the same variability.

Interdecadal Pacific Oscillation (IPO) Index

A measure of the strength and phase of the **Interdecadal Pacific Oscillation** pattern.

Internal forcing – see Forcing

Intertropical Convergence Zone (ITCZ)

An east-west band of low-level wind **convergence** near the equator where the Southeast **trade winds** of the Southern Hemisphere meet the Northeast **trade winds** of the Northern Hemisphere. It is co-located with the ascending branch of the **Hadley Circulation** and has a associated band of heavy rainfall as the winds converge and moist air is forced upward.

L

La Niña – see also El Niño, El Niño–Southern Oscillation

The most common of several names given to cold phase of the **El Niño–Southern Oscillation**. La Niña is the counterpart to the **El Niño** warm event, although La Niña events tend to be somewhat less regular in their behaviour and duration. La Niña is associated with large-scale cooling of the surface waters of the eastern tropical Pacific Ocean and a strengthening of the **Walker Circulation**.

M

Madden Julian Oscillation

The Madden Julian Oscillation (MJO) is a global-scale feature of the tropical atmosphere that is characterized as an eastward moving pulse of cloud and rainfall near the equator that typically recurs every 30 to 60 days, but it is not always present.

Maritime Continent

The Maritime Continent consists of parts of Southeast Asia and the islands of Indonesia and the Philippines on the western equatorial edge of the Pacific, and includes large areas of ocean as well as the islands.

Mass balance (of ice sheets)

The mass balance is the net gain or loss of ice and snow for an ice sheet. It is related to difference between snow accumulation versus melt, runoff and iceberg calving.

Mean High Water (MHW)

The average of all high waters observed over a sufficiently long period.

Mean Higher High Water (MHHW)

The mean of the higher of the two daily high waters over a period of time.

Mean sea level – see also **Relative sea level**, **Sea level change/rise**

Mean sea level is normally defined as the average relative sea level over a period, such as a month or a year, long enough to average out transients such as waves and tides.

Meridional – see also **Zonal**

In meteorology, a flow in a direction that is parallel to a line of longitude; along a meridian; northerly or southerly; as opposed to **zonal**.

Model bias

Model biases are spurious differences between climate model simulations and observations. These may be caused by a number of factors including a lack of model resolution or an insufficiently realistic representation of certain physical processes. Systematic biases are errors that are common to a majority of the climate models.

Model drift

Model drift refers to spurious trends in climate simulations that are not caused by changing external **drivers** (such as increased greenhouse gases or changes in solar radiation). Instead these spurious trends arise as a result of the way that models are initialised or imperfections in the representation of physical processes. Under many circumstances drift only introduces a small error in the estimation of climate trends however it must be accounted for where it is large.

Model skill

Model skill is a measure of how well a climate model can realistically represent the climate system.

Multivariate ENSO Index (MEI)

A measure used to describe ENSO combining six observed variables over the tropical Pacific. These six variables are: sea-level pressure, zonal and meridional components of the surface wind, sea-surface temperature, surface-air temperature, and total cloudiness fraction of the sky.

N

Natural forcing – see also **Forcing**

A **forcing** in the climate system due to natural causes as opposed to **anthropogenic forcing**. Natural forcing includes changes in solar output, the Earth's orbit and volcanic eruptions.

NINO3 index

An average of sea-surface temperature anomalies in the Pacific Ocean over the area 5°N to 5°S, 150°W to 90°W.

NINO3.4 index

An average sea-surface temperature **anomaly** in the central Pacific (latitude 5°N to 5°S; longitude 170°W to 120°W).

NINO4 index

An average of sea-surface temperature anomalies in the Pacific Ocean over the area 5°N to 5°S, 160°E to 150°W.

O

Ocean acidification – see also **Aragonite saturation state**

Ocean acidification is the name given to the ongoing decrease in the **pH** of the Earth's oceans, caused by their uptake of **anthropogenic** carbon dioxide from the atmosphere. When carbon dioxide dissolves in the ocean it lowers the **pH**, making the ocean more acidic.

Oceanic NINO3.4 Index (ONI)

An average of sea-surface temperatures anomalies in the Niño 3.4 region (latitude 5°N to 5°S; longitude 120° to 170°W).

P

Pacific Climate Change Science Program (PCCSP)

A collaborative research partnership between Australian Government agencies, 14 Pacific island countries and East Timor, and regional and international organisations.

Pacific Climate Change Science Program (PCCSP) Region

The region defined by the coordinates: 25°S–20°N and 120°E–150°W (excluding the Australian region south of 10°S and west of 155°E).

Pacific Decadal Oscillation (PDO)

A naturally recurring pattern of variability in the tropical and northern Pacific characterised by warming and cooling sea-surface temperature, similar to that of ENSO, although broader in a north-south direction. Oscillations in the PDO take multiple decades usually 20–30 years.

Parameterisation

Representing in an approximate form processes that cannot be explicitly resolved at the spatial or temporal resolution of the model (e.g. cloud formation, ocean eddies).

Patterns of variability – see also [Climate variability](#)

Natural variability of the climate system, in particular on seasonal and longer time scales, predominantly occurs with preferred spatial patterns and time scales, through the dynamical characteristics of the atmospheric circulation and through interactions with the land and sea surfaces. Examples include the [El Niño-Southern Oscillation](#).

pH

A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The pH scale ranges from 0 to 14.

Potential evapotranspiration

Evapotranspiration is the sum of evaporation from the land surface (e.g. from the soil and bodies of water such as lakes and rivers) and transpiration from vegetation. Potential evapotranspiration is defined as the evapotranspiration that would take place if there was an unlimited water supply. It is a representation of the environmental demand for evapotranspiration.

Probability Distribution Function (PDF)

A PDF describes the likelihood that a certain event or outcome will occur based on prior experience. For example a PDF of daily temperatures would provide information on how likely it is to have an extremely hot or cold temperature.

Pycnocline

Moving downward through the ocean, the pycnocline is the region where there is a rapid increase in density with depth. It acts as a barrier to mixing between deep and surface waters.

R

Radiative forcing – see [Forcing](#)

Reanalysis – see also [Gridded data](#)

An analysis combining many irregular meteorological or oceanographic observations from close to the same time into a physically consistent, complete [gridded data](#) set for a given time and usually for the whole globe.

Relative humidity

Relative humidity is defined as the amount of water vapour in the air, relative to the maximum amount of water vapour that the air is able to hold, without it condensing (expressed as a percentage).

Relative sea level is sea level measured by a tide gauge with respect to the land upon which it is situated.

Relative sea-level rise – see also [Mean sea level](#), [Sea level change/rise](#)

Relative sea level rise occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence.

Rossby wave

Also known as a planetary wave, it is a large, slow-moving, planetary-scale wave generated in the troposphere by ocean-land temperature contrasts and topographic forcing (winds flowing over mountains), and affected by the [Coriolis Effect](#) due to the earth's rotation. Rossby waves are also observed in the ocean.

S

Sea level change/rise – see also [Mean sea level](#), [Relative sea-level rise](#), [Thermal expansion](#)

Sea level can change, both globally and locally, due to; (1) changes in the shape of the ocean basins; (2) changes in the total mass of water and, (3) changes in water density.

Factors leading to sea level rise under global warming include both increases in the total mass of water from the melting of land-based snow and ice, and changes in water density from an increase in ocean water temperatures and salinity changes.

Sea-surface temperature

The temperature of the ocean surface. The term sea-surface temperature is generally representative of the upper few metres of the ocean as opposed to the skin temperature, which is the temperature of the upper few centimetres.

Solstice

The times of the year when the Sun is at its greatest distance from the equator, occurring around June 21, when the Sun reaches its northernmost point on the celestial sphere, or around December 22, when it reaches its southernmost point.

Southern Annular Mode (SAM)

The Southern Annular Mode (SAM) is the most important recurring pattern of natural variability in the Southern Hemisphere outside of the tropics. Oscillations in the SAM are associated with shifts in the position and strength of the mid-latitude westerly winds.

Southern Annual Mode (SAM) Index

Index measuring the difference in surface pressure between latitudes 40°S and 65°S. A positive SAM index corresponds to a southward movement and intensification of the sub-tropical westerly winds.

Southern Oscillation – see also **El Niño-Southern Oscillation**

Fluctuation of a global-scale tropical and subtropical surface pressure pattern.

Southern Oscillation Index (SOI)

The Southern Oscillation Index (SOI) is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin.

South Pacific Convergence Zone (SPCZ)

A persistent and greatly elongated zone of low-level **convergence** extending from approximately 140°E near the equator to approximately 120°W at 30°S. The zone is not quite linear, but is oriented more west to east near the equator and has a more diagonal orientation (northwest to southeast) at higher latitudes.

SPCZ Position Index

The SPCZ Position Index is a measure of SPCZ location and is calculated as the normalised November–April difference in 9am (local time) in mean sea-level pressure between Suva and Apia. The SPCZ Position Index defines the latitude of the SPCZ between longitudes 180°W and 170°W.

Standardised Precipitation Index (SPI)

The Standardised Precipitation Index (SPI) is an **index** based on the probability of recording a given amount of precipitation. The probabilities are standardized so that an index of zero indicates the median precipitation amount. The index is negative for drought, and positive for wet conditions.

Statistical downscaling

– see **Downscaling**

Steric – see also **Halosteric**, **Thermosteric**

Steric effects refer to the expansion and contraction of sea water.

Storm surge

The temporary increased height of the sea above the level expected from tidal variation alone at that time and place due to extreme meteorological conditions.

Stratosphere

The region of the atmosphere extending from the top of the troposphere at heights of roughly 10–17 km, to the base of the mesosphere at a height of roughly 50 km.

Sub-tropical High Pressure System

Areas of raised surface pressure between latitudes 20° and 40°.

T

Thermal Expansion – see also **Sea level change/rise**, **Mean sea level**

The increase in volume (and decrease in density) that results from warming water.

Thermocline

Moving downward through the ocean, the region where there is a rapid reduction in temperature with depth. The thermocline separates warm surface waters from cold deep waters.

Thermosteric – see also **Steric**

The expansion or contraction of sea water due to heating or cooling.

Time-series

The values of a variable generated successively in time. Graphically, a time series is usually plotted with time on the horizontal axis (x-axis), and the values of the variable on the vertical axis (y-axis).

Trade winds

The wind system, occupying most of the tropics that blow from the subtropical high pressure areas toward the equator.

Tropical cyclone

A tropical cyclone is a tropical depression of sufficient intensity to produce sustained gale force winds (at least 63 km per hour). A severe tropical cyclone produces sustained hurricane force winds (at least 118 km per hour). Severe tropical cyclones correspond to the hurricanes or typhoons of other parts of the world.

Troposphere

The lowest part of the atmosphere from the surface to about 10 km in altitude in mid-latitudes (ranging from 9 km in high latitudes to 16 km in the tropics on average), where clouds and weather phenomena occur.

Trough

An elongated region of low atmospheric pressure.

W

Walker Circulation

The Walker Circulation is the east-west circulation of air, oriented along the Equator, across the Pacific region.

Warm Pool (also known as **West Pacific Warm Pool** and **Indo-Pacific Warm Pool**)

An extensive pool of the world's warmest water, with temperatures exceeding 28–29°C extending from the central Pacific to the far eastern Indian Ocean. The PCCSP focuses on the region of the Warm Pool to the east of 120°E.

West Pacific Monsoon

A monsoon is a tropical and subtropical seasonal reversal of both surface winds and associated rainfall, caused by differential heating between a continental scale land mass and the adjacent ocean.

The Western Pacific Monsoon is the eastern edge of the Indonesian or Maritime Continent Monsoon, and the southern extension of the larger Asian-Australian Monsoon system.

Z

Zonal – see also **Meridional**

In meteorology, latitudinal, that is, easterly or westerly; opposed to **meridional**.



Market, Vanuatu

Index

- acidification, ocean 3, 5, 9, 12, 20, 21, 76–77, 80, 81, 96, 146, 159, 176–177, 178, 214, 215, 248
- anthropogenic emissions 11, 83, 179, 244
- aragonite saturation state 5, 9, 76–77, 96, 176, 177, 178, 218, 221, 244
- atmospheric circulation *see* circulation, atmospheric
- atmospheric data
 - datasets, global/regional grids 20, 28–30
 - homogenised observed station data 28
 - observing stations in Pacific and East Timor 20, 24, 26–7, 28
 - Pacific Climate Change Data Portal 28
 - pressure, air 26, 35
 - rainfall 26–27, 66–67, 132
 - sunshine 26, 68
 - temperature 26–27, 66
 - wind 26–27
- atmospheric extremes 36, 47, 66, 89, 99, 101, 117, 118, 124, 154–157, 194, 214
- atmospheric projections 148–158, 178, 184–193, 215
 - drought 8, 52, 154, 157–158, 166, 178
 - potential evapotranspiration 8, 21, 146, 148, 153, 178, 246
 - rainfall 6, 7, 8, 9, 10, 12, 19, 20, 21, 92, 100, 102, 122, 127, 128, 146, 148, 149–150, 163, 164, 165, 166, 178, 179, 182, 184–185, 189–191, 192–193, 197, 198
 - rainfall, extreme 117–119, 124, 154–155, 157, 191
 - relative humidity 8, 21, 86, 146, 148, 152–153, 178, 218
 - solar radiation, surface 8, 21, 86, 146, 148, 152, 178
 - temperature, extreme air 118, 154–155, 156
 - temperature, surface air 6, 7, 8, 11, 21, 100, 101, 102, 103, 114, 118, 119, 121, 128, 130, 132, 133, 142, 148–149, 156, 162, 178, 179, 184, 188, 189, 190–191, 192–193, 194, 197, 198, 202
 - wind, near-surface 7–8, 19, 21, 101–103, 114, 116, 120, 151, 178–179, 186
- carbon cycle 11, 83, 168, 179, 215, 244
- carbon dioxide 5, 52, 71, 76, 77, 82, 83, 146, 208
- CCAM *see* Conformal Cubic Atmospheric Model (CCAM)
- circulation
 - atmospheric 4, 24, 33, 34–35, 43, 49, 57, 65, 114, 160
 - ocean 33, 34, 43, 45, 46, 60, 65, 77, 160, 161
 - projections 159, 160–161, 172, 218
- CliCom Climate Data Management System 26–27
- CLiDE (Climate Data for the Environment) 27
- climate
 - current, in the region 4, 13, 14, 33–36, 43–46, 90, 93, 94, 98, 100, 134, 135, 146, 148, 149, 155, 159, 167, 197, 203, 204, 205, 206, 207, 209, 210, 211, 214, 215, 219, 221
 - definition 2, 15
 - indigenous terminology 36
 - mean, at key locations across the region 41–42
- climate change
 - definition 2, 15
 - global 54, 92
 - Holocene 56, 57
 - local perceptions 55
 - past 1000 years 57
- climate data *see* atmospheric data and *see* ocean data
- climate extremes *see* extreme events
- climate features 4, 6, 7, 10, 12, 21, 24, 37–40, 41, 99, 111–116, 120, 135, 140, 142, 143, 203, 214
- climate models 6, 79–143, 145–179, 181–211, 215, 217
 - bias 6, 70, 88, 89, 90, 94, 98, 100, 101, 103, 111, 112, 115, 117, 118, 120, 121, 122, 130, 132, 135, 147, 148, 149, 152, 165, 184, 185, 197, 215
 - drift 85, 99, 107–108, 142, 143, 248
 - performance 6, 14, 21, 98, 99, 114, 117, 118, 121, 132, 134, 135, 136, 142, 143, 219, 220, 221
- projections *see* atmospheric projections and *see* ocean projections
- Climate Prediction Centre Merged Analysis of Precipitation (CMAP) 29, 30, 31, 35, 39, 63, 101, 102, 114, 115, 116, 117, 122, 123, 129, 131, 132, 164
- climate projections *see* atmospheric projections and *see* oceanic projections
 - methods 12, 21, 79–96, 179, 184, 203, 204, 211, 215
 - regional 115, 158, 173, 215
 - small-scale projections 87, 127–130
 - tropical cyclone 10, 203–210, 211
 - uncertainty 10, 11, 19, 88, 89, 100, 111, 120, 134, 136, 156, 179, 215
- climate variability 3, 5, 6, 7, 11, 12, 15, 17, 20, 31, 48, 51–78, 88, 92, 99, 100, 101, 107, 107, 111, 120, 146, 162, 170, 179, 214
- climatological periods 31–32
- Conformal Cubic Atmospheric Model (CCAM) 89–90, 121–131, 184–197
 - downscaling at 8 km resolution 90, 127–130, 182, 183, 188–196
 - downscaling at 60 km resolution 90, 121–127, 182, 183, 184–188
- convection 4, 34, 35, 38, 40, 58, 111, 115, 131, 160
- convergence 4, 25, 38, 44, 82, 101, 103, 104, 120, 149, 160, 167
- Cook Islands 2, 3, 4, 9, 14, 18, 20, 24, 26, 27, 37, 38, 41, 42, 64, 73, 74, 87, 92, 136, 141, 149, 151, 175, 176, 178, 181, 198, 199, 200, 201
- Coriolis Effect 34, 36, 43, 160, 245
- Coupled Model Intercomparison Project
 - Phase 3 (CMIP3) 80, 84, 85, 86, 87, 93, 94, 95, 96, 99, 101–120, 124, 139, 149, 142, 143, 153, 154, 156, 157, 159, 160, 162, 163, 164, 166, 167, 171, 172, 173, 208, 211, 215, 217–221, 245
 - Phase 5 (CMIP5) 214, 215
- CSIRO Direct Detection Method (CDD) 94–95, 136, 139, 218

- Currents *see* ocean currents
- Curvature Vorticity Parameter (CVP) 94, 95, 98, 135, 136, 137, 138, 204, 206, 218, 219
- cyclones *see* tropical cyclones
- data record *see* atmospheric data and *see* ocean data
- downscaling
- dynamical 10, 80, 81, 87, 88, 89–91, 98, 121–134, 183, 184–197, 215
- methods 89–91
- projections 10, 181–211
- statistical 10, 21, 80, 81, 87, 88, 92, 99, 121, 132, 134, 182, 183, 198–202, 208, 211, 245
- drought 4, 8, 52, 55, 56, 59, 65, 88, 154, 157–158, 211, 245, 158, 166, 178
- dynamic response (ice sheets) 9, 93, 168, 169, 175, 178, 215, 245
- dynamical downscaling *see* downscaling, dynamical
- East Timor 2, 3, 4, 7, 10, 14, 15, 16, 17, 18, 20, 23, 26, 27, 36, 39, 40, 41, 42, 62, 65, 66, 73, 74, 90, 114, 115, 141, 153, 163, 178, 186, 188
- Ekman currents 43, 45, 160, 245
- El Niño *see* El Niño–Southern Oscillation (ENSO)
- El Niño–Southern Oscillation (ENSO) 5, 7, 19, 31, 53, 58, 99, 111, 146, 160, 162, 179, 203, 215
- canonical El Niño 58, 59, 112, 113, 245
- El Niño Modoki 58, 59, 60, 112, 113
- indices
- El Niño Modoki Index (EMI) 60, 112, 113
- Southern Oscillation Index (SOI) 59, 75
- emissions scenarios 6, 7, 7, 9, 11, 14, 20, 21, 81, 82, 83, 85, 86, 88, 89, 96, 143, 146, 147, 148, 149, 150, 151, 152, 153, 154, 158, 168, 169, 176, 177, 178, 208, 215
- Equatorial Cold Tongue 33, 34, 44, 104, 120, 158
- European Centre for Median-Range Weather Forecast (ECMWF) 29
- evaporation *see* potential evapotranspiration
- evapotranspiration *see* potential evapotranspiration
- extreme events 2, 3, 4, 5, 12, 20, 24, 25, 56, 68, 71–75, 88, 100, 117–120, 143, 154, 155, 157, 183, 184, 214, 215
- downscaling 194–196, 203–210
- projections 154–158, 215
- rainfall 8, 47, 55, 66, 117, 118, 155, 157, 178, 215
- sea level 48, 52, 71–75, 172
- temperature 118, 154, 156
- see also* drought, *see* tropical cyclones
- Federated States of Micronesia 2, 3, 4, 10, 14, 18, 20, 26, 27, 36, 38, 39, 41, 62, 73, 74, 75, 90, 92, 115, 141, 158, 178, 188, 198, 199
- Fiji 2, 3, 4, 10, 14, 18, 20, 26, 27, 36, 38, 41, 42, 64, 66, 73, 74, 90, 92, 118, 121, 122, 124–130, 132, 133, 136, 141, 175, 178, 183, 188, 189, 190, 192, 193, 194, 195, 198, 199, 200
- flux adjustment 85, 90, 108, 120, 246
- forcing
- anthropogenic 52, 60
- external 57, 60, 85, 244
- radiative 64, 244, 246
- Genesis Potential Index (GPI) 94, 98, 136, 140, 206, 218, 219
- global climate models (GCM) *see* climate models
- Global Precipitation Climatology Project (GPCP) 29, 30, 39, 101, 102, 117, 122, 123, 129, 131, 132, 164
- greenhouse gases 5, 6, 11, 52, 60, 64, 70, 71, 82–83, 85, 107, 108, 110, 175, 179, 244
- Hadley Circulation 34, 35, 38, 52, 64, 185
- Holocene 56, 57
- humidity *see* relative humidity
- ice discharge 168, 169
- ice sheet mass balance 93
- Indian Ocean Dipole (IOD) 7, 52, 65, 111, 114, 163, 179
- model reliability 114
- projections 7, 114, 163, 179
- indigenous weather and climate terminology 36
- insolation *see* solar radiation
- Interdecadal Pacific Oscillation (IPO) 5, 52, 56, 60–61, 116, 163, 166
- Intergovernmental Panel on Climate Change (IPCC) 7, 9, 11, 14, 16, 19, 20, 21, 52, 81, 82, 100, 110, 111, 147, 168, 169, 178, 179, 208, 215
- Special Report on Emissions Scenarios (SRES) 20, 81, 82, 83, 85,
- International Climate Change Adaptation Initiative 2, 14, 15, 16
- Intertropical Convergence Zone (ITCZ) 4, 7, 19, 24, 25, 35, 37, 38, 44, 45, 52, 56, 61, 99, 115, 146, 149, 163, 179
- Kiribati 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 41, 42, 49, 62, 73, 74, 103, 118, 120, 141, 148, 149, 153, 175, 176, 178
- La Niña 5, 7, 35, 38, 48, 57, 58, 59, 60, 61, 62, 67, 72, 75, 112, 113, 114, 115, 162, 163, 179
- Madden–Julian Oscillation (MJO) 40, 41, 100
- Marshall Islands 2, 3, 4, 10, 14, 18, 20, 26, 27, 36, 38, 39, 41, 61, 62, 73, 74, 75, 92, 141, 158, 175, 178, 198, 199, 200, 201
- National Institute of Water and Atmospheric Research (NIWA) 26
- National Oceanic and Atmospheric Administration (NOAA) 26, 27, 31, 32
- Nauru 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 41, 42, 59, 64, 66, 73, 74, 103, 118, 120, 141, 148, 149, 153, 175, 178

- Niue 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 42, 64, 66, 73, 74, 136, 141, 175, 178
- ocean
- acidification 3, 5, 9, 12, 20, 21, 76–77, 80, 81, 96, 146, 159, 176–177, 178, 214, 215, 248
 - circulation 33, 34, 43, 45, 46, 60, 65, 77, 160, 161
 - currents 4, 24, 45–46, 49, 75, 93, 161
 - data 30–32
 - mass changes 173
 - measurements 214
 - salinity 6, 8, 21, 30, 31, 32, 43, 44, 45, 69–70, 71, 86, 93, 96, 99, 104, 105, 146, 159, 160, 161, 172, 176, 178, 218, 221
 - temperature 31, 33, 35, 36, 41, 48, 54, 58, 69, 71, 90, 93, 100, 107, 111, 159, 218
 - thermal expansion 9, 98, 111, 168, 169, 172, 175, 178, 249
- ocean projections 8–10, 159–161, 170–175, 178, 215
- acidification 9, 80, 176–177, 178
 - circulation 75, 160–161
 - salinity 8, 159–160, 178
 - sea level 9, 10, 93, 173–5, 178, 215
 - stratification 8, 159, 160, 162, 178
 - temperature 90, 100, 159, 178
- Pacific Climate Change Data Portal 28
- Pacific Climate Change Science Program (PCCSP) 2, 5, 14, 15, 16, 17, 20–21, 24, 27, 80, 214
- Pacific Decadal Oscillation (PDO) 5, 52, 60–61, 69, 106, 116
- Pacific Islands Framework for Action on Climate Change 2, 14, 16, 216
- Palau 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 39, 41, 42, 61, 62, 73, 74, 75, 115, 141, 158, 175, 179
- Papua New Guinea 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 39, 40, 41, 62, 66, 73, 74, 90, 103, 112, 115, 121, 122, 124, 125, 126, 127, 128, 141, 149, 151, 152, 153, 156, 158, 171, 175, 178, 183, 188, 189, 191, 196
- parameterisation 84, 111, 122, 131, 249
- pH 5, 19, 66, 76, 96, 176, 248
- potential evapotranspiration 8, 21, 146, 148, 153, 154, 178, 218, 220, 246
- projections 8, 153, 178
- precipitation *see* rainfall
- Probability Density Function (PDF) 117, 118, 119, 124, 127, 193–194
- Projections *see* climate projections
- pycnocline 44–45, 160, 249
- rainfall
- data 26–27, 66–67, 132
 - extreme 8, 47, 55, 66, 117, 118, 155, 157, 178, 215
 - projections 7, 8, 92, 147, 157, 165, 185, 188, 189–193, 198–202
 - seasonal 4, 25, 40, 116, 128, 192
- relative humidity 8, 21, 47, 86, 95, 138, 146, 148, 152, 153, 178, 218, 200
- projections, near surface 152, 153
- Rossby wave 60, 171
- salinity, *see* ocean salinity
- Samoa 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 41, 42, 64, 73, 74, 75, 90, 92, 136, 141, 175, 176, 178, 188, 198, 200, 201
- sea level
- data 31, 32, 74, 214
 - current 72–75
 - change, past 31, 46–47, 71–74
 - changes, regional 171–173
 - extremes 48, 49, 71–75, 214
 - projections 3, 9, 10, 11, 20, 93, 110, 111, 146, 159, 168–175, 178, 179, 215
- solar radiation 8, 21, 33, 34, 56, 60, 73, 84, 86, 146, 152, 153, 178, 218, 220, 247
- projections 8, 152, 178
- Solomon Islands 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 39, 40, 41, 42, 62, 64, 73, 74, 90, 92, 103, 115, 136, 141, 149, 151, 152, 153, 158, 175, 178, 188, 199, 200, 201
- South Pacific Convergence Zone (SPCZ) 4, 5, 6, 7, 8, 9, 10, 12, 19, 21, 24, 35, 36, 37, 38, 39, 41, 45, 52, 64, 66, 67, 70, 94, 99, 103, 111, 114, 116, 120, 122, 131, 135, 142, 143, 146, 149, 152, 166, 167, 179, 186, 203, 214, 215
- Southern Annular Mode (SAM) 40, 52, 56, 65, 75
- Standardised Precipitation Index (SPI) 157, 158, 250
- statistical downscaling *see* downscaling, statistical
- stratosphere 73, 250
- storm surge 4, 24, 25, 47, 48–49, 55, 135, 140, 203, 214, 250
- sub-tropical high pressure system 34, 36, 37, 40, 65, 250
- surface air temperature *see* temperature
- surge *see* sea level extremes
- temperature, air 29, 33–34, 54
- data 26–27, 66
 - extremes 66
 - projections
 - extreme air 118, 154–155, 156
 - surface air 6, 7, 8, 11, 21, 100, 101, 102, 103, 114, 118, 119, 121, 128, 130, 132, 133, 142, 148–149, 156, 162, 178, 179, 184, 188, 189, 190–191, 192–193, 194, 197, 198, 202
- temperature, ocean 31, 33, 35, 36, 41, 48, 54, 58, 69, 71, 90, 93, 100, 107, 111, 159, 218
- temperature, sea-surface 4, 5, 30, 32, 38, 41, 43, 44, 47, 52, 57, 58, 59, 60, 69, 70, 80, 88
- projections 3, 6, 20, 21, 90, 94, 96, 98, 104, 105, 106, 108, 112, 113, 114, 120, 121, 122, 131, 132, 135, 142, 151, 159, 160, 162, 163, 167, 178, 183, 184, 185, 186, 188, 203, 218, 221
- thermocline 7, 44, 45, 65, 71, 107, 111, 162, 163, 179, 250
- Tonga 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 41, 42, 59, 64, 66, 73, 74, 87, 92, 97, 118, 136, 141, 149, 175, 178, 198, 199, 200, 201

trade winds 4, 7, 19, 34–35, 36, 37, 38, 41, 43, 45, 46, 48, 56, 58, 59, 72, 74, 75, 107, 128, 160–161, 167, 171, 179, 246

tropical cyclones 4, 5, 24, 25, 34, 36, 41, 47, 48, 49, 52, 55, 56, 59, 67, 68

projections 10, 19, 203–210, 211

projection methodology

- CSIRO Direct Detection Method (CDD) 94–95, 136, 139, 218
- Curvature Vorticity Parameter (CVP) 94, 95, 98, 135, 136, 137, 138, 204, 206, 218, 219
- Genesis Potential Index (GPI) 94, 98, 136, 140, 206, 218, 219

trends 5, 47, 52, 55

wind risk hazard 140–141

troposphere 34, 35, 52, 160, 249

Tuvalu 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 39, 41, 42, 62, 64, 73, 74, 136, 141, 153, 175, 176, 178

uncertainty 10, 11, 19, 74, 88, 89, 99, 100, 111, 120, 134, 136, 156, 175, 179, 215

Vanuatu 2, 3, 4, 9, 10, 14, 18, 26, 27, 36, 38, 39, 41, 42, 46, 62, 64,, 73, 74, 90, 92, 118, 136, 141, 149, 175, 178, 186, 188, 198, 199, 200, 201, 202

Walker Circulation 7, 34, 35, 52, 55, 58–60, 75, 107, 111, 151, 162, 163, 164, 179

Warm Pool *see* West Pacific Warm Pool

waves 43, 44, 45, 47, 48, 49, 65, 71, 172, 214

West Pacific Monsoon (WPM) 4, 7, 24, 25, 33, 34, 36, 37, 38, 39, 52, 94, 99, 101, 103, 111, 115, 116, 122, 135, 142, 143, 149, 164, 165, 179, 186

West Pacific Warm Pool 4, 33, 34, 35, 37, 38, 43, 44, 56, 104, 146, 160, 178

wind 4, 7, 19, 24, 29, 31, 33, 34, 35, 36, 37, 38, 39, 41, 43, 44, 45, 46, 47, 48, 56, 58, 59, 62, 63, 64, 65, 72, 74, 75

projections *see* atmospheric projections

World Meteorological Organization (WMO) 27, 31