ENSO Impact Outlook: Papua New Guinea 2017/2018

Key Messages

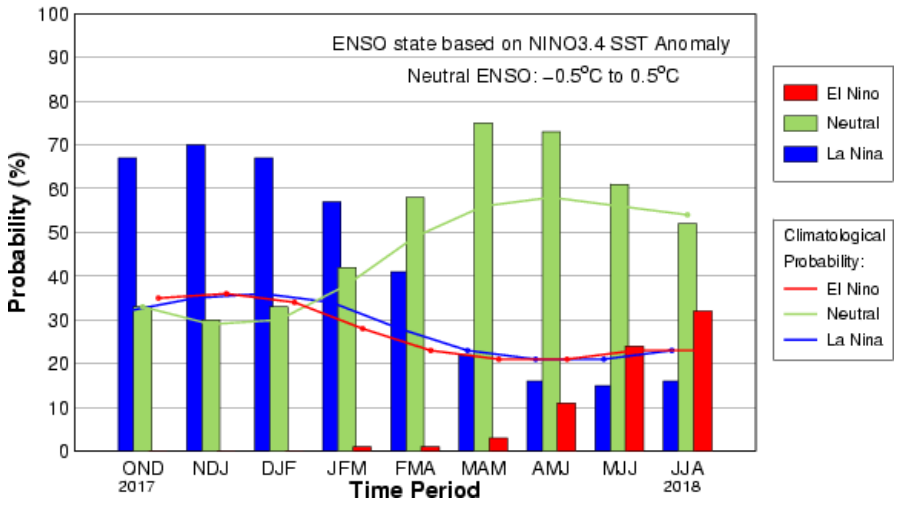
- The latest (mid-Oct) ENSO forecast indicate a 60% chance for weak La Niña condition to persist during the Nov-Jan and this might likely to continue until the end of the wet season in PNG. Therefore evaluating possible potential impact pathways for La Niña conditions and having contingency plans in place, would be helpful preparedness measure to reduce risks and harness favorable weather conditions.
- Four possible ENSO scenarios are considered during the first half of the PNG wet season viz. neutral condition; weak, moderate and strong La Niña. The ENSO associated impacts observed during past years is presented in this outlook document.
- As the ENSO Outlook indicates a weak La Niña conditions it is desirable to anticipate weak La Nina associated outlook could be relied upon.
- The impacts of La Niña on rainfall patterns vary across PNG. In the past, the La Niña conditions results in wetter condition over most of the PNG except eastern islands of Milne Bay region. The chances of occurrence of floods, landslides, and cyclones are most likely and these hazards could affect the following sectors agriculture, infrastructure, water resources and health.
- The priority sectoral agencies could prepare contingency plans based on the four impact scenarios presented in this outlook document and dynamically adjust contingency plans based on upcoming monthly forecasts from NWS.
- RIMES could facilitate stakeholder participatory district level risk assessment in case relevant data is made available.

1. ENSO forecast

ENSO forecast indicate a 60% chance of La Niña condition during Nov-Jan 2017 (Figure-1). Few global centers forecasted the current persisting neutral condition to continue.

Climate Prediction Center/ National Centers for Environmental Prediction (CPC/NCEP) and International Research Institute for Climate and Society (IRI), 19 Oct 2017:

"The probability for El Niño conditions is likely to be within the range 57-70 % during Nov 2017 to Feb 2018. The probability range for the El Niño conditions is likely to be far more than then neutral condition" (IRI 2017)



(Source: IRI 2017)

Figure 1. CPC/IRI consensus probabilistic ENSO forecast

2. ENSO characterization

As there is an oscillation between La Nina and neutral conditions to persist during Nov-May months of wet season in PNG, four scenarios of ENSO conditions could be considered to assess the potential impacts from the past analogue years (Table 1). Three categories of La Niña might be possible, which will likely cause shift in a weather pattern and thereby biophysical impacts. The ENSO neutral year is complex and the variations in weather patterns are defined mostly by the regional and local climate drivers, which could be inferred from the seasonal forecasts/climate outlook issued by PNG National Weather Service.

Table 1 Scenarios for ENSO conditions and its analogue years.

	ENSO conditions	**Selected analogue years for assessing the ENSO impacts*+**
Scenario 1	Neutral	1990-91, 1993-94, 2013-14
Scenario 2	Weak La Niña	2000-01, 2005-06, 2008-09
Scenario 3	Moderate La Niña	1995-96, 2011-12
Scenario 4	Strong La Niña	1998-99, 1999-00, 2007-08, 2010-11

** The analogue years are considered for assessing ENSO impacts on rainfall characteristics and for the biophysical impacts only the recent years are considered.*

+ The analogue years are chosen based on the latest SST classification by CPC, which is released on October 2017 (http://ggweather.com/enso/oni.htm)

3. ENSO impacts on weather patterns

ENSO impacts on weather patterns remain complex due to the influence of various climate drivers (topography, oceanic and atmospheric circulations). Smith et al. 2013 highlighted that the El Nino causes drier conditions over western provinces and wetter conditions over eastern provinces, and La Nina lead to wet condition over the Island provinces including New Britain, New Ireland, and ARoB. The analysis of rainfall patterns during the analogue La Niña years indicate that the wet conditions are dominant over most of the PNG except the Milney Bay region (Figure-2). However, the resulting rainfall patterns influenced by other climate drivers could be well captured by the seasonal climate outlook released by National Weather Service during the Climate forum on 13 October 2017 at Port Moresby.

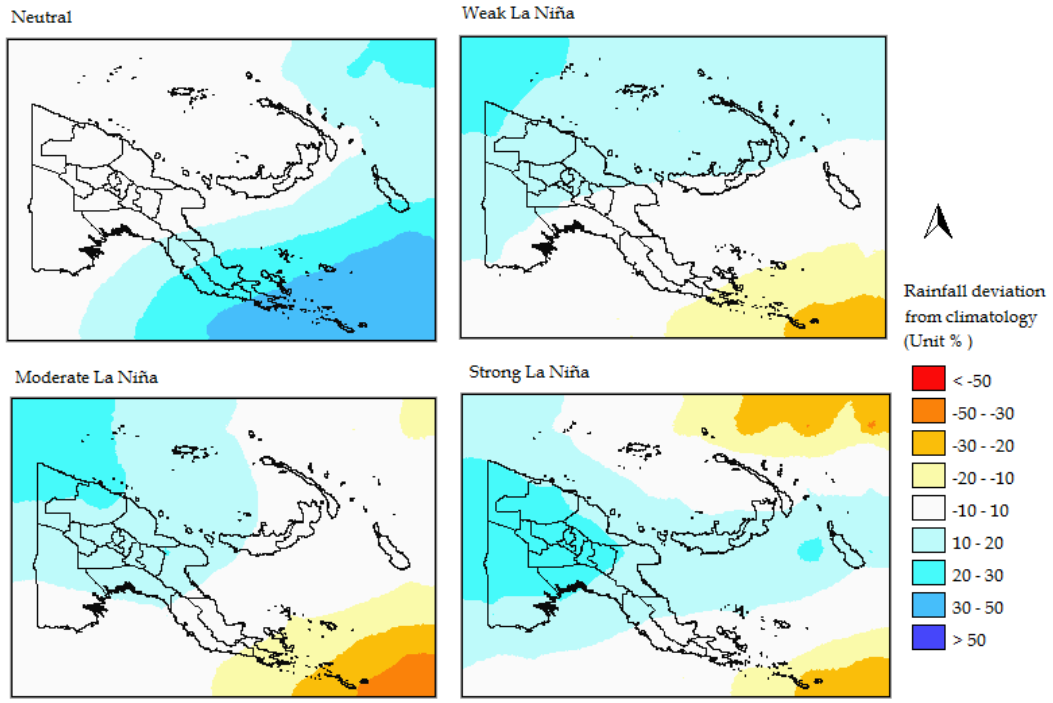


Figure 2. Nov-Apr rainfall deviation from the climatology (1981-2010) during Scenario 1 (ENSO Neutral years), Scenario 2 (Weak La Niña), Scenario 3 (Moderate La Niña), and Scenario 4 (Strong La Niña)

The tropical cyclones crossing the PNG during the years 1913-2015 and the selected analogue years are shown in Figure 3. During the past La Niña years, there were tropical cyclones crossing PNG when compared to all other years. For example, Cyclone Guba during a La Niña year 2007 caused huge damages in PNG. Though the frequency of cyclones are less in PNG, the risk due to tropical cyclone during a La Nina year cannot be fully eliminated as there were few cyclones crossed in the southern region of PNG during the analogue years.

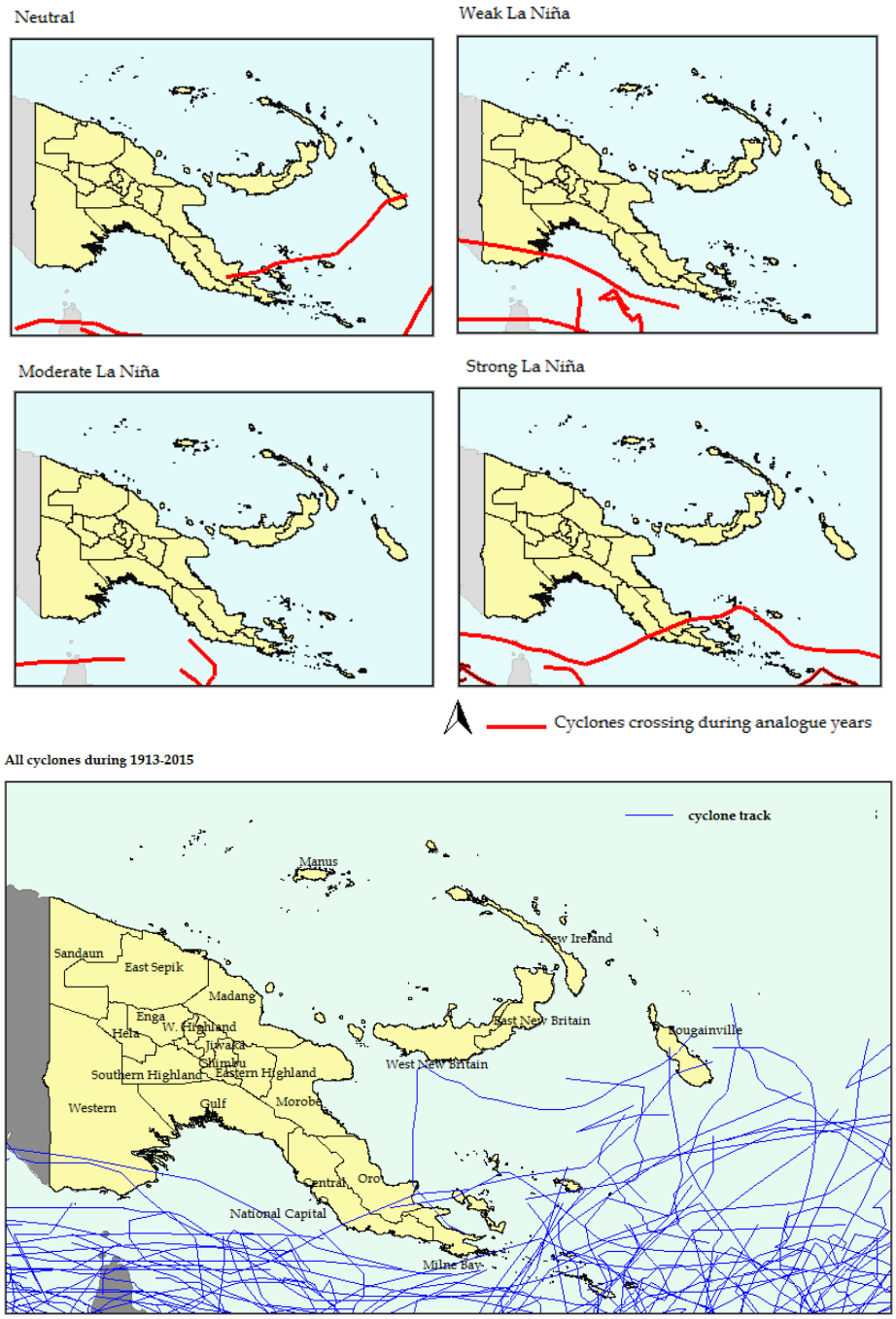


Figure 3. Tropical cyclones crossing PNG during the chosen analogue years for four scenarios, and all years between 1913 and 2015.

4. Biophysical impacts

The observed biophysical impacts due to shifting weather patterns caused by the recent strong, weak and moderate La Niña episodes and ENSO neutral years are presented in this section. It has to be noted that the biophysical impacts on agriculture sector are not only due to seasonal

rainfall quantity or drought conditions, but also the distribution of rainfall against the water requirements at different stages of crops. For example, excessive rains after 1.5 months of sweet potato planting will lead to reduced harvest and wet condition during the flowering stage is disadvantage for coffee (Bourke 2001, NARI 2003)

The biophysical impacts presented for the analogue years are based on the secondary sources available from the documents of national and international agencies, and newspapers. The detailed impact information in the past at finer spatial resolution (for example, by district level) is unavailable and therefore the impacts information presented here could be taken as illustrative and not exact manifestation of ENSO impacts on weather patterns (floods, non-uniform rainfall distribution, etc.,) that could cause biophysical impacts on priority sectors. These sample cases could be used as references/thresholds to interpret the impacts within the local contexts, for example, how the rainfall changes and cyclones during the past ENSO years caused biophysical impacts (crop production loss and infrastructure) in the respective locations. The impacts of La Nina are more of rapid onset hazard such as flash floods and associated e risks to human lives and livelihood. Floods and strong winds could cause huge damage to lives and infrastructure. In some places, the flood causes a dangerous infestation of crocodiles and it is life threatening to human lives, for example Malalaua town in the Gulf province experienced during 2006 floods.

Impacts of enhanced rainfall condition during the analogue years

Sector	Observed impacts	Provinces (District) affected
Agriculture	Food gardens and coconut trees were damaged during the tropical cyclone Adel in 1993.	Milne Bay Province
	1993 floods caused extensive damage to food gardens	ARoB
	Flooding triggered by heavy rainfall in 1996, 2006, 2009 destroyed crops	Oro Province, Morobe province, Western Highlands province, Central province
Infrastructure	During 1993 tropical cyclone, 200 houses, school accommodation and water tanks were destroyed in the Trobriand Islands. Sixty houses were damaged in other islands of Milney Bay province.	Milne Bay Province
	1993 floods damaged roads and bridges	ARoB
	The whole village of Buso vanished completely in a flash flood that was triggered by heavy rainfall (03 Sep 1996). No personal possession and homes were saved	Morobe province.
	2007 Floods have destroyed about 95 percent of Oro province's bridges and roads, which is estimated 2 billion kina. People were displaced as their household structures were damaged.	Oro and Milney Bay Province

	Three months of constant torrential rains have caused floods in Dei district which caused Avani Bridge between Kainantu and Goroka along the Highlands highway collapsed on 06 March 2006, halting traffic between the Highlands and Morobe province	Western Highlands province (Dei district)
	Houses and roads were damaged due to floods in 2006	Central province (mostly in Kairuku Hiri district), Gulf Province (Malaulua town), Sandaun province (Aitape township)
	The landslide in March 2009 has cut-off the Highlands Highway, which links the region with the coastal ports of the country.	Eastern Highlands province
Water	Flood water in 2007 has contaminated village water supplies resulted in lack of clean drinking water	Oro Province
	Water sources have been contaminated due to floods in 2006	Central and Western Highland Province
Health	During 2007 floods, health experts warned potential outbreaks of diseases including cholera, dysentery, diarrhoea and malaria due to the lack of clean drinking water, poor sanitation and plagues of mosquitoes in Oro province, although no data available on disease outbreaks available.	Oro Province

Source: Lauer 2004, Marshall 2007, Reliefweb 1993, Reliefweb 2006, Reliefweb 2009

Biophysical impacts presented in this desktop study are assessed at province level (coarser resolution), and hence for detailed preparedness planning, the risk patterns at a finer spatial resolution (at least district level) are required. A preliminary exercise of district level risk assessment for Highland region has been presented in the El Nino impact outlook (issued on May 2017) based on a research from Bourke et al. (2001) and Hanson et al. (2001). The risk to the ENSO induced hazards depends on many factors, and it varies spatially within the province, so these factors has to be assessed to capture the risk at finer spatial resolution for effective contingency planning. Few of the factors, not all, are discussed below altitude, land resource vulnerability, location (very small islands, fringe locations, high altitude). The district level risk assessment has to be undertaken for effective contingency planning, which remains as a gap at present.

Summary

- A weak La Niña is most likely to bring wetter condition over majority of PNG. The floods, cyclones, and landslides could affect agriculture, infrastructure, water resource associated systems, and health sectors that needs to be prioritized for contingency planning.

- As the impact data is limited, this outlook document has to be considered as preliminary assessment for developing contingency plans. It is proposed to undertake detailed district level impact assessment based on the past observed biophysical impacts.
- An inter-agency collaboration will be critical to ensure understanding of La Niña Associated risk, communicating risk to stakeholders and assist in preparing contingency plans to put in place relevant contingency plans in local contexts.

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