Pacific-Australia Climate Change Science and Adaptation Planning program

International CLIMATE CHANGE ADAPTATION Initiative

Timor- Leste

Terencio Fernandes Moniz, National Directorate of Meteorology and Geophysics (DNMG) & Mario Ximenes, National Directorate of International Environment Issues (DNAAI)

Climate Variability and Projected Future Climate Change in Timor-Leste

Timor-Leste is located in the Southern Hemisphere low latitude tropics between 8°S – 10°S and 124°E – 128°E (Fig. 1) near the eastern end of the Indonesian archipelago. Timor-Leste comprises of the eastern half of the Timor island and includes the exclave of Oecusse-Ambeno as well as the two islands, Atauru and Jaco. A mountain range divides the north and south coasts of Timor-Leste.

The population of Timor-Leste in the 2010 census was 1.066.582. The total land area is 15.007 km^2 which is the divided into 13 administrative districts. Oil and gas deposits are responsible for large part of Timor-Leste revenue. Major export commodities include coffee, vanilla, coconut, sandalwood and marble.

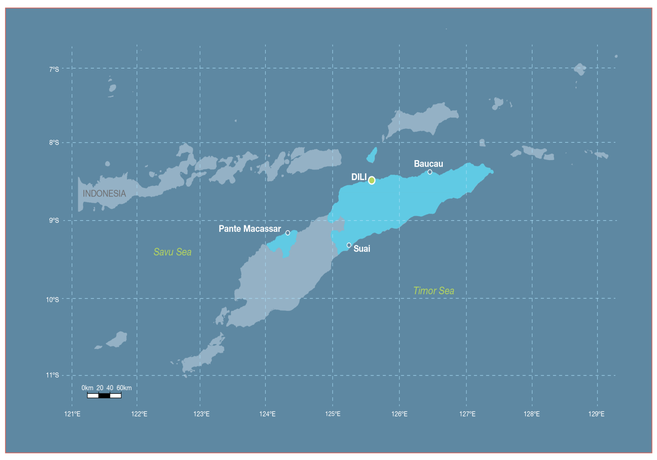

Fig 1 : Map of Timor-Leste.

Observed climate

Timor-Leste's climate is affected strongly by the West Pacific Monsoon (WPM), which is driven by large differences in temperature between the land and the ocean. It moves north to mainland Asia during the southern hemisphere winter and south to Australia in the southern hemisphere summer. Its seasonal arrival usually brings a switch from very dry to very wet conditions. The normal south easterly trade winds in Dili are replaced by westerly winds from the monsoon onset until the end of the monsoon season.

Year to year variations in Timor-Leste's climate are due to El Niño Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD). El Niño generally brings drier conditions to Dili and often lead to a late onset and early finish to wet season and associated with droughts. During La Niña events, dry season rainfall tends to be above normal and the wet season often starts earlier and finishes later, with increased flooding and landslides. During a positive phase of the IOD dry season rainfall in Dili is lower than normal.

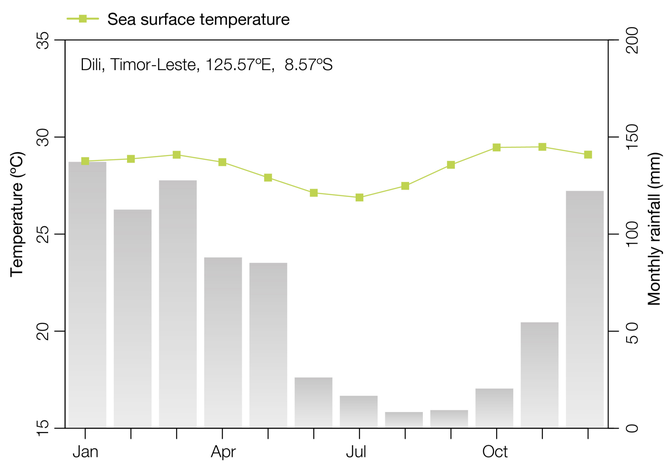

Fig 2: Mean annual cycle of rainfall (bars) at Dili Airport and local sea-surface temperatures.

The seasonal cycle of rainfall (Fig. 2) shows that Dili has a very marked wet season from December to May and a dry season a from June to November. The average monthly rainfall is above 100 mm during the wet season and less than 30 mm during the dry season. Sea surface temperatures are closely related to air temperatures and show a weak seasonal cycle with highest temperatures in March and November, about 2.5º C warmer than those in July, which is the coolest month.

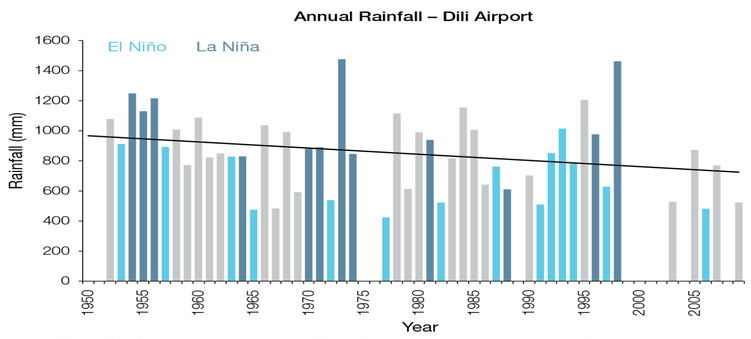

Fig. 3: Annual rainfall at Dili Airport. Light blue, dark blue and grey bars denote El Niño, La Niña and neutral years respectively.

Coastline, Dili district

Taking temperature observations at DNMG

Flooding in Dili during 2001/11 La Niña, photo supplied by DNMG

The Dili Airport negative annual and dry season rainfall trends for the period 1952–2009 (Fig. 3) are statistically significant. The sea level near Timor-Leste has risen at a rate of 9 mm per year since 1993.

On average eight Tropical Cyclones per decade pass within 400 km of Dili, with most occurring between November and April. However, the impact is usually weak due to East Timor's proximity to the equator.

Climate projections

Climate projections have been derived from up to 18 global climate models from the CMIP3 database, for up to three emissions scenarios (B1, A1B and A2) and three 20-year periods (centred on 2030, 2055 and 2090, relative to 1990). These projections do not represent a value specific to any actual location, such as a town or city in Timor-Leste. Instead, they refer to an average change over the broad geographic region encompassing Timor-Leste and the surrounding ocean.

Projections are given for surface air temperature, sea surface temperature (Fig. 4), rainfall, extreme weather events (including temperature, rainfall, drought and tropical cyclone), ocean acidification and sea level.

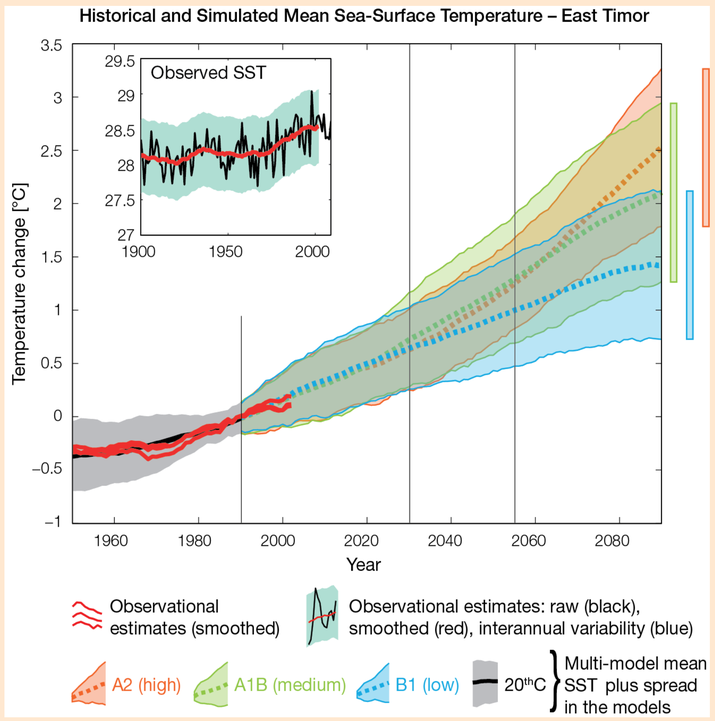

*Fig. 4: Historical climate (from 1950 onwards) and simulated historical and future climate for annual **mean sea surface temperature** in the region surrounding East Timor, for the CMIP3 models.*

Rainfall Projections

Wet Season (November-April)

Wet season rainfall is projected to increase over the course of the 21st century. There is *moderate* confidence in this direction of change because (a) An increase in wet season rainfall is consistent with the projected likely amplification of the seasonal rainfall-cycle associated with the WPM; and (b) approximately half of the CMIP3 models agree on this direction of change by 2090.

Dry Season (May-October)

Dry season rainfall is projected to decrease over the course of the 21st century. There is *moderate* confidence in this direction of change because (a) Reduced dry season rainfall is consistent with the projected likely amplification of the seasonal rainfall cycle associated with the WPM; and (b) the majority of CMIP3 models agree on this direction of change by 2090.

Annual

Little change is projected in total annual rainfall over the course of the 21st century. There is *low* confidence in this direction of change because (a) Only approximately half of the CMIP3 models suggest this direction of change by 2090; and (b) there is only moderate confidence in wet and dry season rainfall projections, as discussed in *Climate Change in the Pacific: Scientific Assessment and New Research*.

Interannual variability in rainfall over East Timor is strongly influenced by ENSO in the current climate, via its influence on WPM activity. As there is no consistency in projections of future ENSO activity, it is not possible to determine whether interannual variability in rainfall will change in the future.

Sea Level Projections

The CMIP3 models simulate a rise in seas level of between approximately 5-15 cm by 2030, with increases of 20-60 cm indicated by 2090 under the higher emissions scenarios (i.e. A1B (medium) and A2 (high), see Fig. 5)).

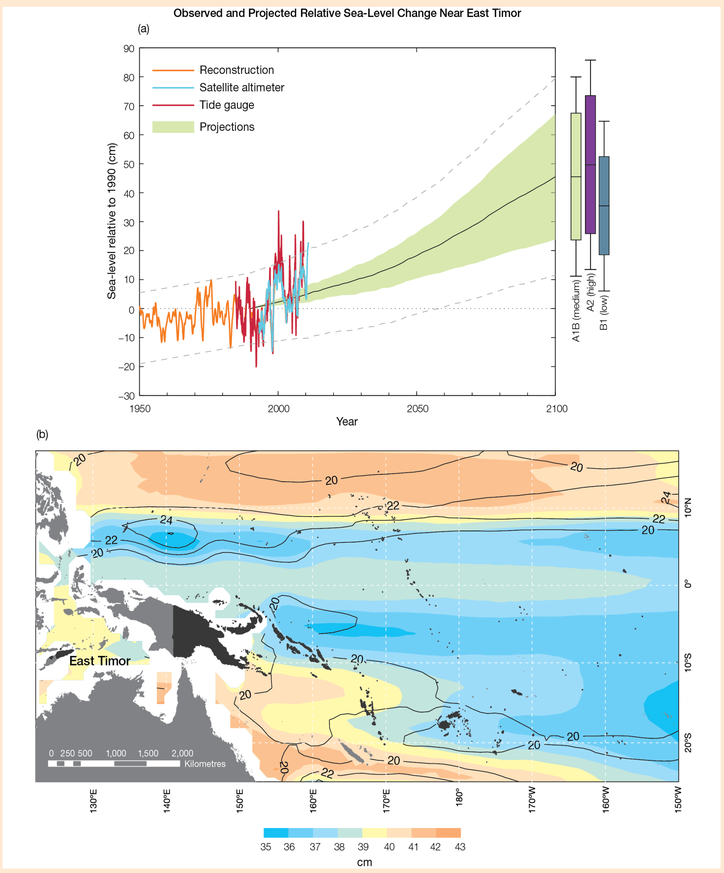

*Fig. 5: Observed and projected relative **sea-level change** near East Timor. (a) For one observational location. (b) The projections (in cm) for the A1B scenario in the East Timor region for the average over 2081–2100 relative to 1981–2000 are indicated by the shading, with the estimated uncertainty in the projections indicated by the contours (in cm).*

Interannual variability of sea level will lead to periods of lower and higher regional sea levels. In the past, this interannual variability has been about 24 cm (5–95% range, after removal of the seasonal signal; dashed lines in Figure 3.8 (a)) and it is likely that a similar range will continue through the 21st century. In addition, winds and waves associated with weather phenomena will continue to lead to extreme sea-level events.

Summary of other Projections

- Surface air temperature and sea surface air temperature are projected to continue to increase. Increase in average temperatures will also result in a rise in the number of hot days and warm nights and a decline in cooler weather (*very high confidence*)
- The intensity and frequency of days of extreme heat are projected to increase (*very high confidence).*
- The intensity and frequency of days of rainfall are projected to increase (*high confidence*).
- Little change is projected in the incidence of drought (*low confidence).*
- Tropical cyclone numbers are projected to decline in the broad region surrounding Timor-Leste (0-20º S and 100º E) (*moderate confidence*)
- Ocean acidification is projected to continue (*very high confidence).*
- Mean sea level rise is projected to continue (*very high confidence).*

Acknowledgement

Materials in this presentation are obtained from BoM and CSIRO (2011) *Climate Change in the Pacific: Scientific Assessment and New Research (Vol. 2: Country Reports)* produced by the Pacific Climate Change Science Program.

Australian AID

Australian Government AusAID

Australian Government Bureau of Meteorology

Australian Government Department of Climate Change and Energy Efficiency

CSIRO

Further information:

> contact: Terencio Fernandes Moniz> phone: +760 7230218> email: moniztete@yahoo.com> web: www.dnmg.tl

www.pacificclimatechangescience.org

Australian Bureau of Meteorology and CSIRO, 2011. Climate Change in the Pacific: Scientific Assessment and New Research. Volume 1: Regional Overview. Volume 2: Country Reports.