Sub-seasonal teleconnections between El Niño & East African long rains

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1) Motivation, Data & Method

Climate information beyond the upcoming season could be most valuable in East Africa where dry conditions have dramatically increased since 1999. This study aims at identifying recurrent weather types over **a broad Indian Ocean (IO) region (Fig.1)** through a **k-means clustering of 1979-2013 MAM daily NOAA OLR** (*Liebman and Smith*, 1996) and **composite analyses of CHIRPS rainfall** (*Funk et al*, 2014) **& NCEP2 re-analyses** (*Kanamitsu et al*, 2002).

2) IO convection regimes & East African long rains

The OLR clustering reveals 4 recurrent clusters (Fig.1) consisting of **"wet" (1&2)/"dry" (3&4)** regimes in regards to East African long rains (Fig.2), more frequent at the **beginning/end** of the season (Table 1). **Increased regimes 3&4 frequencies** (Fig.3) and **regime 3 persistence** (Table 1) since 1999 coincide with the abrupt long rains decline observed (*Lyon*, 2014).

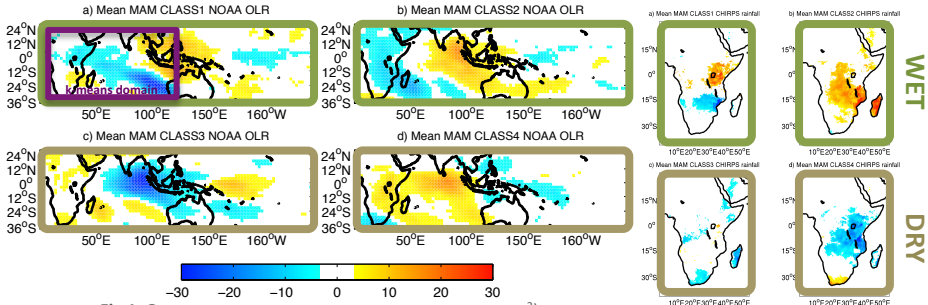


Fig.1: OLR anomalies associated to each regime (in W/m^2)

Fig.2: CHIRPS rainfall anomalies for each regime (in mm/day)

	Class 1	Class 2	Class 3	Class 4
March	173	**301**	308	272
April	**194**	276	258	292
May	167	250	**319**	**318**
Total	534	827	885	882
Post vs pre 1999	-86	-56	+86	+56

Table1: Monthly occurrences and post minus pre-1999 differences

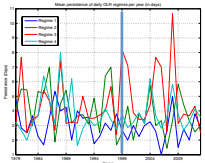


Fig.3: Mean yearly persistence (in days) for each regime

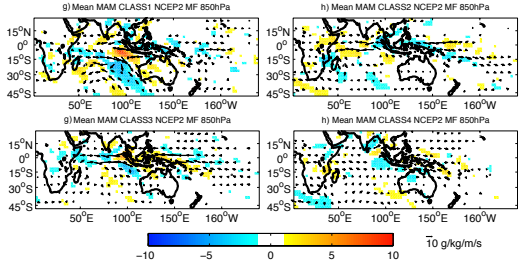
4) Conclusions

Enhanced/reduced long rains are found to be associated with **easterlies anomalies in the equatorial IO/the establishment of the Somali Jet**. The recent drying coincides with more persistent/frequent **dry regimes**. **El Niño teleconnections identified through one wet regime (most active in April)** suggest **rather wet conditions for the upcoming 2016 MAM season**, illustrating the relevance of weather typing approaches for S2S predictability locally.

REFERENCES: Funk et al (2014) A quasi-global precipitation time- series for drought monitoring, *USGS Data Series*, 832, 4p; Kanamitsu et al (2002) NCEP-DOE AMIP-2 Reanalysis (R-2), *Bul. of the Atmos. Met. Soc.*, Nov., 1631–1643; Liebman & Smith (1996) Description of a complete (interpolated) Outgoing Longwave Radiation dataset, *Bull. Am. Met. Soc.*, 83, 1631–1643; Lyon (2014) Seasonal drought in East Africa and its recent increase during the March-May long rains, *J. Clim.*, 27, 7953-7975

3) Related atmospheric circulation & Pacific SSTs

A composites analysis of NCEP2 re-analyses (Fig.4) reveals,
-for wet regimes: low-level easterlies over the equatorial IO favoring moisture convergence over East Africa
-for dry regime 4: establishment of the Somali Jet feeding in the Indian monsoon to the disadvantage of East Africa



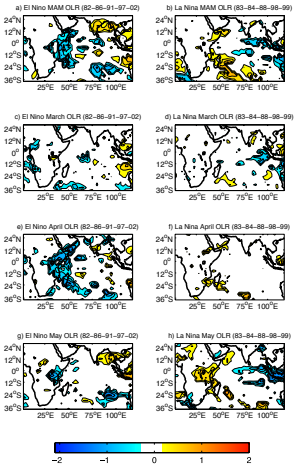


Fig.4: (Top) Mean MAM 850hPa moisture fluxes/convergence (in g/kg/s) composites for each regime (1979-2013); **Fig.5:** (Right) Mean OLR composites (in W/m^2) for the 5 strongest El Niño/La Niña over the 1979-2013 period

Daily OLR composites for the five largest El Niño/La Niña events of the last 30 years (Fig.5) exhibit strongest teleconnections with East African rainfall in April-May/May respectively. The **pattern for El Niño resembles wet regime 1** which is most frequent in April (Table 1).

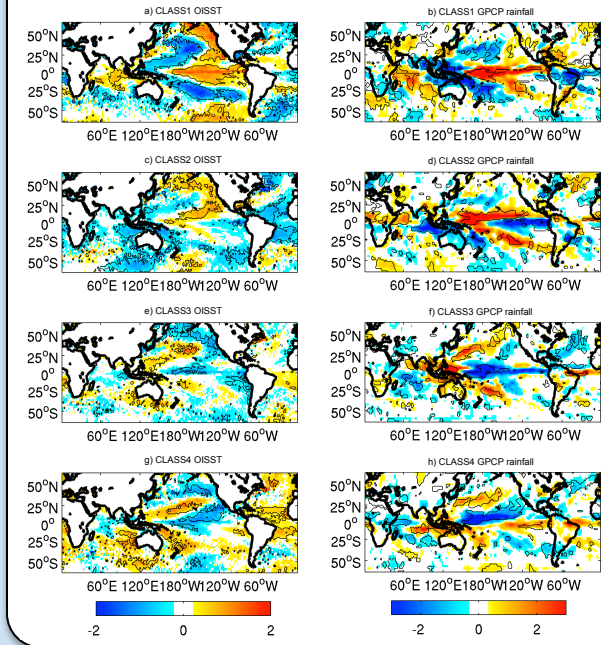


Fig.5: Composites of OISST (left) and GPCP rainfall (right) differences for the 5 years with the highest/lowest frequencies of each regime (1979-13)

In terms of large-scale SSTs (Fig.6), **one mode of variability** is dominated by **west-central Pacific SST gradients in the tropics (regime 1&3)**, **another** primarily controlled by **off-equatorial Pacific SSTs (regimes 2&4)**. Increased regime 1 frequencies with warming in the west Pacific coupled with contrasted rainfall impacts between the west and central Pacific suggest that **El Niño teleconnections with the long rains could be explained by this wet weather type**.