

Pacific Climate Change Science



Current and future climate of the **Pacific**

Guide for **workshop facilitators**



Australian Government

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For more information about the
use of this resource, please email
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Climate change science in the Pacific

Small island developing countries are among the most vulnerable to our changing climate. People living in the Pacific islands and Timor-Leste are already experiencing higher temperatures, shifts in rainfall patterns, rising sea levels and changes in frequency and intensity of extreme climate events, with further changes expected long into the future as a result of climate change associated with human activity.

These changes are occurring on top of a naturally variable climate, with consequences for human health, infrastructure, coastal resources, disaster management, fresh water availability, agriculture, fisheries, forestry, marine ecosystems and tourism.

Scientific knowledge is urgently needed to help Pacific island countries and Timor-Leste to plan for the future in a changing climate.

The Pacific-Australia Climate Change Science and Adaptation Planning program helped fill this knowledge gap by:

- collating and digitising climate data records for Pacific island countries and Timor-Leste
- examining past climate observations, trends, large-scale climate processes and natural variability
- providing relevant national scale climate projections based on global climate model outputs
- developing a number of digital tools to improve management, access, modelling and analysis of climate data, including enhanced seasonal forecasting capability at national scale
- communicating key climate science findings and developing in-country climate science capability.

The Pacific-Australia Climate Change Science and Adaptation Planning program

The Pacific-Australia Climate Change Science and Adaptation Planning program (PACCSAP, 2011–14) and its predecessor, the Pacific Climate Change Science Program (PCCSP, 2009–11), were major research programs supported by the Australian Government to provide targeted climate information to 14 Pacific island countries (Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu) and Timor-Leste.

For more information visit
www.pacificclimatechangescience.org.

Introduction to the training package

This document is a step-by-step guide to facilitating a one-day workshop on understanding climate change science in the Pacific island region and Timor-Leste. It is part of a training resource package informed by science from the PACCSAP program.

About this guide

The training package builds on workshops conducted by PACCSAP and the PCCSP, in 14 Pacific island countries and Timor-Leste throughout 2010–2014. It brings together lessons learnt from over 45 different workshops into one accessible and easy to use training resource.

This training package will assist staff in national meteorological services in the Pacific islands and other relevant organisations to communicate the climate science reported in PACCSAP tools and publications—and turn today's climate science into tomorrow's climate service.

Training package contents

The Pacific Climate Change Science training package contains:

- this flexible 'how to' guide for running workshops on climate change science in the Pacific, which can be adapted to individual country and stakeholder contexts
- PowerPoint presentations to use in the workshop
- publications, tools and resources developed through the PACCSAP program.





PowerPoint presentations

A PowerPoint slide package has been developed for each Pacific island country and Timor-Leste. Each workshop presentation consists of four sessions:

1. **Welcome and introduction**
2. **Climate variability and climate change**—an introduction to concepts of weather, climate and climate change as well as natural variability and key features of the Pacific climate. This session also explores the impacts of a changing climate in the Pacific, and details the current and changing climate of the country/region.
3. **Climate projections**—a summary of how climate projections are made and how they are used, including key concepts such as climate models, emissions scenarios and uncertainty. The latest projections for each country/the region are also covered.
4. **Evaluation and close.**

The presentation can be delivered as a whole, or divided into two presentations (one based on Session 2 and one based on Session 3).

Publications, tools and resources

Familiarising yourself with the reports, brochures and climate analysis tools on which this workshop is based will assist you in preparing to facilitate your workshop.

It is also a good idea to provide workshop participants with the details of these tools and resources so they can continue learning about climate change science in the Pacific after the workshop.

Details are listed at the back of this guide. These pages can be easily copied and distributed to workshop participants. Alternatively, you can direct participants to the Pacific Climate Change Science website at www.pacificclimatechangescience.org, where all the resources can be accessed.

Workshop overview

This workshop takes the participants through basic concepts of weather, climate variability and climate change, encouraging them through participatory exercises to think of real-life examples of each concept.

Format and delivery

The workshop is a mix of presentations and small group discussions aimed at sharing information between participants and consolidating learning.

Any session in this workshop can be used on its own, or can be adapted and incorporated into other workshops. It is particularly important, however, that climate projections are presented with essential context around uncertainty and confidence levels.

Due to its participatory nature, it is recommended that around 30 people be invited to take part. It is also recommended that there is a team of between three and five facilitators to assist with the running of the workshop. If there are fewer facilitators available, it is advisable to limit the number of participants to allow for around five to ten participants per facilitator.

The workshop has been designed to be broadened to a regional level, or focused in at a country level, depending on who the audience is. Materials have been designed for country-specific workshops or a regional Pacific workshop and the program can be easily adapted for either audience.

Workshop objectives

- To build participants' understanding of key climate change science concepts
- To assist participants to think about climate change in a local context
- To build a foundation on which participants can start planning for climate change.

Target audience

This workshop is a useful resource for national meteorological services tasked with presenting technical climate change science information to other sectors in their country and beyond. It is targeted at officers working on climate change projects or activities across all sectors in Pacific island countries and Timor-Leste. It is designed to build knowledge of key climate change science concepts and the latest climate change science research for the region.

The target audience includes:

- staff in government departments such as health, disaster management, environment, transport, tourism, fisheries, agriculture
- staff of non-government organisations working on climate-related issues
- staff of regional organisations.

This workshop is not meant to cover the underpinning science at a highly technical level and is general in nature. For more detailed data and analysis, see the National Meteorological Services in each country.

Workshop program

This one-day workshop can be adapted to suit the needs of the audience, the facilitator and the local context. Facilitators should adapt the workshop program to be appropriate for the work hours in each country.

This guide provides presentations and notes for the following program. You may wish to use this program as a guide for running your own workshop. Page numbers in the notes column refer to session notes provided in this guide.

Time	Session	Notes
8.00 am	Arrival/welcome tea and coffee	
	Session 1: Introduction	
8.30 am	Introduction and welcome	
8.45 am	Roundtable participant introduction	
	Session 2: Climate variability and climate change	
9.15 am	Impacts of a changing climate	
9.45 am	Understanding climate variability and change	
10.15 am	Current and changing climate (region/country)	
10.30 am	Morning tea	
10.45 am	Small group discussion: Climate variability and climate change	
11.15 am	Report back from groups	
	Session 3: Climate projections	
11.45 am	Understanding climate projections	
12.15 pm	Small group discussion: Climate projections terms*	
12.45 pm	Lunch	
1.30 pm	Report back from groups	
2.00 pm	Future climate (region/country)	
2.30 pm	Small group discussion: Possible impacts and planning	
3.30 pm	Report back from groups	
	Session 4: Workshop evaluation and close	
4.00 pm	Evaluation and close	
4.30 pm	Workshop ends	

* session may extend into lunch

SESSION 1

Introduction

Suggested duration: 45 mins

The purpose of this session is to introduce facilitators and participants in a way that creates an atmosphere that promotes participation, and to develop an understanding of the audience and their background to better target the workshop.

Introduction and welcome - 15 mins

The most appropriate person to open the workshop will depend on the context - including the agency running the workshop. The workshop could be opened by a senior member of the government agency who is the focal point for the project, program or for climate change.

After the workshop is opened, spend a short time discussing the role that climate information service providers play in turning climate science into climate services. Ensure that participants are aware that this workshop has been developed to help them better understand the science, so they will be able to effectively carry out this important role.

Roundtable participant introductions - 30 mins

Ask everyone to introduce themselves, including their name, job title/agency and their interest/experience in climate change. Try to keep these very short—the lead facilitator can give the first example. The aim of this activity is for both the facilitating agency and the participants to understand the breadth of experience and knowledge in the room. This will help to target discussions later in the workshop.



Tips for facilitators

- Ensure your training room has pens, post-it notes, paper and a whiteboard available.
- Remember that not everyone will be familiar with scientific graphs, flow charts or other ways in which climate science information is presented. Your workshop participants may be people with a technical background in weather and climate, but may also be people with a technical background in another field, like health or fisheries. The PowerPoint presentations provide notes on how to explain any graphs or images used to communicate the information. It is a good idea to use a laser pointer, a long stick, or even just your hands to point out the key aspects of the graph like the measurements on an axis, the time period or the units used. Also be prepared to answer questions about how the figure/graph was developed and be prepared to talk about relevant in-country examples.
- Pay close attention to keeping the workshop on time. If the workshop is running late, try these ideas:
 - When asking groups to report back after discussion, ask them to present one rather than all their ideas.
 - Cut morning tea and lunch breaks short.
- If you are not a national meteorological service staff member, get in touch with the NMS in the country you are going to run the workshop in and see if they could provide assistance as presenters and facilitators.
- If your participants are particularly interested in a tool or resource, you might consider modifying the workshop to focus on it, if appropriate.
- Test the knowledge/understanding of participants at the end of each session with some simple quiz-type questions and make it a fun review activity.

SESSION 2

Climate variability and change

Suggested duration: 2 hrs 15 mins

Learning objectives

- To understand the concepts of weather, climate variability and climate change – particularly in relation to the different timescales of the concepts and how they interact together
- To think about these concepts in their own local context
- To understand that weather and climate impacts present risks and opportunities that need to be managed

Impacts of a changing climate – 15 mins

Slide cue: Impacts of a changing climate

Use the slides to review some of the key impacts that a changing climate will have on water, biodiversity, food and natural resource, infrastructure, tourism and health. This will inform the group discussion that is held at the end of Session 3. It is introduced in this session so participants can consider potential impacts during the course of the workshop.

Understanding climate variability and change - 30 mins

Slide cue: Understanding climate variability and climate change

This presentation in the toolkit outlines key concepts of weather, climate variability and climate change, with particular emphasis on climate features of the region.

Current and changing climate (region/country) - 30 mins

Slide cue: Current climate and changing climate

Using information from resources on the Publications, tools and resources page at the end of this guide, this session puts into context the concepts defined in the previous session to highlight the key characteristics of historical and current climate of the region or country. the best person to present this information is a representative of the national meteorological service, or equivalent agency, in the country.

Small group discussion: climate variability and climate change - 30 mins

Slide cue: Small group discussion: climate variability and climate change

The purpose of this activity is for participants to think further about climate variability and climate change by suggesting possible impacts of both concepts.

Participants will need to be divided into groups of around five people. Each group should be given large sheets of paper and thick marker pens. For this exercise it doesn't matter if members of each group come from different sectors. Ask each group to designate a scribe to write down the group's ideas, and a presenter to present the information back to the main group at the end of the exercise.

Put up the presentation slide titled *Small group discussion: climate variability and climate change* which lists the following activities:

- Identify two changes to the climate and/or ocean in your country or the region (depending on the audience) that have been observed or that you know about, and that indicate climate change.
- Identify two extreme events in the climate and/or ocean in your country, that have been observed or that you know about, and that indicate climate variability.

There is also a slide that gives some examples from Australia to help participants understand the exercise.

Facilitators will need to visit the groups to check they have understood the exercise. Facilitators can prompt groups with ideas; however, they should not direct the group's discussion.

Report back from groups - 30 mins

This activity is designed so that the ideas from each group can be shared and discussed with all participants. Make sure to mention that only new ideas should be presented to avoid the same ideas being repeated by every group.

The facilitator can and should ask questions to clarify points and avoid misinterpretation. The facilitator should end the session by explaining that this shows that it is sometimes difficult to identify events as either climate change or climate variability and emphasise that the important thing is that resilience is built to withstand a variable and changing climate.

While climate change is a gradual process that will not happen overnight and there is time to plan for climate change impacts, facilitators should note that climate change impacts are already occurring and they are not something that can be ignored in the short term.

Climate projections

Suggested duration: 3 hrs 30 mins

Learning objectives

- To understand how projections are created and what they are used for
- To understand key concepts of projections
- To understand and be able to communicate uncertainty
- To start thinking about projections in a local context, their possible impacts and how to use this information in planning for climate change adaptation

Understanding climate projections - 30 mins

Slide cue: Understanding climate projections

This presentation is aimed at communicating the main concepts needed to understand how climate projections are created and what they are used for. It covers what a climate model is and how climate models were evaluated during PACCSAP.

(Make sure all the facilitators assisting with the workshop understand the definitions so they can support the groups during the exercise.)

Ask each group to discuss the terms and write down what they mean on flip charts. This could include asking them to consider how they could be described in local languages. The group has 30 minutes to come up with some descriptions.

Small group discussion: climate projections terms - allow 1 hour

Slide cue: Small group discussion: climate projections terms

This small group discussion activity aims to help participants really understand the previous presentation on climate projections by asking participants to explain a number of climate projections terms.

Divide the participants into groups of four or five people and put up the slide titled *Small group discussion: climate projections terms*, which asks participants to come up with explanations for the six concepts on the next page.

Facilitators should be circulating the room and assisting groups who are having difficulty with any of the terms, without dominating the group discussion. Facilitators should feed back to the lead facilitator any concerns they have about groups' understanding of particular terms as this can be dealt with when groups report back to all participants.

Climate projections terms

Climate variability

Climate variability refers to fluctuations in the climate due to natural processes. Important climate variability occurs from month to month, season to season, year to year and even decade to decade. The main driver of year to year in the region is the El Niño Southern Oscillation (ENSO).

Climate change

Changes in the Earth's climate, generally referring to those due to human activities but can also include natural processes. These changes can include more intense extreme events such as droughts, floods and tropical cyclones, and changes in average rainfall patterns. Climate change that is due to human activity has happened and is expected to continue much more quickly than natural changes in the climate, due to the unprecedented rate of increase in greenhouse gases.

Global climate model

A global climate model is a computer representation of the Earth's climate system, which is used to simulate the fundamental processes driving weather and climate. Climate models are three dimensional mathematical representations of the climate system that require very powerful computers. They are based on the laws of physics which will continue to apply in a changed environment and include information about the atmosphere, ocean, land and ice.

Time slice

When developing climate projections you also need to consider time periods. When we are talking about future projections for a particular year (like 2050), we are not talking about a single year, but the climate averaged over a number of years for which 2050 happens to be the central year. Projections relate to the average climate and should not be confused with a forecast for any particular year. The PACCSAP projections are based on four 20-year time periods centred on 2030, 2050, 2070 and 2090.

Emissions scenario

Since it is uncertain how society will evolve over the next century, it is impossible to know exactly how emissions of greenhouse gases and aerosols resulting from human activities will change in the future. therefore, 'scenarios' have been developed by the intergovernmental Panel on Climate Change for a number of plausible future trajectories of greenhouse gas and atmospheric aerosols. Each makes different assumptions about future technologies, population, economic conditions, decisions on mitigation measures and other factors. Results are presented for four new scenarios of greenhouse gases and aerosol emissions underpinning representative concentration pathways (RCPs): RCP2.6 (very low emissions), RCP4.5 (low emissions), RCP6.0 (medium emissions) and RCP8.5 (very high emissions). These cover a broader range of possibilities relative to the three previous emissions scenarios (B1-low, a1B-medium and a2-high) presented in the Climate Change in the Pacific report (2011).

Uncertainty

Global climate models enable us make climate projections for the future, however there is still a large amount of uncertainty about these projections for a number of reasons.

1. Emission scenario uncertainty: We don't yet know what the emissions scenario for the future will be as we don't know what mitigation measures will be taken at international and national levels over the next century.
2. Model uncertainty: the PACCSAP program used 24 models in the SPCZ region and another 26 in the rest of the region to create projections for the Pacific and they all produce different values for different variables. all models are different and therefore simulate slightly different futures.
3. Model skill: global climate models have high skill at providing information about the large-scale climate, but they have lower skill simulating regional rainfall and extreme weather events.

A key point to remember when looking at projections is that they are for an average change over a broad geographic region encompassing the country of interest (not a village or city).

SESSION 3

Climate projections

Report back from groups - 30 mins

Groups are each asked to present their explanations, or to describe what one particular term means.

Discussion of the description is encouraged and the facilitator should guide the discussion to the most accurate description of the term. This is important because the exercise is meant to give participants clarity on these new concepts rather than reinforce any misunderstandings.

Depending on if the workshop is keeping to time or not, it might be useful to ask each group to report back one or two different terms rather than all of them.

Future climate - 30 mins

Slide cue: Future climate

This presentation uses information from the technical reports on the Publications, tools and resources page at the end of this guide to communicate some of the projections for either a specific country in which the workshop is being held, or for the region if it is a regional workshop. For projections, some countries have been divided into more than one region - for these countries, projections have been included for the different regions either in the presentation itself or at the end of the presentation as optional slides for inclusion if appropriate.



Small group discussion: possible impacts and planning - 1 hr

Slide cue: Small group discussion: possible impacts and planning

Divide the participants into small groups again and ask them to discuss the following questions with reference to the projections:

- What could be some possible impacts from these projections?
- How can you use these projections in planning for adaptation?

This group exercise is meant to get participants starting to think about how projections can be useful in a local context and in their daily work. It is meant to get participants who may have never thought about projections, climate change impacts and adaptation planning to start looking at these processes. Emphasis should be made by facilitators that this is the beginning of a process that requires detailed analysis and planning.

Facilitators could help to generate discussion through some initial framing, such as potential economic or social impacts, impacts on coastal zones, infrastructure, food and water security, health etc.

An example answer could be:

- Projection: increasing wet season rainfall
- Impact: urban flooding
- Adaptation planning: collect data from relevant agencies (health, infrastructure damage, crop damage) on the last major wet season flood to assess what the damage was. Conduct a risk assessment using Pacific Climate Futures data to see how services will need to plan to respond to increasing flood risk.

Report back from groups - 30 mins

In this session participants report back to the group the ideas they had on impacts and adaptation planning.

It is a good idea to ask participants to limit their answers to one or two impacts and one or two ideas for using the information in adaptation planning and to only report back on ideas that have not already been presented. Facilitators will need to use their discretion as to how much time each group has to report back.

Participants should be reminded at this stage that Pacific Climate Futures is a tool that can assist them with this process. Participants can be directed to the basic level of climate futures which is available on the website and gives very general results that are useful for communicating projections rather than detailed adaptation planning. The intermediate level is available after completing an online course on the website. Facilitators should remind participants that a number of officers in-country have been trained to the advanced level of Pacific Climate Futures.

To get access to projections that can be used in risk assessments, participants are encouraged to get in contact with their local national meteorological service.

SESSION 4

Workshop evaluation and close

Suggested duration: 45 mins

This session brings the workshop to a close.

Workshop evaluation

The evaluation is aimed at capturing qualitative information about how the participants assessed the workshop (to inform improvements to the workshop) and also what the participants learnt during the workshop. As this is only a one-day workshop, there is not enough time to create a baseline on which to assess the impact of the workshop.

However, the evaluation form attempts to capture some information about workshop impact on participants' climate change science knowledge. You can use this evaluation to improve the next Pacific climate change science workshop that you run!

An evaluation form template is included on the facing page. It can be copied, handed to participants, filled in and collected before they leave.

Alternatively, you can use the questions in the evaluation form to create an online evaluation via a tool such as Survey Monkey (www.surveymonkey.com), and email the link to the online evaluation to participants after the workshop.

What next?

Depending on the particular purpose of the workshop, it is always a good idea to outline the next steps for participants or what they can do after the workshop.

The workshop close can be used to direct participants to the resources produced by the PACCSAP program (see the Publications, tools and resources page at the end of this module) or other materials for further reading and to the local national meteorological service.



Pacific **Climate Change** Science Workshop evaluation form

Workshop date and time: Workshop location:

For questions 1 & 2, please tick the box that best supports your answer.

1. Today's training was:

very interesting and useful not very useful slightly interesting and useful difficult to understand

2. The information presented at the workshop was:

too easy – I knew most of it already

the right level – I learnt new information

too hard – I found it difficult to understand the information

For questions 3–7, please answer in the space provided

3. What was your favourite/the most useful part of the day?

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4. What was your least favourite/the least useful part of the day?

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.....

5. How will you use the skills/new information you learnt today?

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.....

6. Where will you go to find further information?

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.....
.....

7. Do you have any other comments about today's workshop?

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.....

Publications, tools and resources

Technical reports

Climate Variability, Extremes and Change in the South-Western Pacific: New Science and Updated Country Reports, 2014

Results from the PACCSAP Program have been published as an updated report to Volume 2 of the Climate Change in the Pacific report (below). this updated report provides results from new research and is the basis for the country specific information presented in the PowerPoint presentations in this module.

Climate Change in the Pacific: Scientific Assessment and New Research, 2011

the two volumes of this report present the findings of the research conducted as part of the Pacific climate change science Program and cover 14 Pacific island countries (Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu) and Timor-Leste.

Volume 1: Regional Overview presents a detailed assessment and analysis of the region studied and *Volume 2: Country Reports* provides country-specific information on seasonal cycles, climate variability, observed annual trends and projections for atmospheric and oceanic variables.

Climate analysis tools

Pacific Climate Change Data Portal

The Pacific Climate Change Data Portal allows users to visualise historical climate data in the form of trends, multi-year running averages and long-term averages. as the largest web-based data source for the Pacific region, this tool currently provides users with access to more than 100 individual observation sites across the Pacific islands and Timor-Leste. This tool also includes trends in rainfall and temperature extremes. it is freely available for anyone to explore climate trends.

Southern Hemisphere Tropical Cyclone Data Portal

The Southern Hemisphere Tropical Cyclone Data Portal improves knowledge of past tropical cyclone activity in the Pacific islands and Timor-Leste by plotting tracks of cyclones in the South Pacific from 1969, allowing users to see the characteristics and paths of past tropical cyclone events.

Meteorologists and stakeholders can use this tool to analyse the tracks of historical tropical cyclones and relate them to the impact on lives and infrastructure recorded on the ground.

Pacific Climate Futures

Pacific Climate Futures is a web-tool developed in collaboration with Pacific island countries that provides free and easy access to climate projections data. This data can be used for impact assessment and adaptation planning.

The tool groups projections from individual models into a small set of internally consistent climate futures, such as 'warmer and wetter' or 'hotter and drier'. Each climate future is given a likelihood so the user can readily identify the most likely future, as well as less likely futures that might represent a 'best case' or 'worst case'. Users can select a small set of climate models that represent key climate futures, then download data from these models into an Excel spreadsheet. Observed climate data can be imported into the spreadsheet and combined with model data to create synthetic future climate data for use in impact assessments.

Seasonal Prediction of Sea-Level Anomalies in the Western Pacific

This tool is focused on the development and verification of seasonal forecasts for sea level for Pacific partner countries. it is accessible to interested users who apply to the Australian Bureau of Meteorology. Meteorological agencies from PACCSAP partner countries in the Pacific are the primary users of this tool.

Seasonal Prediction of Extreme Ocean Temperatures and Coral Bleaching

This tool provides seasonal forecasts of ocean temperature and coral bleaching risk. This information is critical to partner countries in planning coastal development and safeguarding agricultural, marine and water resources. the tool is accessible to interested users who apply to the Australian Bureau of Meteorology. Meteorological agencies from PACCSAP partner countries in the Pacific are the primary users of this tool.

Other resources

Current and future climate brochures

These brochures present the material found in the technical reports in a way that is appropriate for a non-technical audience. there are 15 brochures - one for each of the partner countries.

Fact sheets

A suite of fact sheets has been developed to provide further information about the following areas:

- Climate extremes in the western tropical Pacific
- Large-scale climate features in the western tropical Pacific
- Ocean acidification in the western tropical Pacific
- Sea-level rise in the western tropical Pacific
- Climate variability and climate change in the western tropical Pacific

These fact sheets can be used as an aid to the workshop to provide more detailed information to participants.

Animations

The *Pacific Adventures of the Climate Crab* and *Cloud Nasara* animations aim to increase awareness of the science and impacts of climate variability in the Pacific, and to provoke discussion around how communities can access forecast information and take 'low regrets' actions to prepare for future El Niño and La Niña events and adapt to climate change. They are the result of a collaboration between Red Cross, the Australian Government's PACCSAP Program, the Vanuatu Meteorology and Geo-hazards Department (VMGD) and GIZ.

The *Pacific Adventures of the Climate Crab* gives an overview of climate processes and impacts in the Pacific region as a whole. *Cloud Nasara* is specifically focused on Vanuatu as a pilot country. The animations are useful for organisations, government, schools, and community groups in Pacific countries and for regional bodies across the Pacific. They are accompanied by a comprehensive resource tool kit and may assist those working in areas such as disaster risk management, health, food security, community planning, and environmental protection.



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Department of the Environment and Energy



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SPREP
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Environment Programme

www.pacificclimatechangescience.org