Agriculture Knowledge, Learning Documentation and Policy (AKLDP) Project, Ethiopia

Technical Brief

September 2015

El Niño in Ethiopia

Uncertainties, impacts and decision-making

> Agriculture which is highly dependent on rainfall can perform well in normal years, but is at risk when rains fail. When agriculture is central to human food security, poor rain translates into declining food security.

Introduction

In recent years Ethiopia has seen substantial investments in agriculture through the Government of Ethiopia's Agricultural Growth Programme, the Feed the Future program of the United States Government, and programs supported by a range of other donors. However, the economy of Ethiopia and the food security of its population are highly dependent on agriculture which is rain-fed, and therefore, susceptible to drought. As recently as 2008 localized droughts in crop-producing and pastoralist areas led to food assistance for 12 million people – up to that point, the second highest number of food insecure people in any given year in Ethiopia's history.[i] In 2015 food security reports and humanitarian needs assessments in Ethiopia refer to failed or poor rains, which in part relate to El Niño weather events.[ii]

- First, in early June 2015 Ethiopia's National Meteorological Agency (NMA) reported that the important spring *belg* rains of March to May, had failed.
- Second, an emerging El Niño episode was associated with the delayed onset of the main summer *kiremt* rains, normally falling in June to September.

This Technical Brief explains the current problem of poor rain in Ethiopia, and in a context of uncertain climate predictions, summarizes some of the likely impacts of El Niño on the main *kiremt* summer rains, and assesses the risks of delayed planning and response to these impacts.

The weather in Ethiopia

Rainfall in Ethiopia, Djibouti and Somalia is influenced by weather systems which evolve thousands of miles away in the Pacific Ocean, especially the central and east-central parts of the Pacific around the Equator. One of the main factors driving these systems is the temperature of the Pacific's surface, because this affects the air pressure above the sea, and related wind and rainfall patterns across large areas of the tropics and sub-tropics. A warmer sea leads to high air pressure, and a cooler sea leads to low air pressure. Relatively large changes in the sea's temperature create unusual weather patterns, such as drought or excessive rainfall and storms.

Key terms

Sea surface temperature (SST) – the temperature of the sea close to its surface

El Niño – is a warming of the central Pacific leading to high pressure weather systems. The term was first used by fishermen in the 1600s along the coasts of Ecuador and Peru to describe an unusually warm ocean current, typically observed around Christmas time and lasting for several months.[iii]

La Niña – the opposite of El Nino warming, being a colder SST leading to low pressure weather systems. For example, the Horn of Africa drought of 2011 was triggered by a deep and prolonged *La Niña* episode and resulted in a severe food security and nutrition crisis that affected the lives and livelihoods of more than 12.5 million people living in the region's drylands.

El Niño-Southern Oscillation (**ENSO**) – El Nino warming and La Nina cooling are coupled, with each event lasting several years. The ENSO is the changes in air pressure associated with the changes in SST.

Oceanic Niño Index (ONI) – based on SST measurements, a high ONI indicates that SST has shifted from average.

Although numerous El Niño events have been recorded, there are no clear trends in El Niño timing or intensity. Computer models have improved our ability to forecast the *onset* of an El Niño episode[1], but it is still very difficult to predict the *intensity* of an El Nino and its impact on weather patterns. As El Niño episodes cause major global weather and climate fluctuations, they have a significant impact on agriculture and food security – especially in countries such as Ethiopia where most agriculture is rain-fed. For this reason, El Niño conditions are closely monitored by national and international meteorological institutes, including the NMA.

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El Niño impacts on rainfall in Ethiopia

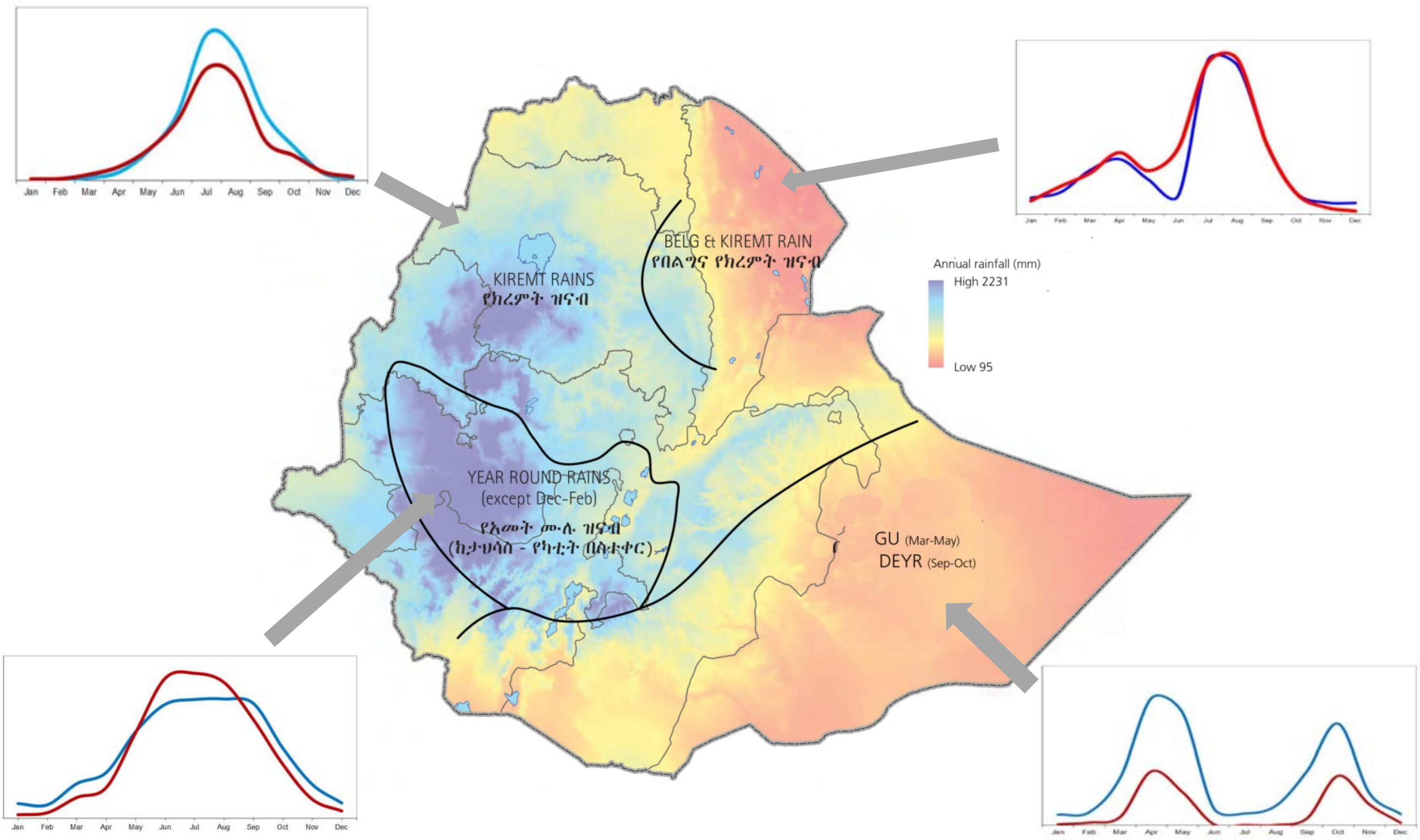
Normal rainfall patterns in Ethiopia are very complex and characterised by mono-modal rainfall or bimodal rainfall, according to different parts of the country, as illustrated below and summarized as follows:

- Long summer rains *kiremt* in June to September, throughout highland areas; the longest *kiremt* rains are bimodal and fall in the south-western and western parts of Ethiopia including parts of SNNP and eastern Oromia Regions; the rains are mono-modal in the north western part of the country, including large parts of Amhara and western part of Tigray Regions
- Short spring rains *belg* in March to May, throughout highland areas of the central, north eastern, and eastern part of Ethiopia
- In southern and southeast lowland areas, the main *gu* rains in March to May, and shorter *deyr* rains in September and October.

There are also two main cropping seasons as follows:

- Any crop harvested between September and February is considered a *meher* season crop; *Meher* is the main cropping season and Ethiopia's *meher* zone covers the western part of Tigray, Amhara, Oromia and SNNP Regions.
- Any crop harvested between March and August is considered a *belg* season crop; although a shorter season, *belg* crops are critical to food security in some areas.

Seasonal rainfall in Ethiopia, normal year[iv]

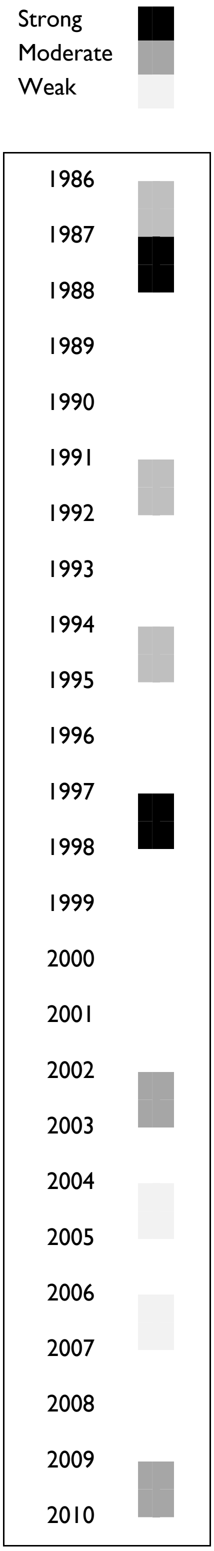


While forecasting the intensity of an El Niño episode is difficult, in Ethiopia there is general agreement that an El Niño episode has a high probability to cause:

- Above-normal rainfall from October to March in the south and south east areas; typically associated with supporting pastoralist areas due to good pasture but can also cause flooding and outbreaks of human and livestock diseases.
- Above-normal *belg* rains with an early onset as early as January or February. At the same time, harvesting the main season cereal crops between October and November may be disrupted due to off-season rains.
- Below-normal *kiremt* rains which are also typically late, erratic and shorter than usual.[i]

Although this Technical Brief focuses on the El Niño impacts on the *kiremt* rains, it is also critical to note that in 2015, the *belg* rains had already failed. As OCHA reported in September 2015, more than 10% of Ethiopia's population is entirely dependent on the *belg* rains[ii] - this translates into approximately 9 million people.

El Niño events 1986-2010



Uncertainties around El Niño-specific impacts on the main *kiremt* rains

The FAO Agricultural Stress Index System (ASIS)[v] assesses crop growing conditions in El Niño episodes from 1986 to 2013 and in particular, detects agricultural areas with a high likelihood of water stress or drought. During the period for which ASIS data is available, a total of nine El Niño events occurred, with varying levels of intensity. In Ethiopia, four out of the nine El Niño – 1987, 1991, 2002 and 2009 – coincided with intense and/or extended drought conditions from April to November, which encompassed the main *meher* cropping season.

However, the relationship between El Niño intensity and impacts is clearly not linear or straightforward – five out of the nine El Niño were not associated with drought during *meher*. Also, the El Niño between May 1997 and April 1998 was reported to be one of the strongest ever recorded, and the most severe and prolonged of the latest 25 years.[vi] Although serious impacts were reported in eastern Africa, the same FAO report noted that for Ethiopia there were, "… *satisfactory crop-growing conditions with only localized mild agricultural stress, and in 1997 total cereal production was similar to the output gathered in the previous year (which was ENSO-neutral) and 42 per cent higher than the average of the previous five years"*.

But there are also contrasting analyses and viewpoints, covering both the rainfall patterns and crop production figures. For example, another review of the 1997-1998 El Niño effects in Ethiopia reported a 25% decrease in production compared to the previous year and that, *"… yields were low because of reduced land preparation and planting and poor and early cessation of rainfall. Heavy rain and pest infestation also reduced output. Prices of agriculture commodities also increased by between 13 and 53 per cent from those of 1996".*[vii] The review also referred to UNOCHA reports that 4.2 million people in Ethiopia received more than 560,000 mt of food aid in 1998, indicating that the 1997-1998 harvest was well below normal.

Looking more closely at weather conditions in Ethiopia, it is also evident that El Niño is only one of several complex climatological factors which influence rainfall patterns in the country. Other factors include:

- The seasonal northward advance of the Inter-Tropical Convergence Zone over Ethiopia
- Formation of heat lows/low pressure areas over the Saharan and Arabian landmasses
- Establishment of sub-tropical high pressure over the Azores, St. Helena and Mascarene
- Southerly/ southwesterly cross-equatorial moisture flows from the southern Indian Ocean, central tropical Africa and the equatorial Atlantic
- Upper level Tropical Easterly Jet flowing over Ethiopia
- Low level jet (Somali jet).[vii]

In part, this mix of climate factors explains why it is easier to predict the onset of El Niño conditions, rather than their intensity and associated impacts on the ground. Furthermore, local impacts on agriculture are also influenced by factors such as farmer practices, commodity prices and shocks such as crop diseases and infestations. Another layer of complexity is that within Ethiopia, the impacts of El Niño will vary considerably across the country's diverse agro-ecological zones.

Decision making with uncertainty

The previous section shows programming responses to El Niño-related events cannot rely on a single climate analysis or forecast. Even with advances in climate science, rainfall predictions will always be subject to uncertainty. Instead, response decisions need to be based on a mix of different types of information, which collectively, point to consistent trends and outcomes. By mid-September 2015, the evidence to support a substantial humanitarian response in Ethiopia was as follows:

1. At the level of climate science and retrospective analysis, strong evidence to correlate El Niño events in the Pacific with increased variability of the *kiremt* rains in Ethiopia, and especially, declines in rainfall.
2. Clear evidence that the *belg* rains in Ethiopia had failed.
3. Clear evidence that the start of the *kiremt* rains was delayed and erratic in northern and eastern areas. Erratic *kiremt* rains have resulted in reduced and delayed planting, poor germination and establishment and increased incidence of pests and diseases. This will impact on Ethiopia's main *meher* harvest which feeds 75-80 per cent of the population although the extent of the reduced harvest will not be known until later in the year.
4. Relative to previous major droughts, a substantial and verifiable increase in human population.
5. Pre-El Nino, a "baseline" national level of stunting in children under five of 44%, with levels of up to 52% in Amhara Region and 51% in Tigray Region.[viii]
6. Cessation of Productive Safety Net Programme (PSNP) cash and food distributions in July following the close out of PSNP3; PSNP4 will be officially launched in January 2016.
7. Reports of stress-related sales of assets including sheep, goats and cattle in eastern Amhara, eastern Oromia, Afar Region, northern Somali Region and several zones in SNNP Region.
8. Falling livestock prices and rising cereal prices, typical of early drought conditions, and verifiable.
9. Reports of stress-related household migration in Afar, northern Somali Region and in some *belg*-dependent areas.
10. Reports of a humanitarian crisis in parts of Afar and northern Somali Region.

The Government of Ethiopia is providing strong leadership to mitigate the worst effects through a range of health, water, food distribution and agriculture-related interventions. On 18th August 2015 the Government development partners launched the Mid-Year Review of the Humanitarian Requirements Document. The Review declared a 55 per cent increase in the number of people needing emergency food and nutrition assistance by the end of 2015, from 2.9 to 4.55 million people. This number is expected to increase following the current Government-led national food assessment, with results expected before the end of September. Looking to 2016, the UN Ethiopia Humanitarian Country Team (EHCT) recently released its forecasts with the, "*… most likely scenario for the start of 2016: 15 million people will require food assistance*"[ix] i.e. an increase of more than five times. The same report further underlines the seriousness of the situation, "*Food assistance in early 2016 is likely to be required throughout an extended eight-month 'hunger season' when food aid in Ethiopia's is typically required for only four months of the year*".[i]

Although information is always imperfect, current analysis clearly points to a major El Niño-related crisis in Ethiopia, which in some areas, is worsened by failed *belg* rains. In specific pastoralist areas, humanitarian response is on-going, but will need to continue into 2016. A coordinated response from the Government of Ethiopia and *all* of its main international development and humanitarian partners is needed, as is a perspective which plans for El Nino impacts throughout 2016.

Endnotes

[i] Graham, J., Rashid, S. and Malek, M. (2011). Disaster Response and Emergency Risk Management in Ethiopia. In: Dorosh, P.A. and Rashid, S. (eds.), *Food and Agriculture in Ethiopia: Progress and Policy Challenges*. International Food Policy Research Institute, Washington DC.
[ii] OCHA (2015). Ethiopia slow onset natural disaster. United Nations Office for the Coordination of Humanitarian Affairs, Addis Ababa
[iii] El Niño is Spanish for "the boy" which in the context of Christmas, derives from Jesus "the Christ Child".
[iv] Sources: map adapted from CSA/EDRI/IFPRI (2006), *Atlas of the Ethiopian Rural Economy*; graphs provided by Dr. Dawit Abebe.
[v] See http://www.fao.org/climatechange/asis/en/ for further details of the ASIS methodology.
[vi] GIEWS/FAO (2014). Ethiopia: El Niño-Southern Oscillation (ENSO) and the main *Kiremt* season.
[vii] Wolde-Georgis, T., Aweke, D., and Hagos, Y., 2000. The Case of Ethiopia - Reducing the impacts of environmental emergencies through early warning and preparedness: the case of the 1997-98 El Niño
[viii] CSA/ICF (2012). Ethiopia Demographic and Health Survey. Central Statistics Agency, Addis Ababa/ICF International, Maryland.
[ix] Coverage for 7.8 million people is included in the fourth generation of the Government of Ethiopia Productive Safety Net Programme, for six months for January to June 2016.

Disclaimer

The views expressed in this technical brief are those of the AKLDP project and do not necessarily reflect the views of USAID or the United States Government.

This Technical Brief was produced by the USAID Ethiopia Agriculture Knowledge, Learning, Documentation and Policy (AKLDP) project, implemented by the Feinstein International Center, Friedman School of Nutrition Science and Policy, Tufts University. For more information about the AKLDP contact adrian.cullis@tufts.edu