Science and Policy Knowledge Series

Integration of Disaster Risk Reduction and Climate Change Adaptation into Sustainable Development

Advisory Note

December 2015

El Niño 2015/2016

IMPACT OUTLOOK AND POLICY IMPLICATIONS

1. Key Messages

- The 2015-2016 El Niño is likely to be one of the strongest El Niño events since 1997-1998.
- Unlike the 1997-1998 El Niño that followed a neutral year in 1996-1997, the 2015-2016 El Niño is following several months of a mild El Niño in 2014. El Niño is currently at its strongest phase so far and is intensifying.
- The observed impacts from July to October 2015 confirmed its influence on weather patterns, resulting in drought conditions with intermittent "very severe" category cyclones over the Asia and Pacific region.
- As indicated in previous El Niño Advisory Notes prepared by ESCAP and RIMES, the impact of the 2015-2016 El Niño could be even more severe in certain locations such as the uplands of Cambodia, central and southern India, eastern Indonesia, central and southern Philippines, central and northeast Thailand, Papua New Guinea and other Pacific island countries.
- In the Pacific region alone, it is estimated that 4.7 million people are facing El Niño induced drought.
- The Pacific island countries are most likely to face severe risks from the ongoing 2015-2016 El Niño. The most vulnerable sectors are agriculture, freshwater resources, reef ecosystems, fisheries, public health systems and infrastructure.

- El Niño will likely continue to cause significant drought during the period from November 2015 to April 2016, spanning southern parts of Sumatra, Java and eastern parts of Indonesia, central and southern parts of the Philippines and Timor-Leste. Most parts of Mongolia could experience a severe winter associated drought (or *dzud*) leading to inadequate pasture or fodder for the livestock. Many Pacific island countries are likely to experience drought as well as intermittent cyclones.

- Sri Lanka and southern India could continue to experience higher than normal rainfall as per the winter SASCOF outlook issued by WMO and this could cause further flooding, particularly urban flooding, in certain locations. In India, severe floods have already been reported in several parts of Tamil Nadu during November and December 2015, inundating most areas of Chennai.

- Though no two El Niño's impacts are identical, past El Niño associated risk patterns could provide guidance to anticipate and manage future El Niño associated risks. Climate change is also likely to increase El Niño risk, and therefore long term development strategies need to factor in these risks.

- Regional cooperation is critical to ensure better understanding of El Niño associated risks. Sharing and exchanging risk information among stakeholders and creating appropriate enabling mechanisms to act on risk information would help address and better prepare for the impacts of El Niño. Many strategies for this are highlighted in ESCAP's recently published Asia-Pacific Disaster Report 2015.

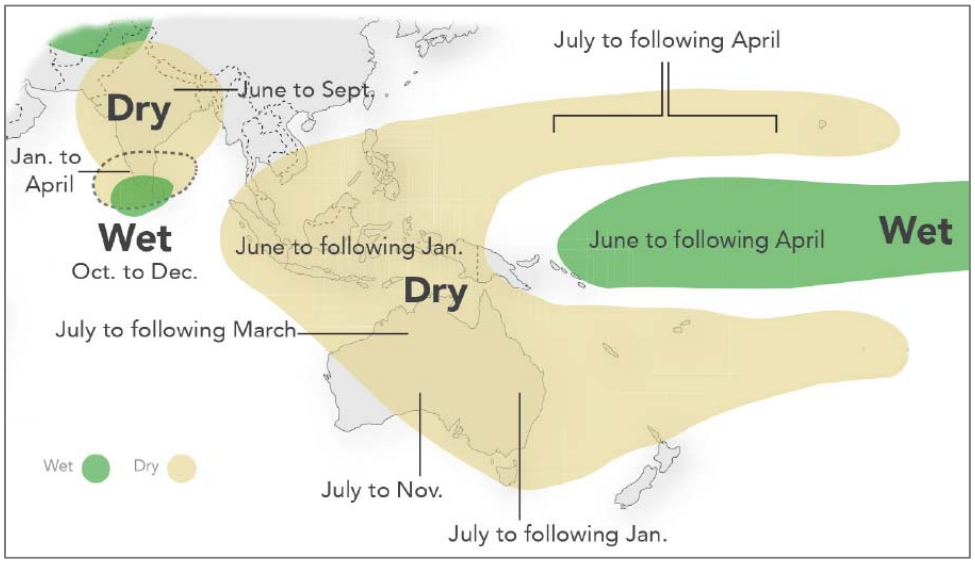
2. Introduction

The El Niño Southern Oscillation (ENSO) cycle is a periodic climatic phenomenon that refers to a warming of the Central and Eastern Pacific, affecting the atmosphere and weather patterns. The effects of El Niño depend strongly on location and season. The main threat comes from reduced rainfall and drought in some regions, but El Niño can also cause heavy rainfall and flooding in others, making it a complex phenomenon.

As forecasted in the previous two El Niño Advisory Notes prepared by ESCAP and RIMES, El Niño which set in around late 2014 has had significant impacts across many countries and sectors of Asia and the Pacific (ESCAP and RIMES, 2014a and 2014b). Climatologists are predicting that the 2015-2016 El Niño event is likely to be one of the strongest since 1997-1998 and may persist until the second quarter of 2016 (FAO, 2015). This is particularly alarming considering the potential effects in Asia-Pacific. The 1997-1998 El Niño alone caused 23,000 fatalities from natural disasters, increased poverty rates by approximately 15 per cent in many countries and cost governments up to USD 45 billion due to severe droughts, storms and other effects (World Bank, 2015).

El Niño conditions are known to shift rainfall patterns across the Asia-Pacific region. These differ from one El Niño event to the next, but the strongest shifts remain consistent in terms of location and season as illustrated in Figure 1, allowing some forewarning for preparedness and adaptation.

Figure 1: Historical El Niño rainfall patterns in the Asia-Pacific.



Source: FAO, 2015.

The strongest effects on precipitation are generally felt in South-East Asia and the Western Pacific Ocean, especially in the dry season between August and November (KNMI, 2015). In the Central and Southern islands of the Pacific and some areas of South-East Asia, where there is a strong reliance on agriculture, the reduced wet season rainfall could have significant impacts.

3. El Niño impacts in Asia

3.1 Observed El Niño impacts and risk patterns in Asia

The mild El Niño conditions during the second half of 2014 have matured to strong El Niño conditions since mid-2015. During the 2014 summer monsoon season (June to September), significant drought conditions were observed over Cambodia, India and Thailand. Certain areas of these countries have been experiencing drought conditions for the second year in succession due to lower than normal rainfall during the 2015 summer monsoon season. Emerging drought conditions during June to October 2015 have also been reported over Indonesia and Timor-Leste. In fact, in parts of Cambodia, the Lao People's Democratic Republic and Viet Nam, farmers have been leaving fields and rice paddies unplanted due to excessively dry and hot conditions. In China's Liaoning province, the lowest rainfall levels since 1951 left more than 230,000 people short of drinking water in July (World Bank, 2015). The details of El Niño risk patterns and observed impacts in past El Niño events, and over 2014 and 2015 where noticeable, are listed below for several countries:

- **Cambodia:** Both drier and wetter rainfall conditions have previously been observed during El Niño years (Thomas et al., 2012). In 2014, 116,129 ha (5 per cent) of cultivated land was affected and 20,289 ha (0.79 per cent) was damaged. In 2015, the onset of rains was delayed until mid-July, affecting 77,419 ha of cultivated land (HRF, 2015).

- **India:** In general, El Niño results in suppressed rainfall conditions during the June to September months, though for some El Niño years there may be no impact on rainfall (Krishna Kumar et al., 2006). Food grain production is highly vulnerable to ENSO events, resulting in significant falls in crop production (especially rice) during El Niño periods (Krishna Kumar et al., 2004). In 2014, seasonal rainfall was around 12 per cent less than normal, which affected food grain production by 10 million tons (RIMES, 2015). In 2015, seasonal rainfall was around 14 per cent lower than normal, with water levels in reservoirs down by 30 per cent. Around 40 per cent of all districts were declared as drought affected (RIMES, 2015). By comparison, and demonstrating the complexity of El Niño, the southern part of India around the peninsular often experiences increased rainfall conditions during October to December during El Niño events (Yadav, 2012, Kumar et al.,2009), which can create a favorable crop production environment but also flooding in certain pockets of southern India.

- **Indonesia**: In general, El Niño conditions result in rainfall being reduced or the onset of the wet season being delayed. In the past, the effect of El-Niño has been particularly strong in regions heavily influenced by the monsoon system (central region) and weak in regions influenced by the equatorial system (the western region) (Boer, 2001). The south and southeast regions of Indonesia, comprising of South Sumatra, South Kalimantan, Java, Bali and Nusa Tengara, are relatively more sensitive to ENSO. Drought-like conditions have led to forest fires, crop production loss (especially in Java where 55 per cent of rice is grown) and water scarcity during

previous El Niño events (Naylor et al., 2001). During the current El Niño period, forest fires have been severe, affecting 2 million hectares of land along with 45 million people and 250,000 hectares of crop area in 2015 (RIMES, 2015).

- **Philippines:** The monthly rainfall received in most parts of the country has been reduced by more than 50 per cent during the peak periods of strong El Niño events in the past, but these strong events have also suppressed tropical cyclone activity, though not during weak-to-moderate events (Reyes and David, 2006). Impacts of El Niño events have also previously been seen on crop production (rice) and water availability for domestic consumption, irrigation and hydropower (de Guzman, 2015). In the second quarter of 2015, paddy crops were down by 7 per cent in upland areas and the overall production has been projected to be 500,000 tons, much lower than normal. The Philippines Government plans to import around 800,000 tons of rice to ensure food security in the country (RIMES, 2015).

- **Sri Lanka:** El Niño typically leads to wetter conditions during October to December and drier conditions during January to March and July to August (Zubair and Ropelwski, 2006). Often, an El Niño brings favorable agriculture crop production during the Maha season and negligible impacts on water resources during January to March months.

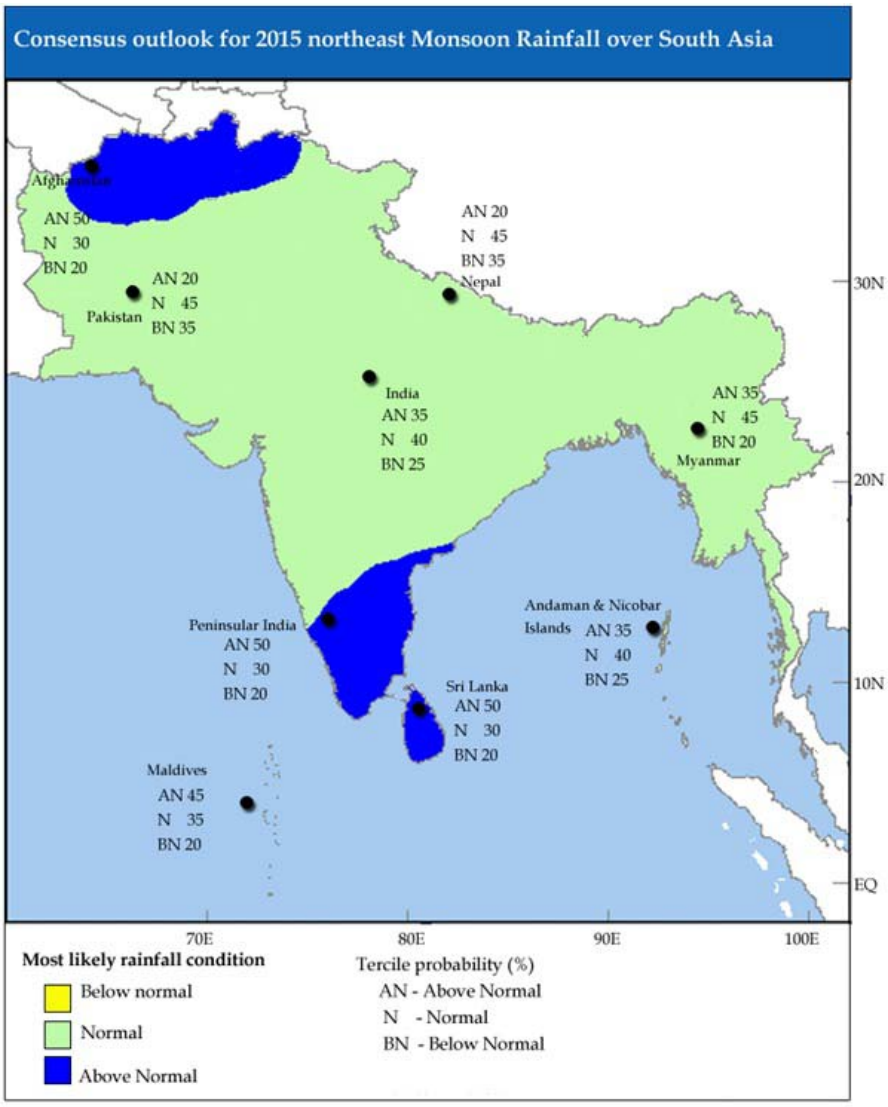
- **Thailand:** Summer season rainfall in 2014 was reduced by 20 per cent in 2014 and reservoir water levels fell by 30-40 per cent, resulting in a loss of around 800,000 million tons of rice in 2014 (RIMES, 2015). A second consecutive year of drought has been seen in 2015, which resulted in insufficient replenishment of key reservoirs. Reservoir levels in late September 2015 were critically low, 40 to 50 per cent less than 2014's drought affected levels (RIMES, 2015).

- **Timor-Leste:** Decreased rainfall conditions are usually observed during the El Niño years, often leading to reduced groundwater availability, with knock-on effects in the agriculture sector.

3.2 El Niño 2015 -2016: Flooding in South Asia

A consensus outlook for the 2015 northeast monsoon season rainfall over South Asia was released on 14-15 October 2015 jointly by WMO, IMD/Government of India, RIMES and CIDA. The outlook highlighted that the prevailing strong El Niño conditions in the equatorial Pacific would affect substantially the 2015 Northeast monsoon season (October–December) particularly in the southern peninsular of India, Sri Lanka and the Maldives (Figure 2) (IMD, 2015a).

Figure 2: Consensus Outlook for Northeast Monsoon Rainfall in South Asia, 2015

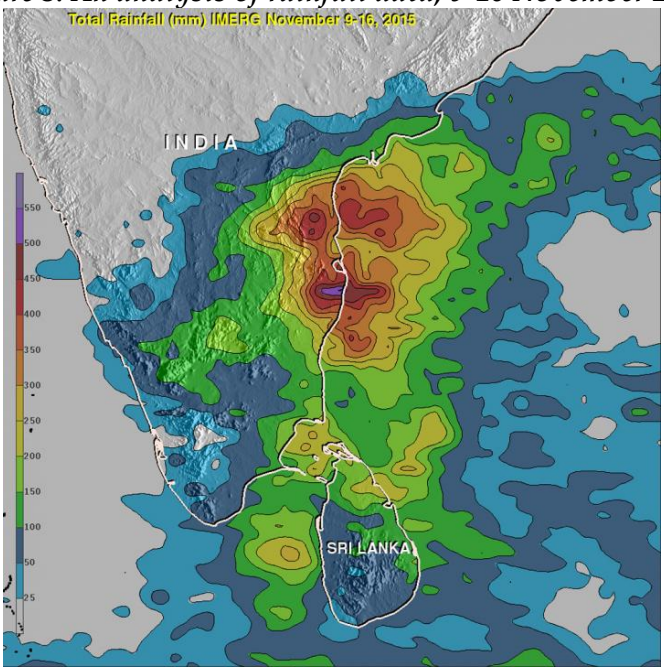


Source: WMO, Indian Meteorological Department/Government of India, RIMES and CIDA – Winter South Asia Climate Outlook Forum, Chennai, India, 14-15 Oct 2015.

As predicted, the middle of November 2015 witnessed extreme rainfall that caused severe flooding in southeastern India and northern Sri Lanka. The city of Chennai in the state of Tamil Nadu was hit exceptionally hard, with numerous deaths recorded. Extreme heavy rainfall over southeastern India caused deadly flooding in mid-November. Figure 3 shows the rainfall data provided by The Global Precipitation Measurement satellite. Up to 550 mm (21.7 inches) of rain was recorded, which drenched India's southeastern coast in the state of Tamil Nadu and over 200 mm (7.9 inches) fell in large areas of southeastern India and northern Sri Lanka. Record-setting rainfall since November 2015 has generated severe floods, shown in Figure 4, resulting in the death of a large number of people. Reports indicated that the Chennai airport was water-logged and the runway was submerged. While there is no detailed scientific investigation into whether there is a direct link between the 2015-2016 El Niño and Chennai city flooding yet, the consensus that strong El Niño

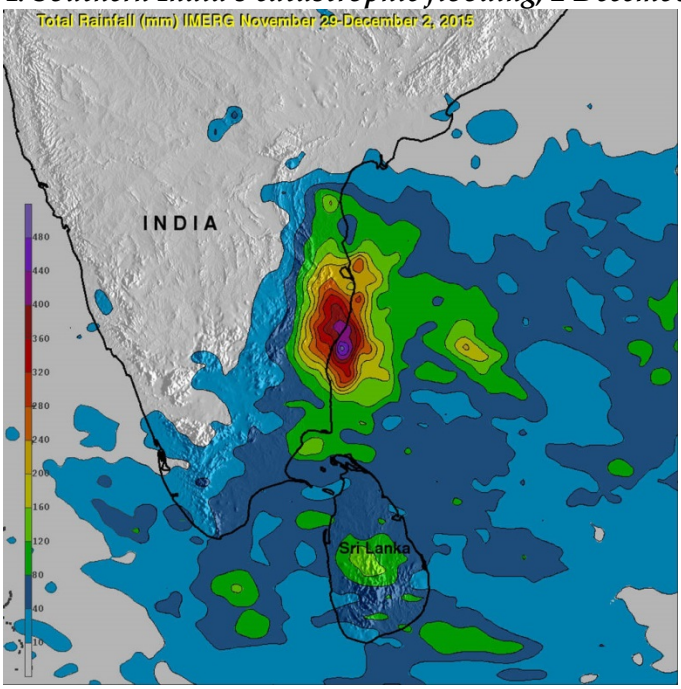
conditions has led to abnormal rainfall during the northeast monsoon season in South Asia indicates that El Niño had a part to play in the sequence of extreme weather events in India.

Figure 3: An analysis of rainfall data, 9-16 November 2015



Source: NASA/JAXA/Hal Pierce, 2015, available from: http://www.eurekalert.org/multimedia/pub/103517.php.

Figure 4: Southern India's catastrophic flooding, 2 December 2015



Source: NASA, 3 December 2015, available from: http://www.nasa.gov/image-feature/goddard/southern-indias-catastrophic-flooding-analyzed-by-nasas-imerg

3.3 Towards 2016: potential impacts in Asia

In Sri Lanka, during the Maha season (November to February), the effects of El Niño are likely to have no impact on paddy production, though heavy rains leading to floods are likely to affect coastal regions. The coconut production might fall in the following year (2017) because of poor rainfall during January to February 2016; however there is unlikely to be an impact on water resources in the country.

Higher than normal rainfall is likely to continue over the southern India and South Asia, including the Maldives and Sri Lanka during the winter period (December 2015 to February 2016), though lower rainfall is expected over the northern part of South Asia (India Meteorological Department, 2015b).

At the same time, the El Niño condition is likely to amplify the observed negative impacts of the 2014 winter season during November 2015 to April 2016 in Indonesia, the Philippines and Timor-Leste. Decreased rainfall conditions over the central and eastern regions in Indonesia are likely during the wet season which can lead to worsening of forest fires, crop production loss (rice, palm) and water scarcity in 2016 (WFP, 2015). Dry conditions will likely continue affecting most parts of the Philippines until April 2016. Drought or dry conditions are likely to affect 69 per cent of the country by the end of December 2015 and 85 per cent of the country by the end of March 2016 (PAGASA, 2015). This could aggravate crop production (rice) and water scarcity issues, for example, irrigation, hydropower generation and domestic water supply (de Guzman, 2015). Timor-Leste is also likely to experience adverse impacts on agriculture due to much lower rainfall.

4. El Niño impacts in the Pacific

4.1 El Niño Risk Patterns and observed impacts in Pacific islands

Pacific islands have different climatic conditions based on their geographical location and the influence of climate drivers, including El Niño. The Central and Southern islands experience dry seasons from May to October, with countries such as Papua New Guinea receiving much less rainfall (Box 1). The Northern islands, on the other hand, receive higher rainfall during May to