A Roadmap to Early Warning Systems for Climate Sensitive Diseases in Tanzania: Demonstrating the Effect of Extreme Climate Events on Malaria Burden

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Background and Objective

Climate sensitive diseases such as malaria are affected with changes in climatic such as temperature/rainfall. Certain levels favor production, or compromise survival, of vectors and hence alter transmission.

The El Niño impacted the climate of East African Region again in 2015

Tanzania is among East African countries affected strongly by the extreme climate event of the El Niño that occurred in 1997/1998. A number of districts experienced malaria epidemics which were highly associated with the event.

Recently, the Tanzania Meteorological Agency (TMA) launched a new climate service which offers access to over 30 years of gridded rainfall and temperature data throughout the country. This is the only local climatic data which is well organized, complete and with high spatial resolution. There is a need of putting efforts to ensure the data is utilized by right people to guide decisions in health sector

This study analyze district level malaria data and the climate information to study malaria seasonality and demonstrate contribution of extreme climate events in the disease burden.

Understanding the patterns of climate extreme events can facilitate establishment of effective early warning systems for outbreaks, and strengthen the capacity of the system to forecast, respond and properly manage malaria outbreaks.

Methodology and Findings

Data
20-years data (1996-2015) of malaria OPD cases collected by the National Malaria Control Program (NMCP) through Health Management Information System (HMIS)

Pilot Sites/Districts (Rain)
Babati - Northern (Bimodal)
Dodoma - Central (Unimodal)
Iringa - Southern Highlands (Unimodal)

Babati and Dodoma experienced malaria epidemic in 1998/1999, Iringa did not report outbreak tthat time

Analysis
Conducted in the light of Oceanic Niño Index (ONI) to detect prominent patterns of malaria cases that might be associated with El Niño Southern Oscillation (El Niño and la Niña) (**Fig. 1**).
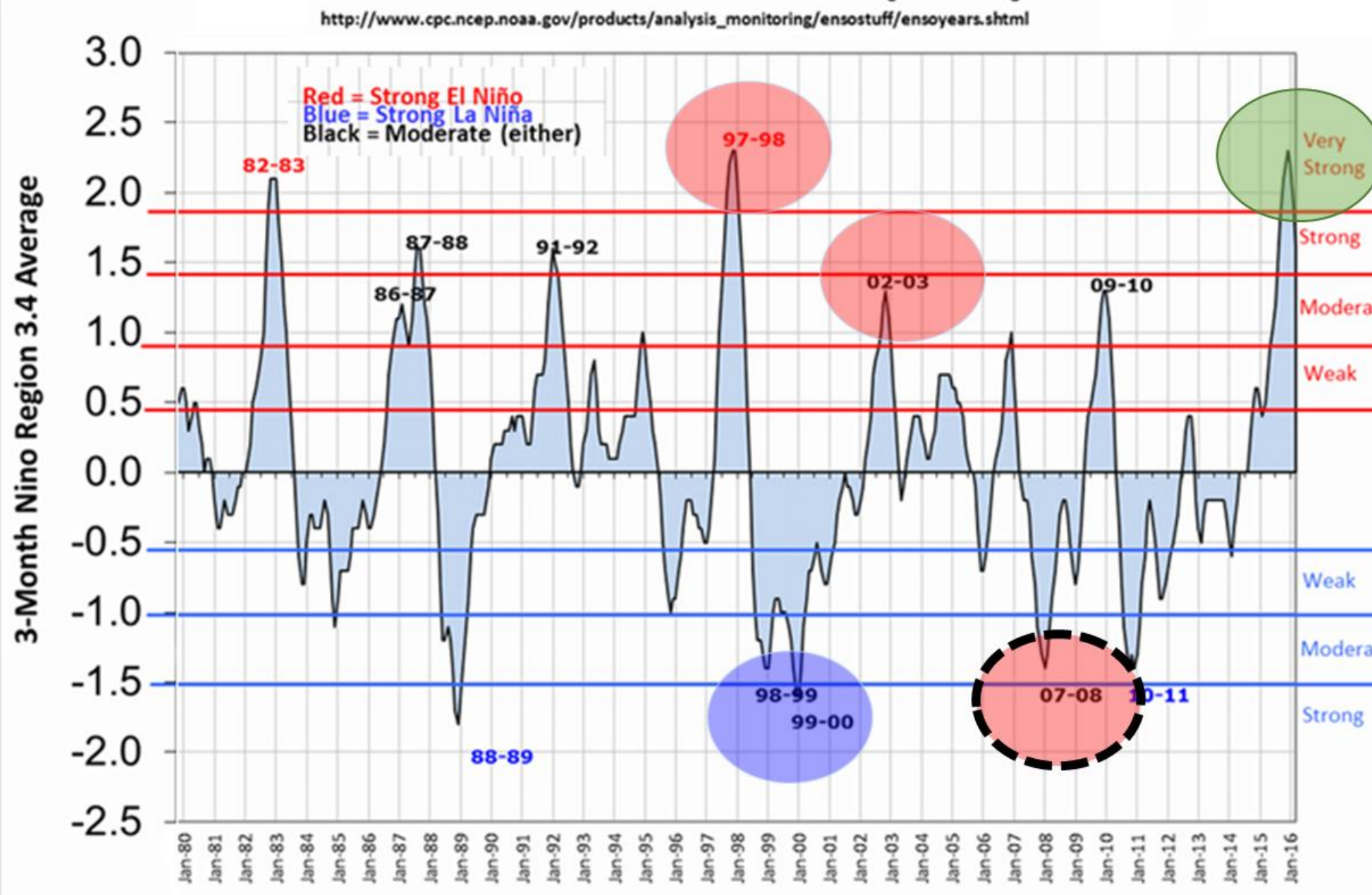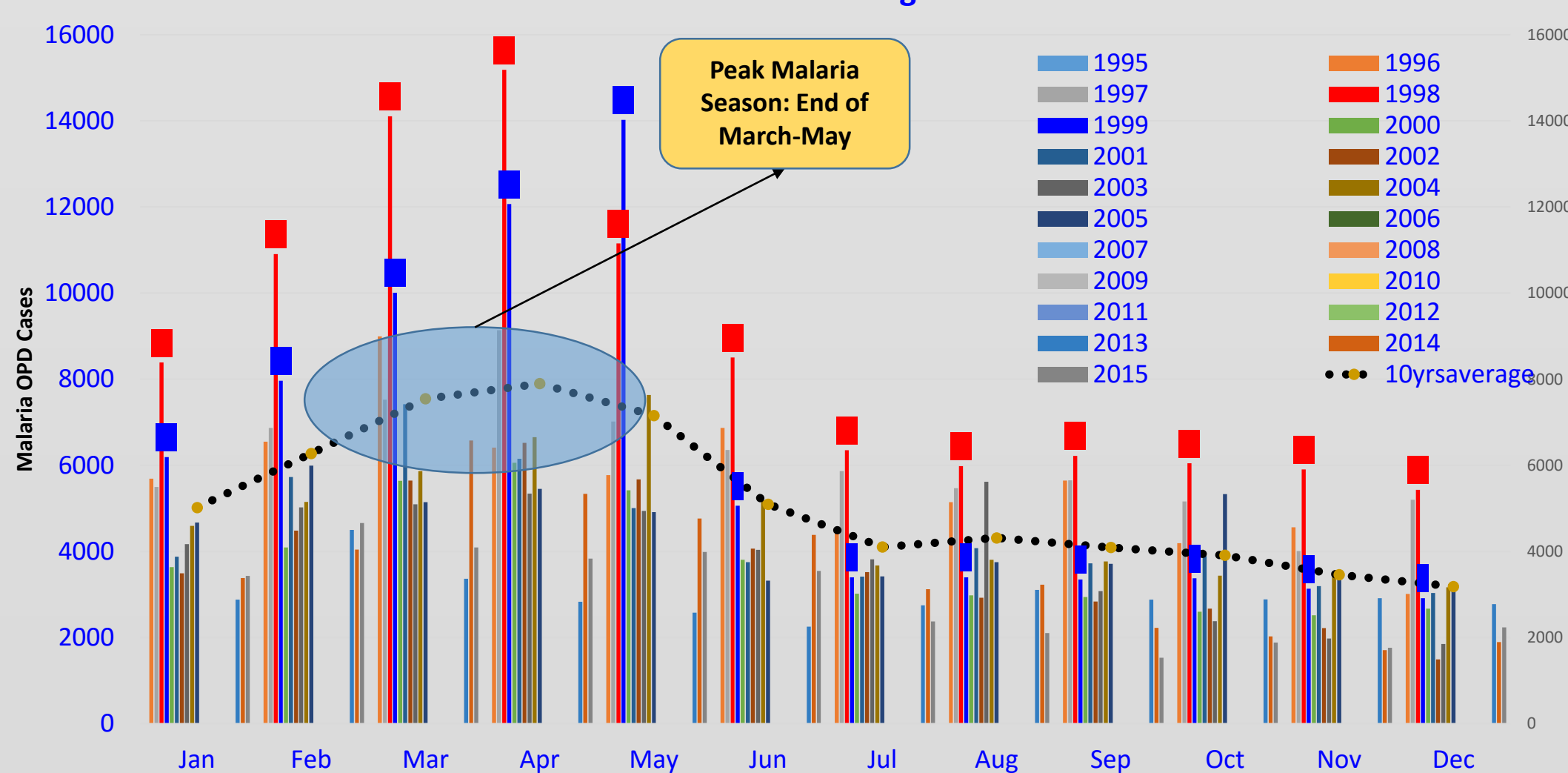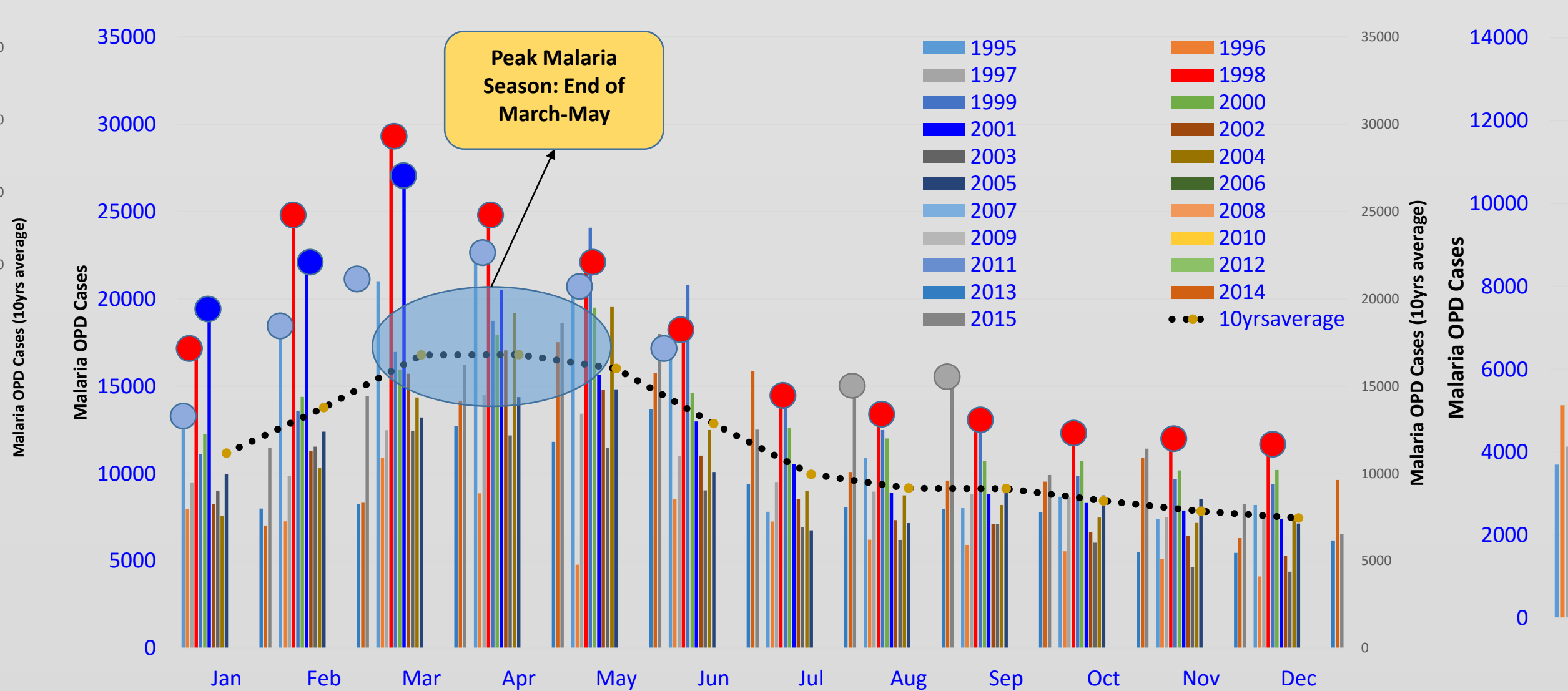

Fig 1. Patterns of El Niño and La Niña 1980 -2016

Seasonality: Peak malaria season for Dodoma and Iringa is March – May, while Babati indicated a whole year (holoendemic) malaria with slight peak on Apr-May.
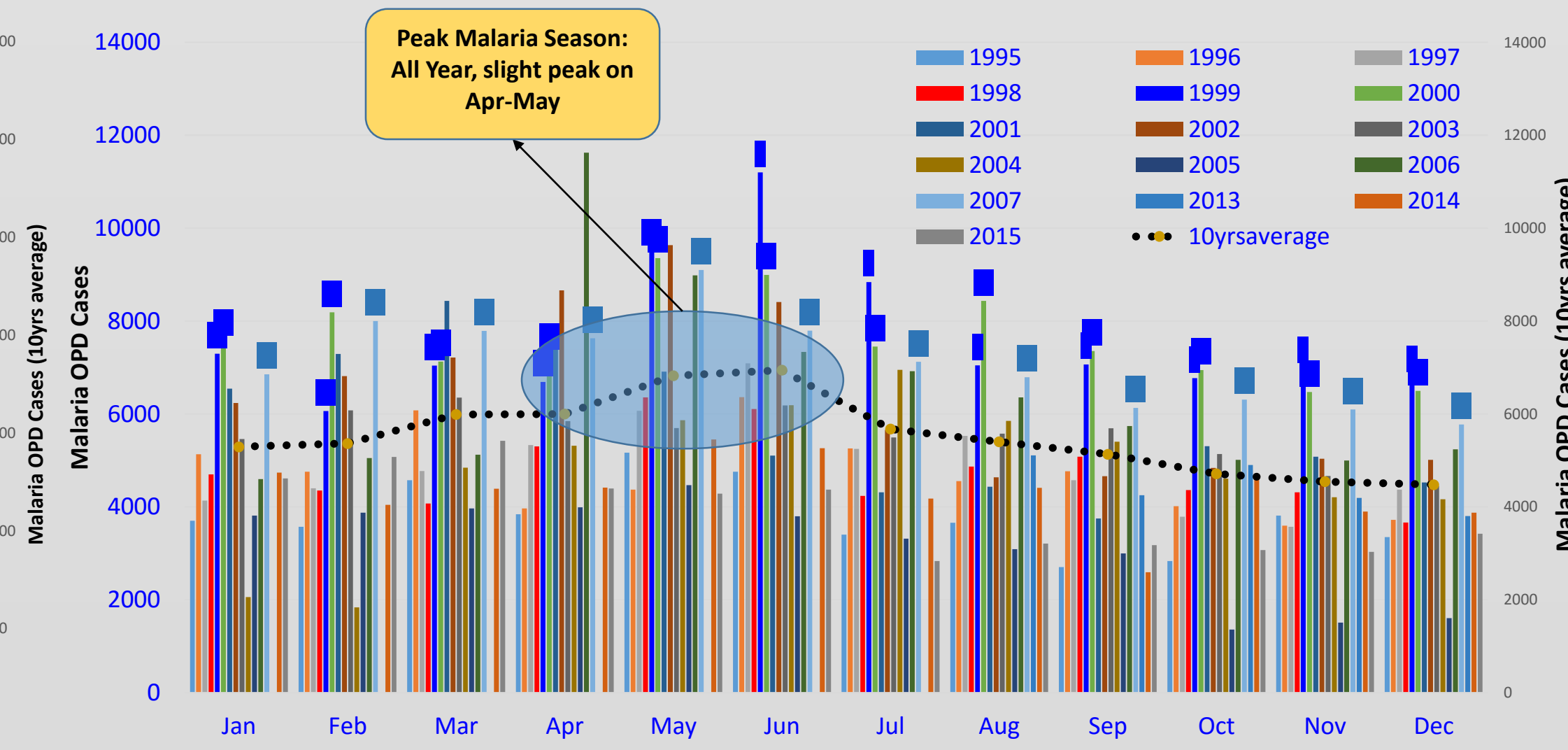

Pattern of Malaria - Iringa District

Pattern of Malaria Dodoma

Pattern of Malaria - Babati District

- 1997/1998 malaria was above the average throughout the year; a very strong El Nino was recorded
- 1999 malaria was high in the first five months of a year and increased sharply; a moderate La Nina was recorded
- 1998/1999 malaria was above the average throughout the year, in these years there was a moderate La Nina

- 1995 malaria was above average in the first 6 months of the year; a weak La Nina was recorded
- 1998 malaria was above the average the entire year; a very strong El Nino was recorded
- The first 3 months of 2001 malaria was highly above the normal range, a strong La Nina recorded in 1999 and 2000
- The district recorded higher cases of malaria since August 2015, that time there were already warning of a Strong El Nino

- 1999/2000 malaria was high in the entire year, in this year there was a moderate La Nina
- 2007 malaria was above the average throughout the year; a moderate La Nina recorded

What do we see?
- Malaria cases increased in times of moderate to very strong El Niño/La Niña index levels
- In some instance malaria cases increased during weak index
- Spatial variation of the effect was observed, districts are affected differently
- In all 3 districts, for all the times that index was abnormal, malaria cases went above the expected range, not only for the peak times but also other months (**Fig. 2**).
- Dodoma district recorded high cases in almost all occurrences of El Niño and La Niña.
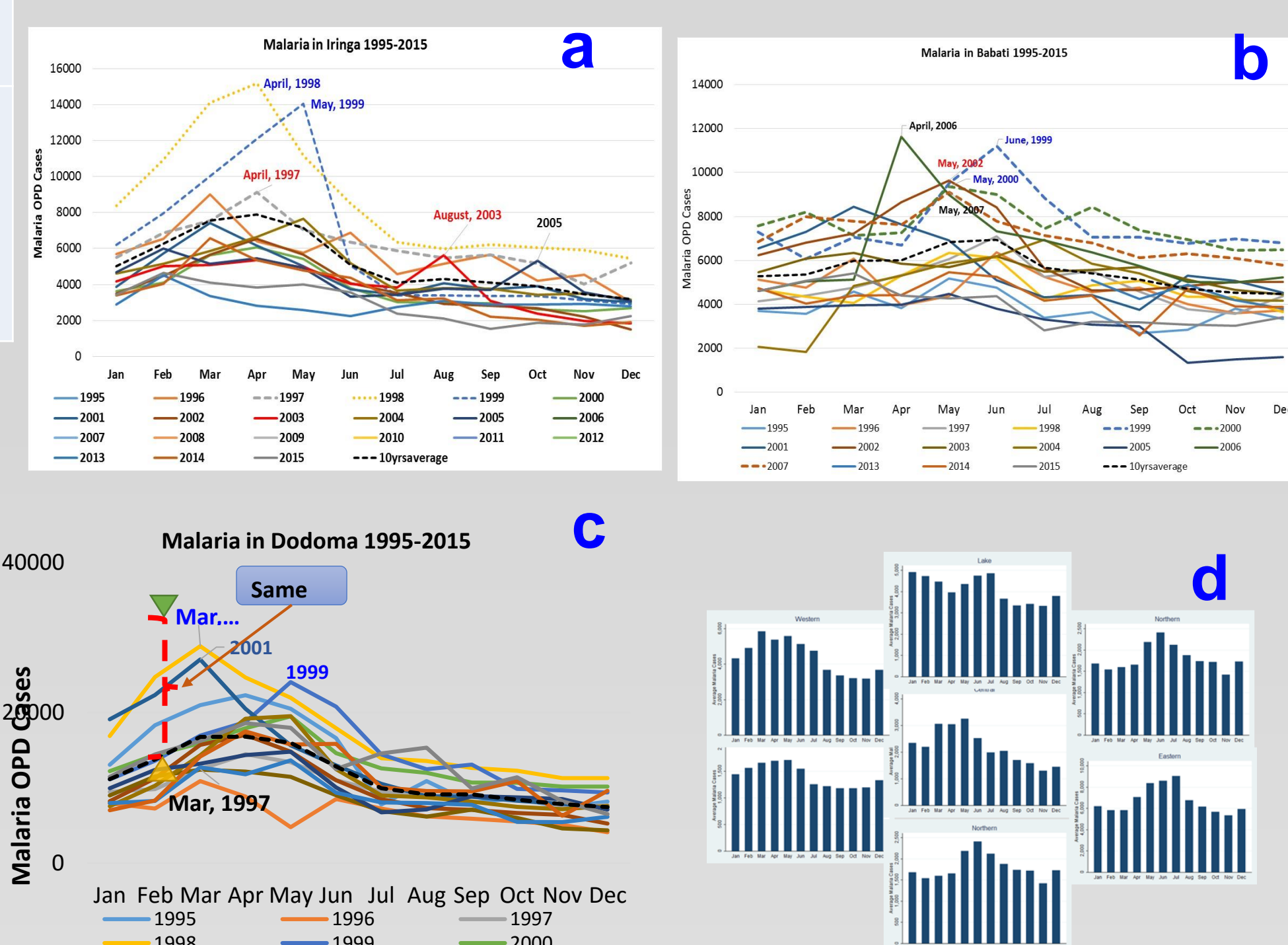

Fig 2. Patterns of Malaria indicating high cases than expected (a-c) and patterns of malaria by zones (d)

Conclusion: This pilot analysis indicates that studying patterns of extreme weather events can be useful to inform the health system and initiate effective response to malaria epidemics. Full analysis will utilize the high quality climate products from the TMA.

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