El Niño 2015/2016

Impact Analysis

Monthly Outlook

February 2016

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SECTION 1

Introduction

During the summer and autumn of 2015, El Niño conditions in the east and central Pacific strengthened, disrupting weather patterns throughout the tropics and into the mid-latitudes. For example, rainfall during the summer's Indian monsoon was approximately 15% below normal. The continued strong El Niño conditions have the potential to trigger damaging impacts (e.g., droughts, famines, floods), particularly in less-developed tropical countries, which would require a swift and effective humanitarian response to mitigate damage to life and property (e.g., health, migration, infrastructure). This analysis uses key climatic variables (temperature, soil moisture and precipitation – see section 1.1) as measures to monitor the ongoing risk of these potentially damaging impacts.

The previous 2015-2016 El Niño Impact Analysis was based on observations over the past 35 years and produced Impact Tables showing the likelihood and severity of the impacts on temperature and rainfall by season. The current report is an extension of this work, providing information from observations and seasonal forecast models to give a more detailed outlook of the potential near-term impacts of the current El Niño conditions by region.

This information has been added to the Impact Tables in the form of an 'Observations and Outlook' row. This consists of observational information for the past seasons of JJA 2015, SON 2015 and DJ 2015/2016, a detailed monthly outlook from 5 modeling centres for Feb 2016 and then longer-term seasonal forecast information from 2 modeling centres for the future seasons of MAM 2016 and JJ 2016. The seasonal outlook information is an indication of the average likely conditions for that coming month (or season) and region and is not a definite prediction of weather impacts. There is no seasonal forecast information yet available for Aug-Nov 2016, seasons which include these months are marked by 'X'.

Summary Table of Observations and Outlook Information

<table>
<tr><th rowspan="2">JJA 2015</th><th rowspan="2">SON 2015</th><th colspan="2">DJF 15/16</th><th rowspan="2">MAM 2016</th><th colspan="2">JJA 2016</th><th rowspan="2">SON 2016</th></tr>
<tr><th>DJ-15/16</th><th>Feb-16</th><th>JJ-2016</th><th>Aug-16</th></tr>
<tr><td colspan="3" rowspan="2">Observations</td><td colspan="4">Outlook</td><td rowspan="2">X- No information yet</td></tr>
<tr><td colspan="2">5 Models</td><td colspan="2">2 Models</td></tr>
</table>

1.1 Update of current event

Strong El Niño conditions continue to be present in the east and central Pacific. However, the peak of this event has already occurred in November and December 2015 with conditions starting to weaken in January 2016. Most models predict that El Niño conditions will continue (although weaker) during January-March 2016 and further weaken transitioning to ENSO-neutral conditions during late spring or early summer (CPC/IRI consensus forecast; A2.2). There is potential after that to transition into La Niña conditions, which are characterised by cooler than normal tropical Pacific sea surface temperatures. Such a

transition from strong El Niño conditions to La Niña conditions has been observed in nearly 90% of past El Niño events between 1950 and 2011.

Broadly speaking, global climate impacts of La Niña, especially in the tropics, tend to be opposite to those of El Niño. A full report on the historical impacts of past La Niña events will be available soon.

1.2 Forecast Model Data

The data used to produce the monthly outlook comes from 5 seasonal forecast models. The models used in this analysis are the Bureau of Meteorology (BoM; Australia), the European Centre for Medium Range Weather Forecasts (ECMWF; Europe, based in UK), the National Centers for Environmental Prediction (NCEP; United States), Météo-France (MetFrance) and the UK Met Office (UKMO). These models were chosen because they are known to be reputable, reliable seasonal forecast models. Data for the extended range outlook is only available from 2 models (NCEP and UKMO). The current tables and maps are based on forecasts made in January 2016. The length and frequency of the forecast data available differs between modeling centres, the details of these different data are described in section A2.1 of Annex 2.

Seasonal forecasts: The chaotic nature of the atmosphere means that it is hard to predict exactly what will happen months in advance. There are some aspects of the global weather and climate system that are more predictable than others and it is because of these that we are able to make seasonal forecasts. Such forecasts are able to show what is more or less likely to occur but acknowledge that other outcomes are possible.

Uncertainty at longer forecast lead times: Due to this chaotic nature of the atmosphere, it is easier to predict what will happen in the near-term over the next month or so than it is to predict what will happen 3 or 6 months from now. Therefore, as the length of the seasonal forecast increases, the level of skill decreases. This means we have higher confidence in the near-term forecasts than in the extended-range forecasts. In addition to this, we have higher confidence in the monthly outlook because information from more models has gone into the monthly outlook (5 models) compared with the extended-range outlook (2 models).

Data variables:
Precipitation: In the report and tables this is referred to as rainfall but in fact encompasses any form of water, liquid or solid, falling from the sky. The seasonal forecasts are compared to observations from the Global Precipitation Climatology Project (GPCP) from 1979-2014.

Soil Moisture: This is the moisture content in the soil over the top 20cm. The seasonal forecasts are compared to the global ECMWF Reanalysis (ERA-Interim/Land) of land-surface parameters from 1979-2010.

Temperature: This is the near-surface temperature (2 metre). The seasonal forecasts are compared to the global ECMWF Reanalysis (ERA-Interim) from 1979-2014.

SECTION 2

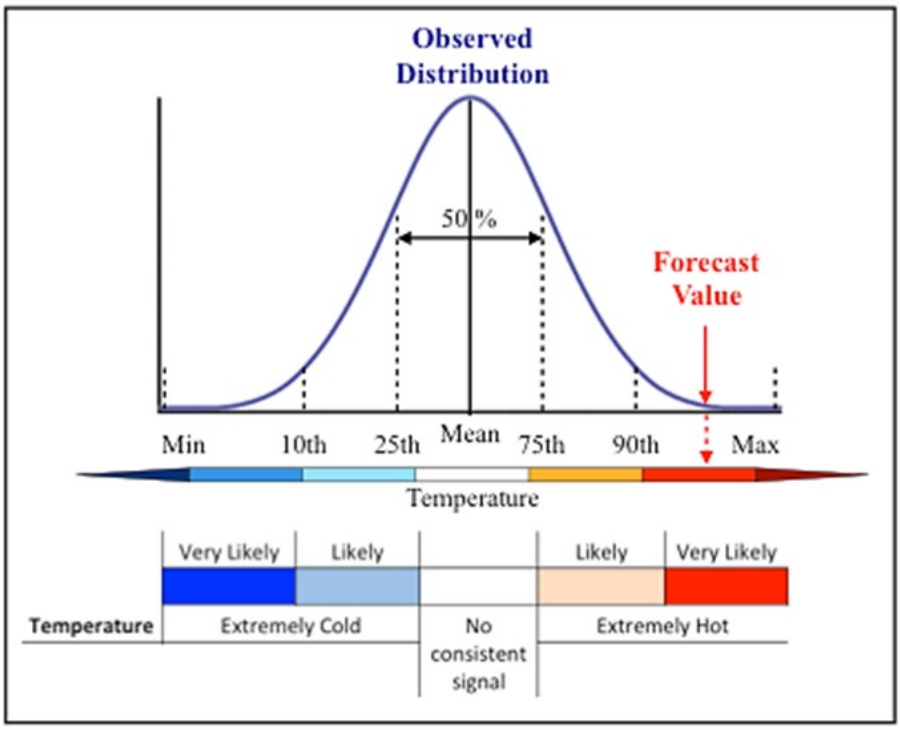
Description of Monthly Outlook Analysis and Tables

2.1 Monthly Outlook Analysis

The ‘Observations and Outlook’ row of the Impact Tables refers to what has already occurred in observations during this el Niño event (JJA 2015, SON 2015 and DJ 2015/2016), what is forecast to occur for the next Monthly Outlook, in this case February 2016, and the extended-range forecast over the following five months (MAM 2016 and JJ 2016). The current season (DJF 2015/16) is broken down into the observations (DJ 2015/2016) and the monthly outlook (Feb 2016) so that the near-term monthly forecast, in which we have more confidence and more models have contributed, can be seen separately. Boxes in future seasons (Aug-Nov 2016) where there is no information yet available are marked by an ‘X’.

The analysis for the outlook part of the Impact Table takes the forecast of rainfall, soil moisture and near-surface temperature for the forecast period and compares it with the observed distribution of the same period over the past 35 years. This method of comparing the forecast to the observations is explained schematically in Figure 2.1 and more technical details of this method are described in section A2.2.

Figure 2.1. Schematic representation of the methodology. This is an example for Temperature comparing the forecast value to the observed distribution. The top colour scales represents that used for Temperature in the Forecast Maps in Annex 1. The bottom colour scale refers to how this links to the colours used in the impact tables. See the description of this ‘worked example’ in the text in section 2.



If the forecast value lies within the middle 50% of the observed distribution (i.e. between the 25th and the 75th percentile) then there is no deviation from normal conditions predicted and these regions are left white in the Forecast Maps (see Annex 1) and labeled 'no consistent signal' in the Impact Tables. If, as the example in Figure 2.1 shows, the forecast value is above the 90th percentile of the observed distribution it will be coloured red in the temperature maps in Annex 1. An assessment will be made about whether this is a consistent signal across the models. If it is both a strong signal (above the 90th percentile) and robust across the forecast models then it will appear as dark red in the Impact Tables referring to "Very Likely Extremely Hot".

If either the signal is weaker (e.g., only above the 75th percentile) or the signal is not consistent across all the model forecasts then this would appear in the Impact Tables as only a "Likely" signal rather than a "Very Likely" signal.

2.2 Interpretation of the Forecast Maps

- The Forecast Maps (Annex 1) are designed to put the current seasonal forecast in the context of the observed record over the past 35 years by comparing to the same period in observations (see Figure 2.1).
- In the **temperature** maps, regions coloured in orange or red indicate areas where it is forecast to be warm or very warm compared with previous observations of that period. Blue regions show areas where it is forecast to be cold or very cold compared to the normal for that period.
- In the **rainfall and soil moisture** maps, regions coloured blue show areas where it is forecast to be wet or very wet compared with previous observations of that period. Brown regions show areas where it is forecast to be dry or very dry compared to the normal for that period.

2.3 Interpretation of the Impact Tables

For each region/country and variable, the Impact Tables are divided into two separate rows. The top row, labeled 'Analysis of Past El Niño Events' refers to the mean impact of past, observed El Niño events that have occurred over the last 35 years. The bottom row, labeled 'Observations and Outlook' refers to what has been happening during this current El Niño event. For past seasons/months, JJA 2015, SON 2015 and DJ 2015/2016, this is information from observations (see section A2.1 for details of the data used). The monthly outlook, in this case February 2016, is the forecast from 5 models (BoM, ECMWF, MetFrance, NCEP, UKMO). The following five months of outlook, MAM 2016 and JJ 2016, is the extended-range forecast from 2 models (NCEP, UKMO). The 'X', marks future seasons where there is no forecast information yet available.

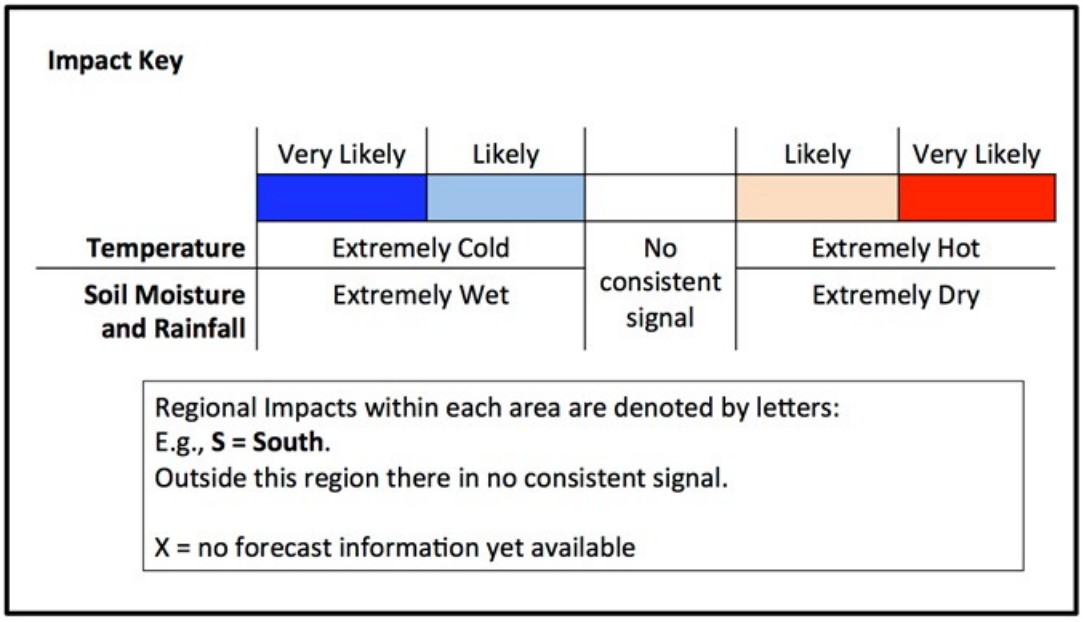
The remainder of the table, the Risk and Evidenced Impacts columns, refers to analysis of past, observed El Niño events over the last 35 years and remains unchanged from previous analysis.

2.4 Impact, Symbol and Level of Confidence Keys

Meteorological Analysis
As in previous analysis, for each country or region, the **likelihood** of temperature and rainfall[1] extremes occurring is shown by the coloured boxes according to the Impact key below. For example, dark blue colours for temperature – corresponding to "Very Likely

[1] Rainfall in the Impact Tables refers to analysis of both Rainfall **and** Soil Moisture.

Extremely Cold" conditions – can be interpreted as extreme[2] cold conditions in that season, in that country as being at least twice as likely to occur during El Niño. If the impact is limited to a particular region of that country then that region is represented in that box (e.g., S referring to South) and there is no consistent signal in the rest of that region or country.



Impact Analysis
An extensive **literature search** has been carried out. Scientific literature has been reviewed using the *science direct, web of knowledge* and *google scholar* databases. Grey literature and media reports were also analysed *(e.g., NGO reports)*. In addition specific case study details were analysed using databases of past natural disasters *(e.g., EM-DAT – International Disaster Database).*

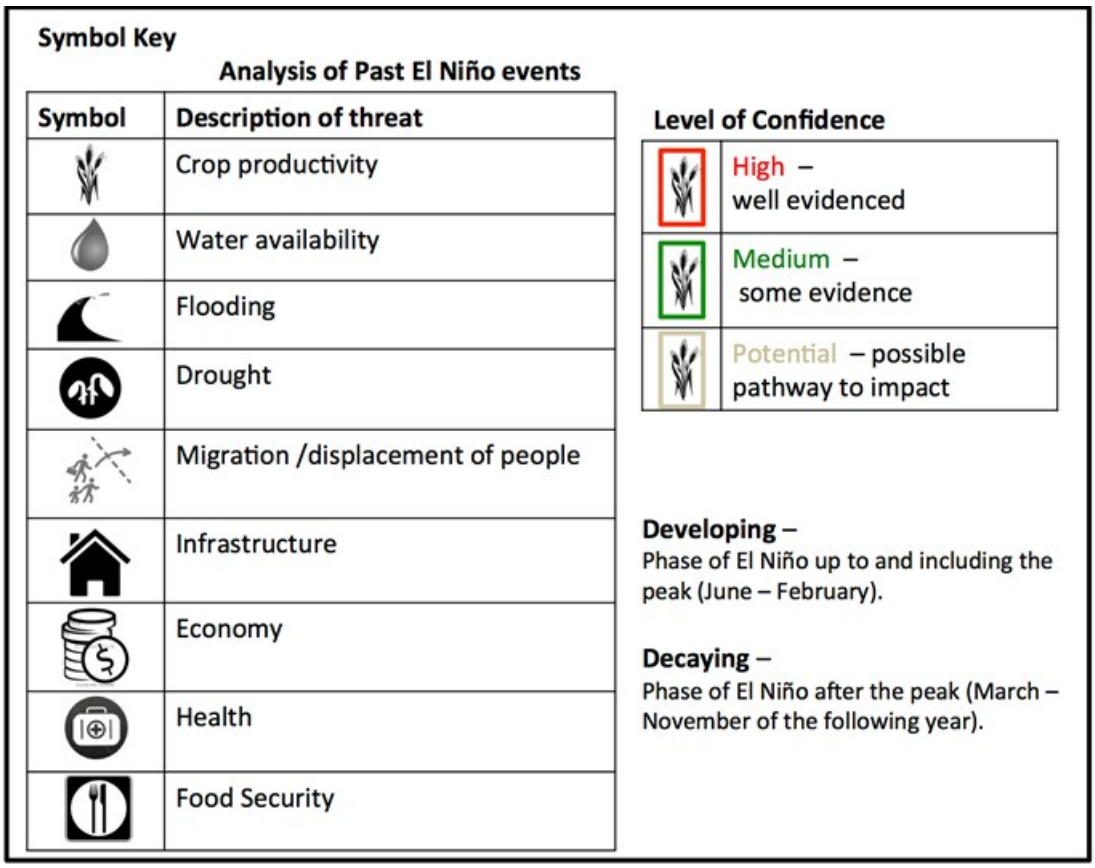
Potential **socio-economic impacts** that were identified in the literature search have been categorized by sector e.g., 'Food Security' and 'Health'. The evidenced impacts, based on past events, are summarised using sector symbols (see the Symbol key below). The uncertainty of the impact in these sectors is represented by the coloured borders around the symbols: red, green and beige correspond to high, medium and potential impacts respectively (see Level of Confidence key below).

It should be noted that the impacts are not updated with the seasonal forecast data but are the impacts of past El Niño events.

Time evolution of Impacts
It is not possible to break the sector impacts down by season because each event is slightly different and therefore the timing or occurrence of particular impacts can vary considerably. However, in some regions there is a clear distinction between the impacts that occur during the developing phase of El Niño (June– February) and those which occur during the decaying phase of El Niño (March- November of the following year). Where impacts differ significantly between the developing and decaying phases this is made clear in the Risk column of the Impact Tables. For example, in Indonesia, analysis of previous events shows that drought is likely during the developing phase of the El Niño while flooding is likely during the decaying phase after the peak of the event. Where this distinction is appropriate it is

[2] In the grey dotted boxes extreme refers to an event being in the upper or lower quartile - the bottom or top 25% of the observed record for that country for that season.

made clear on the Impact Table by showing sector symbols for the ‘developing’ phase and ‘decaying’ phase separately. If there is no clear distinction between impacts in the developing and decaying phases then the impacts are assumed to occur most strongly during the peak of the El Niño event.



Symbol Key

Analysis of Past El Niño events

Symbol	Description of threat
	Crop productivity
	Water availability
	Flooding
	Drought
	Migration /displacement of people
	Infrastructure
	Economy
	Health
	Food Security

Level of Confidence

	High – well evidenced
	Medium – some evidence
	Potential – possible pathway to impact

Developing –
Phase of El Niño up to and including the peak (June – February).

Decaying –
Phase of El Niño after the peak (March – November of the following year).

SECTION 3

Impact Tables with February 2016 Monthly Outlook

Below are Impact Tables by region. The information is split into (a) ‘Analysis of Past El Niño Events’ – based on past, observed El Niño events over the last 35 years, and (b) ‘Observations and Outlook’ – based on current observations of this El Niño event for past seasons and seasonal forecast information for the next 6 months (month 1 from 5 models and months 2-6 from 2 models). The ‘X’, marks future seasons where there is no forecast information yet available.

3.1 Southern Africa

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
Southern Africa	Temperature	Analysis of Past El Niño Events		no consistent signal				no consistent signal	no consistent signal			Reduced water availability, reduction in crop yields. Increased risk of drought-related humanitarian disaster.
		Observations and Outlook						no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events		no consistent signal						no consistent signal		
		Observations and Outlook	no consistent signal	no consistent signal				no consistent signal	X	X		
South Africa	Temperature	Analysis of Past El Niño Events		no consistent signal			E	no consistent signal	no consistent signal	no consistent signal		Increase water stress, reduction in crop yields (e.g., Maize and Soybean). Below normal instances of Malaria.
		Observations and Outlook						no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events		no consistent signal	E	E	NE			no consistent signal		
		Observations and Outlook	S	no consistent signal	SW	W	W	no consistent signal	X	X		
Mozambique	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	S	S		N	N	S		Drought, and crop failure leading to potential food shortages.
		Observations and Outlook	N	no consistent signal				no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook		no consistent signal			no consistent signal	no consistent signal	X	X		
Malawi	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal				no consistent signal	no consistent signal	no consistent signal		Drought affecting crop productivity.
		Observations and Outlook						no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal		no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook		no consistent signal	S		no consistent signal	no consistent signal	X	X		
Zambia	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	S	S						Increase water stress, crops vulnerable to drought. Increase East Coast Fever in cattle.
		Observations and Outlook	E		S		S	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	E	E	E	no consistent signal	no consistent signal	no consistent signal	E		
		Observations and Outlook	no consistent signal	no consistent signal	S		no consistent signal	W	X	X		
Zimbabwe	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal				no consistent signal	no consistent signal			Drought leads to significantly reduced Maize yield.
		Observations and Outlook	no consistent signal						X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal			no consistent signal			no consistent signal		
		Observations and Outlook	no consistent signal	no consistent signal	E		no consistent signal	no consistent signal	X	X		

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High | Medium | Potential

3.2 West Africa

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
West Africa	Temperature	Analysis of Past El Niño Events		no consistent signal				no consistent signal	no consistent signal	no consistent signal		Risk of drought and reduced crop productivity. Drought-related migration leading to increased disease risk.
		Observations and Outlook		no consistent signal	N	S		no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events										
		Observations and Outlook		no consistent signal	S	S	S		X	X		
Nigeria	Temperature	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal	S	no consistent signal	no consistent signal	no consistent signal		Drought results in reduced Maize yields. Drought-related migration increases risk of spreading infectious disease.
		Observations and Outlook	E	no consistent signal	N	S	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	N	no consistent signal	no consistent signal	S			no consistent signal		
		Observations and Outlook	S	no consistent signal	S	no consistent signal	S	S	X	X		
Ghana	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	S	S		no consistent signal	no consistent signal	no consistent signal		Significantly less rain in May-Jun major rains. Reduced water availability and drought.
		Observations and Outlook		no consistent signal	N	S	S	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	S	no consistent signal			S	S	S	no consistent signal		
		Observations and Outlook	S	no consistent signal	S	no consistent signal	S		X	X		
Sierra Leone	Temperature	Analysis of Past El Niño Events		no consistent signal			no consistent signal	no consistent signal	no consistent signal	no consistent signal		Some risk of drought. Reduced Rice and Maize crop yields.
		Observations and Outlook			no consistent signal		no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal			no consistent signal	no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook		no consistent signal	no consistent signal		no consistent signal		X	X		

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3.3 East Africa

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
East Africa	Temperature	Analysis of Past El Niño Events		no consistent signal						no consistent signal		Risk of flooding causing damage to infrastructure and displacement of people. Increase risk of Rift Valley Fever, Malaria and Cholera.
		Observations and Outlook						no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events					no consistent signal					
		Observations and Outlook		no consistent signal			no consistent signal	no consistent signal	X	X		
Ethiopia	Temperature	Analysis of Past El Niño Events						no consistent signal	no consistent signal	no consistent signal		Risk of flooding causing displacement of people. Increase incidence of Rift Valley Fever, Malaria and Cholera.
		Observations and Outlook			E	SE	NE	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	E			no consistent signal			W		
		Observations and Outlook	N			E	no consistent signal	W	X	X		
South Sudan	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	SE	SE	SE	no consistent signal	no consistent signal	no consistent signal		Flooding affecting infrastructure and access to basic relief for vulnerable people.
		Observations and Outlook				S	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal	SE	SE						
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		X	X		
Kenya	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		Flooding affecting access to food. Increase risk of Rift Valley Fever, Malaria and diarrhoea.
		Observations and Outlook	no consistent signal		E		no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal				no consistent signal			no consistent signal		
		Observations and Outlook	W	no consistent signal			no consistent signal	W	X	X		
Uganda	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal		no consistent signal	no consistent signal	no consistent signal		Significant displacement of people following flooding and landslides. Increase risk of Cholera and highland Malaria.
		Observations and Outlook					no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal				no consistent signal					
		Observations and Outlook		no consistent signal		no consistent signal	no consistent signal		X	X		
Somalia	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	N	N		E	E	NE		Continuous heavy rains causing river bank collapse and flooding. Increase risk of RVF.
		Observations and Outlook		no consistent signal			N	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	S	N	N	no consistent signal			no consistent signal		
		Observations and Outlook	no consistent signal	no consistent signal			no consistent signal	no consistent signal	X	X		
Sudan	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal			no consistent signal	NW	NW	no consistent signal		Flooding and mudslides cause displacement of people and affects access to food.
		Observations and Outlook				no consistent signal	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal	no consistent signal	NE	NE	S		
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	N	N	no consistent signal	X	X		

			JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
Country	Variable	Type			DJ 2016	Feb-16		JJ 2016	Aug-16			
Tanzania	Temperature	Analysis of Past El Niño Events		NW	no consistent signal	no consistent signal		E	E	no consistent signal		Flooding during el Niño peak. Warm temperatures during Mar-May lead to decreased crop productivity. Increase RVF risk.
		Observations and Outlook			E	no consistent signal	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events					no consistent signal	no consistent signal	no consistent signal	SE		
		Observations and Outlook	no consistent signal	no consistent signal	E	no consistent signal	no consistent signal	no consistent signal	X	X		
Rwanda	Temperature	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal		no consistent signal	no consistent signal	no consistent signal		Flooding destroys homes and schools and leads to large numbers being displaced. Increased incidents of highland Malaria.
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal		no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events					no consistent signal	no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		X	X		
Central Africa	Temperature	Analysis of Past El Niño Events	no consistent signal					no consistent signal	no consistent signal	no consistent signal		Flooding during developing phase. Increased Rift Valley Fever risk. Reduced crop productivity during hot temperatures in decaying phase.
		Observations and Outlook			no consistent signal		no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events					no consistent signal			no consistent signal		
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal		no consistent signal	no consistent signal	X	X		
Democratic Republic of Congo	Temperature	Analysis of Past El Niño Events	no consistent signal	S				no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook			no consistent signal		no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	SE	no consistent signal	no consistent signal	no consistent signal	no consistent signal	S	S	N		
		Observations and Outlook	NW	no consistent signal	no consistent signal		no consistent signal	no consistent signal	X	X		

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3.4 Central Africa

3.5 MENA – Middle East and North Africa

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
MENA	Temperature	Analysis of Past El Niño Events		no consistent signal			no consistent signal			no consistent signal		Potential for flooding before el Niño peak. Potential for drought following peak, resulting in reduced crop productivity.
		Observations and Outlook	no consistent signal	no consistent signal		no consistent signal		no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal									
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	no consistent signal			X	X		
Libya	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal		W	W	no consistent signal		
		Observations and Outlook	no consistent signal		S	no consistent signal	S	S	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal	no consistent signal			N		
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
Egypt	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	SW	SW	no consistent signal		Agricultural land and houses flooded during el Niño peak. Reduction in Maize and Wheat crop yields.
		Observations and Outlook					no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		N	N	N	E	E	N		
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
Algeria	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal			no consistent signal	S	S	no consistent signal		Affected by reduced crop productivity and drought.
		Observations and Outlook	no consistent signal				no consistent signal	S	X	X		
	Rainfall	Analysis of Past El Niño Events	W	E	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook	S	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
Lebanon	Temperature	Analysis of Past El Niño Events		no consistent signal	no consistent signal	no consistent signal	no consistent signal			no consistent signal		Flooding and high winds during el Niño peak destroys infrastructure and disrupts power.
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal									
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
Jordan	Temperature	Analysis of Past El Niño Events	E	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		Flash flooding experienced before el Niño peak.
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal									
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal		no consistent signal	X	X		
Palestinian Territories	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal			no consistent signal		
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal									
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal		no consistent signal	X	X		

Syria	Temperature	Analysis of Past El Niño Events	S	no consistent signal	no consistent signal	no consistent signal	no consistent signal			no consistent signal		Heavy rain causing flooding prior to peak. Drought following el Niño, reduced water availability.
		Observations and Outlook	no consistent signal			no consistent signal	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal				W			no consistent signal		
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal		no consistent signal	X	X		
Iraq	Temperature	Analysis of Past El Niño Events	W	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		Flooding destroyed infrastructure and causes displacement of people.
		Observations and Outlook	no consistent signal			no consistent signal	no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		NW	NW	no consistent signal			S		
		Observations and Outlook	no consistent signal	N		no consistent signal		no consistent signal	X	X		
Afghanistan	Temperature	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		Potential for flooding during developing phase of el Niño causing damage to crops, livestock and homes.
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal		no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		N	N	N			N		
		Observations and Outlook	no consistent signal			no consistent signal	no consistent signal	no consistent signal	X	X		

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3.6 Indonesia

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
Indonesia	Temperature	Analysis of Past El Niño Events		S				no consistent signal	no consistent signal	no consistent signal	 Developing	Drought during developing phase, reduction in water availability, crop production, threat of forest fires with health-related risk. Flooding and landslides following peak with increased Dengue Fever.
		Observations and Outlook	no consistent signal						X	X		
	Rainfall	Analysis of Past El Niño Events					no consistent signal				 Decaying	
		Observations and Outlook					no consistent signal		X	X		

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3.7 Southeast Asian Peninsular

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
Southeast Asian Peninsular	Temperature	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal						Increased risk of drought and forest fires. Reduced crop productivity.
		Observations and Outlook				no consistent signal			X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal				no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook		no consistent signal	no consistent signal	no consistent signal			X	X		
China	Temperature	Analysis of Past El Niño Events	SE	no consistent signal	no consistent signal	no consistent signal	NW	no consistent signal	no consistent signal	no consistent signal		Flooding resulting in displacement of people. Reduction in Maize crop productivity. Increase risk of dysentery in east.
		Observations and Outlook	no consistent signal	S	N	no consistent signal	no consistent signal	S	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	SE	SE	SE	N	SE	SE	N		
		Observations and Outlook	no consistent signal	S	SE	N	SE	no consistent signal	X	X		
Vietnam	Temperature	Analysis of Past El Niño Events	no consistent signal				no consistent signal	N	N			Increase incidences of forest fire and smoke-related deaths.
		Observations and Outlook	no consistent signal	no consistent signal		no consistent signal			X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal	N	N		N	N	no consistent signal		
		Observations and Outlook			N	S			X	X		
Myanmar (Burma)	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal			no consistent signal		Affected by moderate drought and reduction in Maize and Rice crops. Increase risk of Cholera and Malaria.
		Observations and Outlook	no consistent signal	no consistent signal	S	S			X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal	S	no consistent signal	no consistent signal	NW		
		Observations and Outlook	no consistent signal		no consistent signal		S	S	X	X		

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3.8 Southern Asia

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
Southern Asia	Temperature	Analysis of Past El Niño Events		no consistent signal	no consistent signal	no consistent signal	no consistent signal			no consistent signal	Developing	Below normal monsoon rainfall, drought risk and reduced crop productivity during developing phase. Potential for flooding following peak with increased Cholera and Malaria risk.
		Observations and Outlook						no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events		no consistent signal			no consistent signal	no consistent signal	no consistent signal		Decaying	
		Observations and Outlook		no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
India	Temperature	Analysis of Past El Niño Events	N	S	no consistent signal	no consistent signal	no consistent signal	W	W	no consistent signal		Slow onset of monsoon in developing phase, drought risk and reduced Soybean crops. Increased water availability and reduced rice crop failure in south.
		Observations and Outlook	S			S	S	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	N	no consistent signal			no consistent signal	S	S			
		Observations and Outlook	SW		no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
Pakistan	Temperature	Analysis of Past El Niño Events			no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		Affected by drought in North. Increased risk of Malaria epidemics after el Niño peak.
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	no consistent signal			X	X		
	Rainfall	Analysis of Past El Niño Events	N				no consistent signal			NE		
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		
Bangladesh	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal			no consistent signal	no consistent signal	no consistent signal			Drought risk in developing phase. Increase Cholera risk after peak.
		Observations and Outlook	no consistent signal		no consistent signal	no consistent signal		no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal		no consistent signal	no consistent signal			
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal		no consistent signal	no consistent signal	X	X		
Nepal	Temperature	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal			
		Observations and Outlook			no consistent signal			no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal			
		Observations and Outlook	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	X	X		

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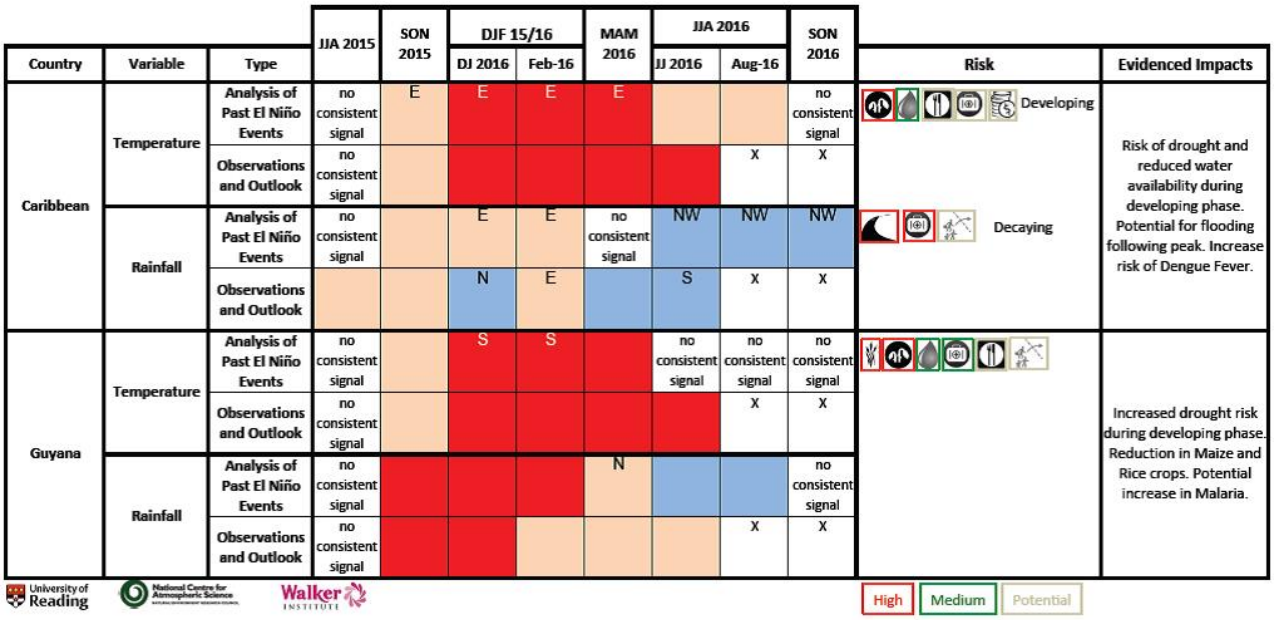
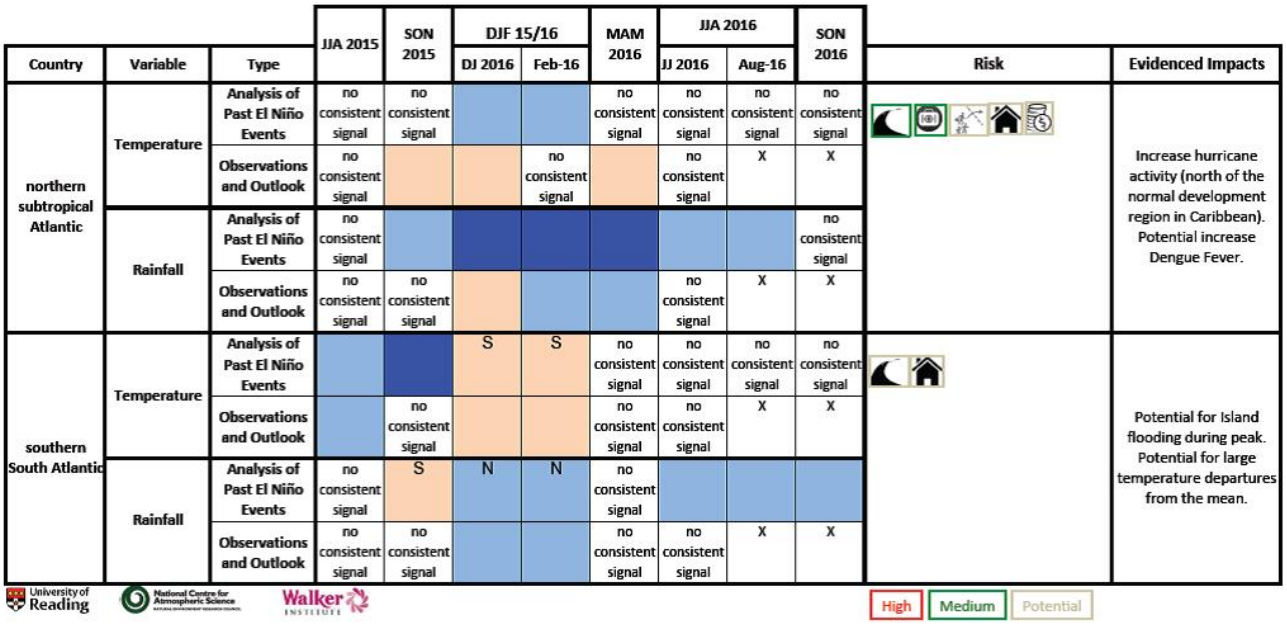
3.9 Caribbean



3.10 British Overseas Territories



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3.11 Southern Europe

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
Southern Europe	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal			no consistent signal	no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook		no consistent signal			no consistent signal	no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events			no consistent signal	no consistent signal	no consistent signal			no consistent signal		
		Observations and Outlook	no consistent signal	no consistent signal		no consistent signal	no consistent signal	no consistent signal	X	X		

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3.12 Indian Ocean

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
Central Indian Ocean	Temperature	Analysis of Past El Niño Events	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook						no consistent signal	X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal		no consistent signal	no consistent signal				no consistent signal		
		Observations and Outlook	no consistent signal					no consistent signal	X	X		

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3.13 Pacific Ocean

Country	Variable	Type	JJA 2015	SON 2015	DJF 15/16		MAM 2016	JJA 2016		SON 2016	Risk	Evidenced Impacts
					DJ 2016	Feb-16		JJ 2016	Aug-16			
Central Pacific	Temperature	Analysis of Past El Niño Events						no consistent signal	no consistent signal	no consistent signal		Increase risk of flooding during the peak for Islands in the South Pacific Convergence.
		Observations and Outlook							X	X		
	Rainfall	Analysis of Past El Niño Events	no consistent signal				no consistent signal	no consistent signal	no consistent signal	no consistent signal		
		Observations and Outlook				E	E	E	X	X		

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Annex 1 Forecast Maps

Figure A1.1 Forecast percentile maps for the Temperature. Blue colours show areas likely to be colder than normal, red colours show areas likely to be warmer (see explanation in section 2.1-2.2). These maps are based on forecasts from January 2016 and are compared to the observations for the period from February 1st 2016 to the end of the forecast (see section A2.1 for exact details for each model).

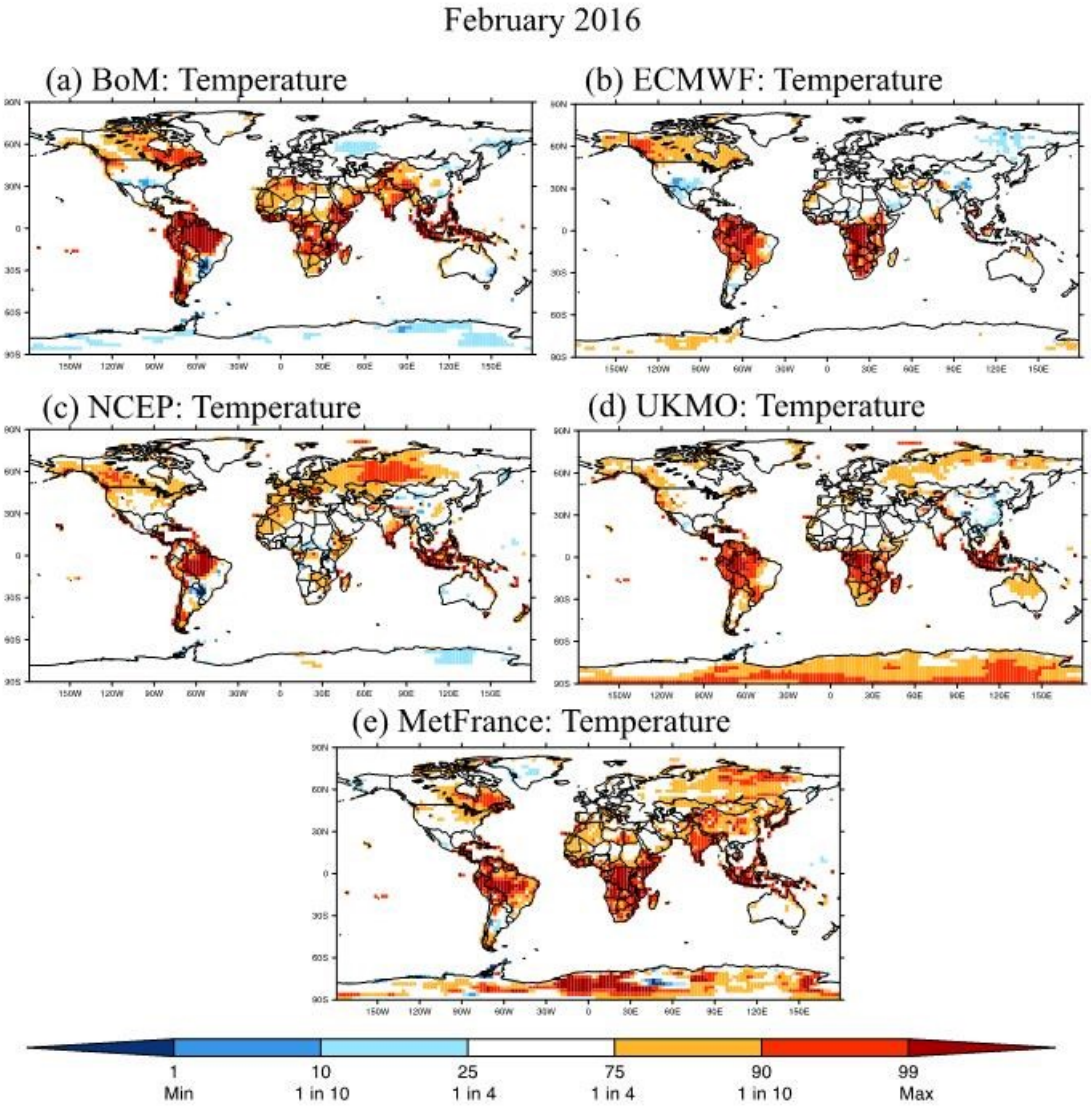

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Figure A1.2 Forecast percentile maps for Rainfall. Blue colours show areas likely to be wetter than normal, brown colours show areas likely to be drier (see explanation in section 2.1-2.2). These maps are based on forecasts from January 2016 and are compared to the observations for the period from February 1st 2016 to the end of the forecast (see section A2.1 for exact details for each model).

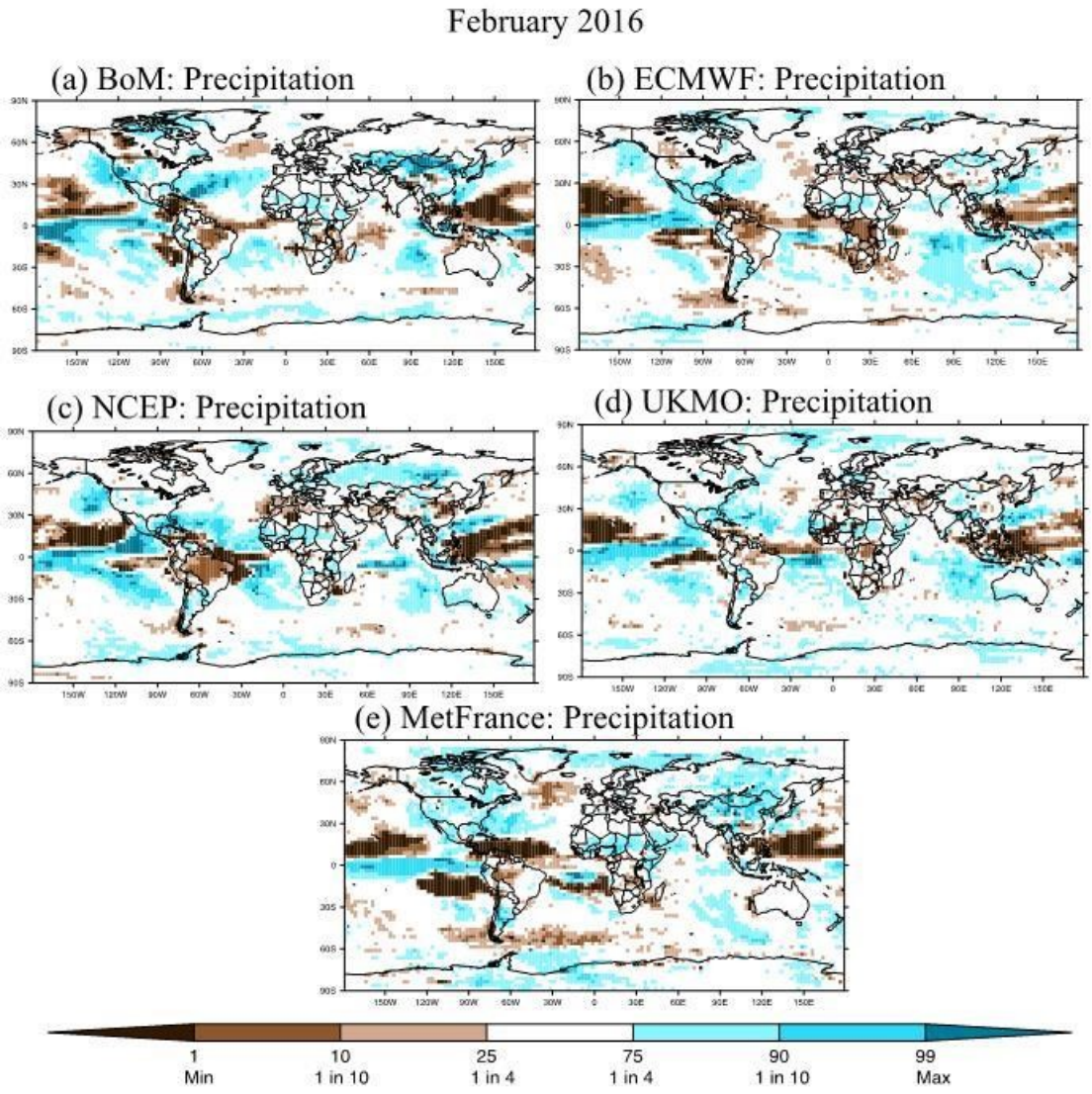

Figure A1.3 Forecast percentile maps for Soil Moisture. Blue colours show areas likely to be wetter than normal, brown colours show areas likely to be drier (see explanation in section 2.1-2.2). These maps are based on forecasts from January 2016 and are compared to the observations for the period from February 1st 2016 to the end of the forecast (see section A2.1 for exact details for each model).

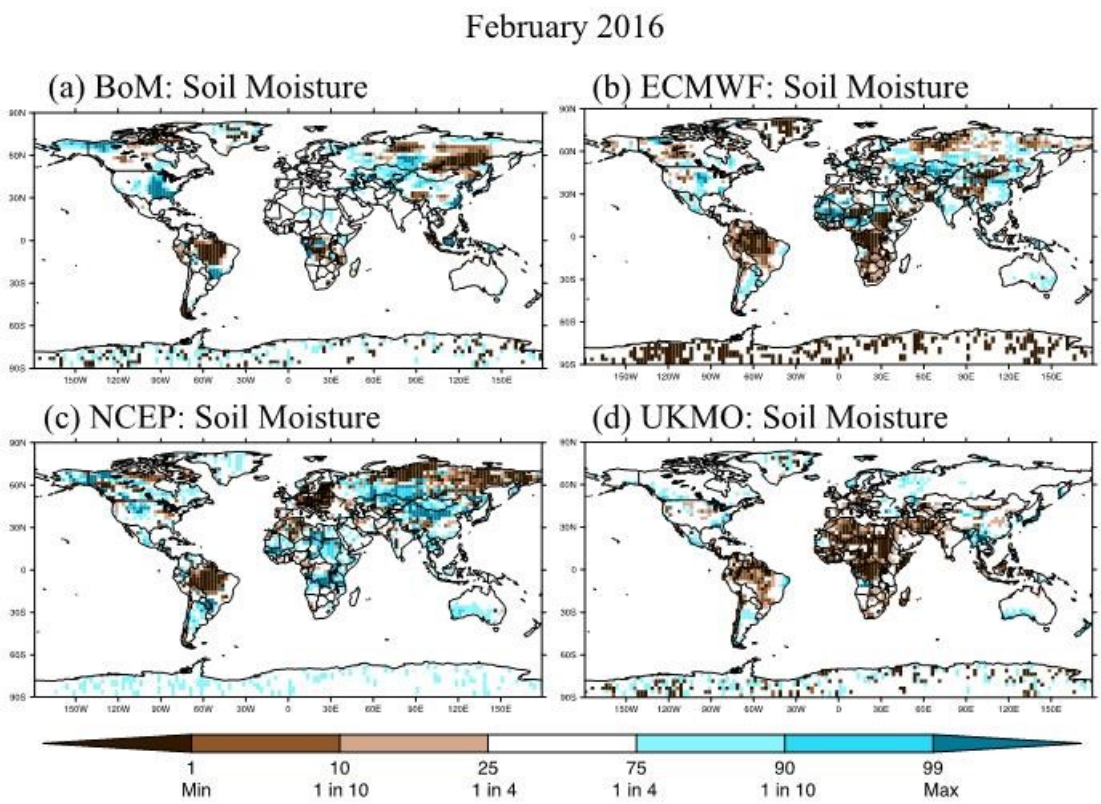

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Figure A1.4: As Figures A1.1-A1.3, but forecast percentile maps for Temperature, Rainfall and Soil Moisture from NCEP and UKMO for March –May 2016 (months 2-4 of the extended-range forecast).

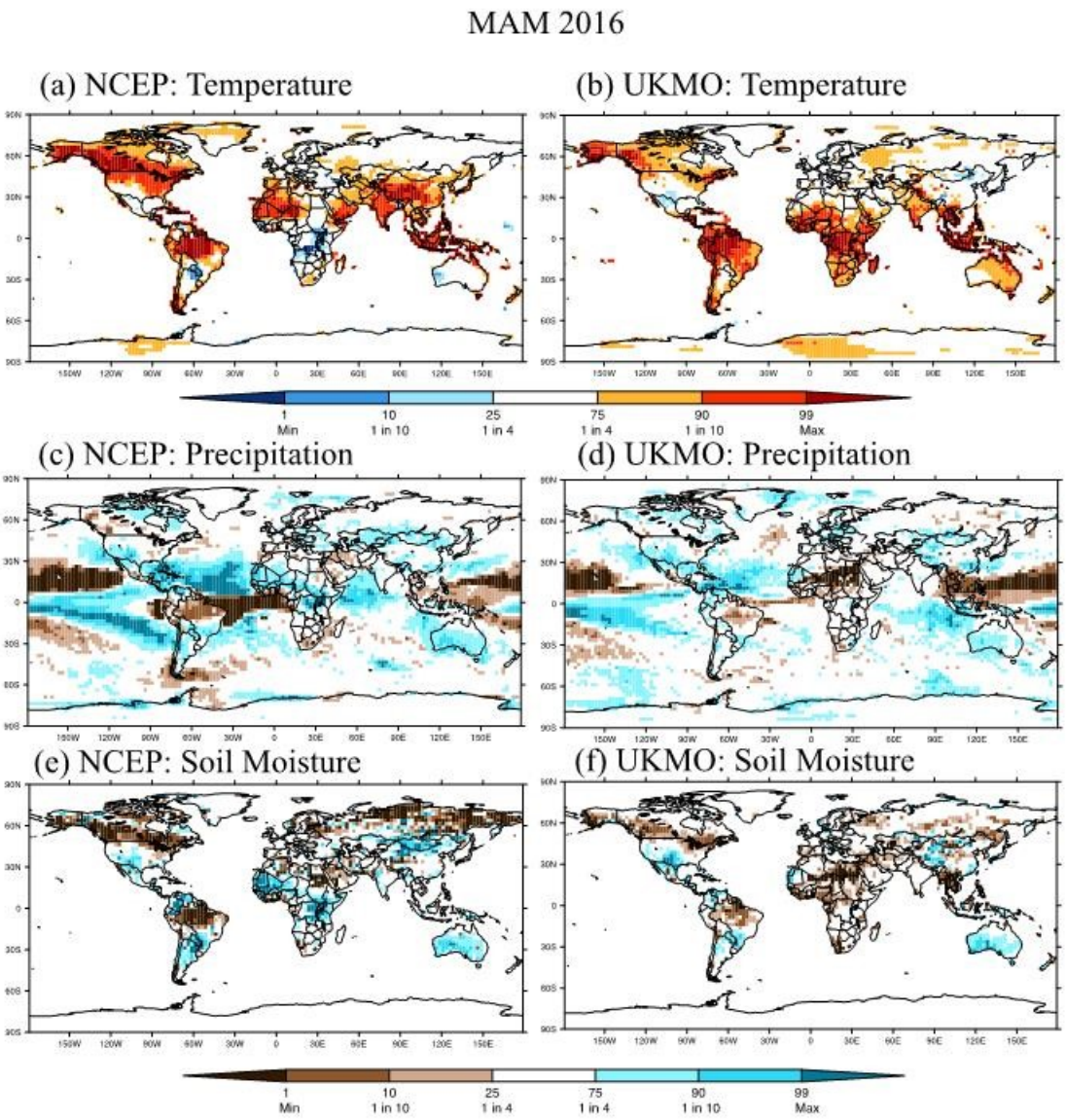
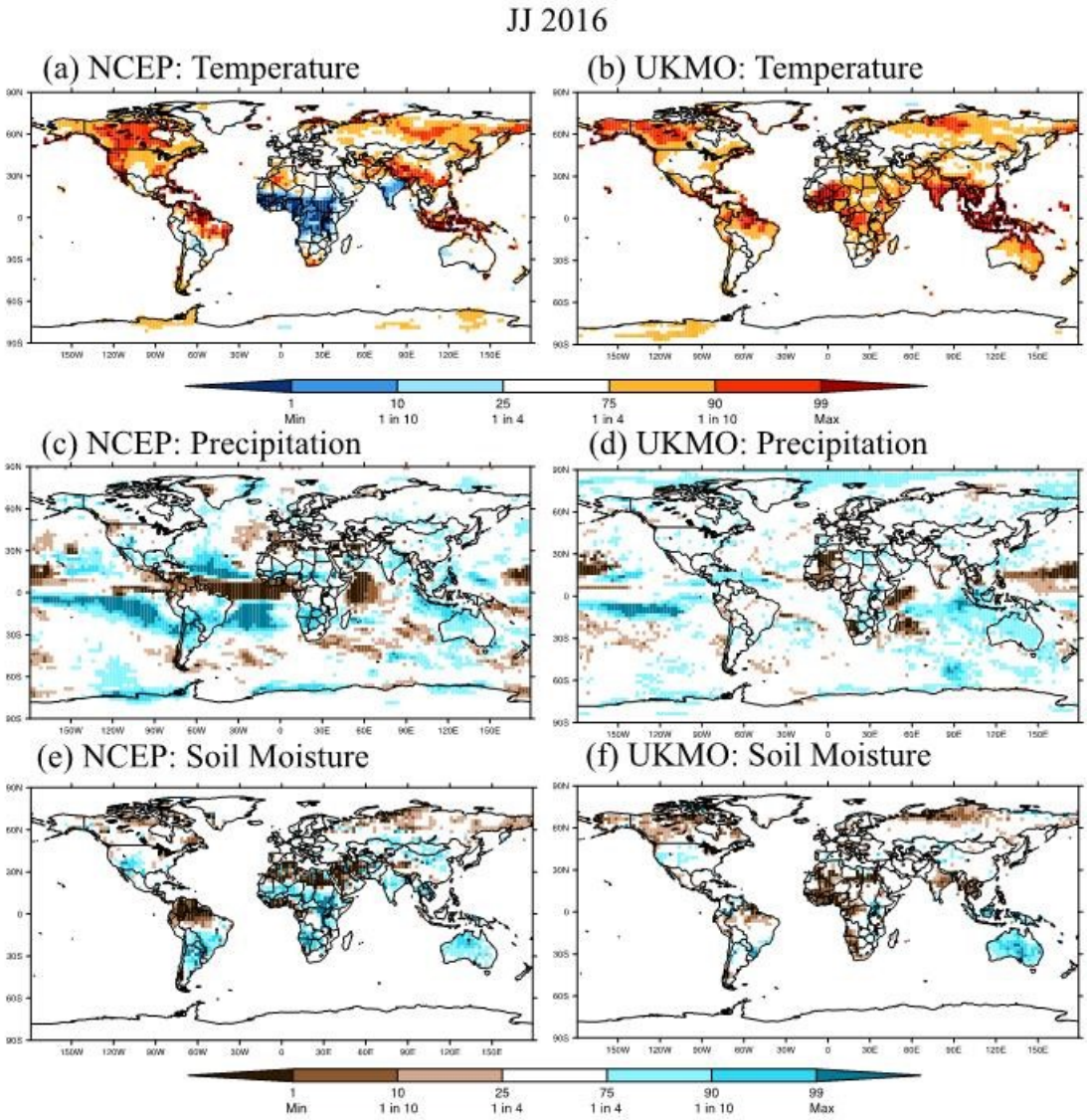


Figure A1.5: As Figures A1.1-A1.3, but forecast percentile maps for Temperature, Rainfall and Soil Moisture from NCEP and UKMO for June-July 2016 (month 5-6 of the extended-range forecast).



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Annex 2 Detailed Technical Methodology

A2.1 Data

The current tables are based on forecasts made in January 2016. The length and frequency of the forecast data available, as well as the climatological period available to calculate the anomalies from, differ between centres. These differences are summarised below, spilt by those models from which only the monthly forecast data is available (BoM, ECMWF and MetFrance) and those which have an extended-range forecast available for the next 6 months (NCEP, UKMO).

Monthly forecast data:

BoM forecasts are updated twice per week and run for 60 days. The forecasts are bias-corrected using hindcasts for 6th January with 33 ensemble members for the period from 1981-2013.
Current forecast start date: 7th January 2016 with 33 ensemble members.

ECMWF forecasts are updated twice per week and run for 46-days. The forecasts are bias-corrected using hindcasts for 7th January 2016 with 11 ensemble members for the period from 1996-2015.
Current forecast start date: 7th January 2016 with 51 ensemble members.

MetFrance forecasts are updated once per month and run for 60-days. The forecasts are bias-corrected using hindcasts for 1st January 2016 with 15 ensemble members for the period from 1993-2014.
Current forecast start date: 1st January 2016 with 51 ensemble members.

Extended-range seasonal forecast data:

NCEP : The hindcast period available, from which the forecast anomalies are calculated, is 1982-2010. For the hindcast, there is one start date (26yh January 2016), with 4 ensemble members per day.
Current forecast period is 22nd January 2016 – 27th January 2016 with 7 ensemble members per day for 6 days (total 42 ensemble members).

UKMO: The hindcast period, from which the forecast anomalies are calculated, is 1996-2009. For the hindcast, there are five start dates (17th, 25th January 2016 and 1st, 9th February 2016), with 2 ensemble members per start date.
Current forecast period is 12th – 21st January 2016 with 2 ensemble members per day for 10 days (total 20 ensemble members).

Observational data for past seasons:

Observational data was used to analyse what has been observed over the two previous seasons (JJA 2015 and SON 2015). For Rainfall monthly data from the Global Precipitation Climatology Project (GPCP), Climate Prediction Centre Merged Analysis of Precipitation (CMAP) and Global Historical Climatology Network (GHCN) was used. For Temperature monthly data from GHCN and the Hadley Centre of the UK Met Office Climate Research Unit (HadCRUT) was used. These were compared with Rainfall, Temperature and Soil Moisture from the NCEP/NCAR Reanalysis.

A2.2 Methodology

To produce the forecast outlook information in the impact table the forecast anomaly, defined as the difference from that model's own climatological value at that location for the hindcast period available (see section A2.1 for details for each model), is compared to the distribution of observed anomalies for the same period as the forecast[3]. To make this comparison at each longitude and latitude between observations and the models, each data were interpolated onto a common 2.5 x 2.5 degree grid using a bilinear interpolation method.

This is a method of understanding where the forecast anomalies fall compared with the observed distribution of anomalies. This method is described schematically in the main report in Figure 2.1 with a worked example.

Forecast Period covered: The most up-to-date forecasts available have been used to make the final tables and maps. Only forecast information from 1st February 2016 onwards is shown on the monthly outlook maps. For example, for BoM forecasts - with a start date of 13th December - only information from January 1st onwards is used to create the forecast map shown in A1.1-A1.3.

CPC/IRI consensus forecast: http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

[3] Note, this is a slightly different period in observations depending on the model.