

Impacts of climate change on Pacific Islands – A Science Update

Warming in western Pacific now unambiguously beyond natural variability

A recent analysis of surface temperature data in the western Pacific shows that surface temperature increase over the last 50 years is now so large that it unambiguously exceeds natural variability. The increase is due to increased greenhouse gas concentrations caused by human activities. Only the lowest of the IPCCs scenarios (RCP2.6), which limits warming below 2°C globally, will significantly slow the rate of increase in western Pacific temperatures by the second half of this centuryⁱ.

Extreme El Niño forecast for 2015/2016 and likelihood of extreme El Niño projected to double in future

While El Niño conditions are already present, 2015/2016 is forecast to be an extreme El Niño year, probably similar to 1997/1998. At the same time, science is telling us that the frequency of such extreme El Niño events will more than double under unabated global warming.ⁱⁱ These events strongly increase the risks posed to Pacific islands of coral bleaching, and other extreme weather eventsⁱⁱⁱ, such as droughts across the western Pacific, and heavy rains and flooding over a narrow band around the equator eastward from the dateline (e.g. Kiribati). At the same time, an increased frequency of extreme El Niño events is conducive to the development of extreme La Niña events in years following extreme El Niño events, thus projecting more frequent swings between opposite extremes from one year to the next^{iv}.

Risks of extreme tropical cyclones projected to increase - Pacific highly exposed

As tropical oceans warm, there is an apparent trend over the last several decades of increasing tropical cyclone intensity of the highest category cyclones, including in the South Pacific. Science is clear that climate change will likely lead to increased frequency and intensity of the most devastating tropical cyclones such as Cyclone Pam. Pacific small islands rank high in relative exposure to tropical cyclones. Economic losses by tropical cyclones translate to losses in GDP of 15-25% over a 10-year period, hampering economic development.^v

Risks of future sea-level rise rising by 1 metre by 2100 increasingly likely

Recent science indicates that the polar ice sheets are much more vulnerable than previously thought, which has very significant and adverse implications for future sea-level rise over the coming century, as well as in the longer term.^{vi} NASA has recently reported that, due to ongoing acceleration of loss of ice from Greenland and Antarctica, sea level rise is likely to be a metre by 2100, at the upper end of recent IPCC projections^{vii}. For the longer term, over many centuries, recent science indicates that there is a high risk of a sea-level rise of many metres (potentially up to 9m) as a result of a sustained 2°C warming^{viii}.

Ocean acidification, coral reefs and marine ecosystems

Ocean acidification due to the oceans' absorption of excess CO₂ is one of the key impacts of anthropogenic emissions. This will have strong detrimental effects on marine ecosystems and, in particular, coral reefs combining with high temperatures and bleaching to exacerbate coral reef loss. The vast majority of reef-building corals in the Pacific regions are already in rapid decline.^{ix} Simultaneously, increasing warming leads to increased coral bleaching and at 2°C warming, virtually all tropical coral reefs are projected to experience severe bleaching by the 2050s. Limiting warming below 1.5° provides space for coral reefs to persist and adapt. Damage to tropical coral reefs will likely be increased by disease-related mortality due to climate change.^x

Inundation and saltwater intrusion rising rapidly with sea levels

Rising sea levels greatly increase the risk of inundation and a salinisation of limited freshwater resources. This leads to disastrous effects on health and to substantial risks for agricultural production.

Food security risks increasing with warming

Tropical crop production is projected to be strongly negatively affected by climate change in the future. Food security of small islands is at risk due to risks to agriculture from saltwater inundation and reduced fish abundance caused by coral ecosystem damage.

Multiple health risks rising with warming

Sea level rise, coastal inundation, increased heat waves, drought and other weather extremes projected to increase in intensity are likely to exacerbate health risks significantly. Increased incidence of water-borne and vector-borne diseases, such as malaria, dengue fever and diarrhoea, will contribute to this exacerbation of health risks.^{xi}

ⁱ Wang, G., Power, S.B. & McGree, S., 2015. Unambiguous warming in the western tropical Pacific primarily caused by anthropogenic

ⁱⁱ Cai, W. *et al.* ENSO and greenhouse warming. *Nat. Clim. Chang.* (2015). doi:10.1038/nclimate2743

ⁱⁱⁱ Christensen, J. H. *et al.* in *Clim. Chang. 2013 Phys. Sci. Basis. Contrib. Work. Gr. I to Fifth Assess. Rep. Intergov. Panel Clim. Chang.* (Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, P. M. M.) (Cambridge University Press, 2013).

^{iv} Cai, W. et al. Increased frequency of extreme La Niña events under greenhouse warming. *Nat. Clim. Chang.* 5, 132–137 (2015).

^v PCC AR5 WGII Ch29, Table 29.5

^{vi} Rignot, E., et al. Widespread, rapid grounding line retreat of Pine Island, Thwaites, Smith, and Kohler glaciers, West Antarctica, from 1992 to 2011. *Geophys. Res. Lett.* **41**, 3502–3509 (2014).

Favier, L. et al. Retreat of Pine Island Glacier controlled by marine ice-sheet instability. *Nat. Clim. Chang.* **4**, 117–121 (2014).

Joughin, I., et al. Marine Ice Sheet Collapse Potentially Underway for the Thwaites Glacier Basin, West Antarctica. *Science* **344**, 735–738 (2014).

^{vii} <http://climate.nasa.gov/news/2329/>

^{ix} 1 - 2% per year for 1968–2004 (IPCC AR5 Cross-Chapter Box)

^x Maynard, J. et al. Projections of climate conditions that increase coral disease susceptibility and pathogen abundance and virulence. *Nat. Clim. Chang.* (2015). doi:10.1038/nclimate2625

^{xi} http://www.cakex.org/sites/default/files/documents/NCA-PIRCA-FINAL-int-print-1.13-web.form_.pdf