Subseasonal convection variability over the Caribbean from May to November

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1) Motivation, Data & Method

Providing climate information beyond the upcoming season could be most valuable in the Caribbean where local societies are still very vulnerable to flood risk. Hence, this study aims at identifying recurrent weather types relevant to local rainfall through a **k-means clustering of 1979-09 May-Nov daily NOAA OLR** (*Liebman and Smith*, 1996) and **composite analyses of CHIRPS rainfall** (*Funk et al*, 2014) **and NCEP2 re-analyses** (*Kanamitsu et al*, 2002).

2) Convection regimes and Caribbean rainfall

The clustering of NOAA daily OLR reveals 7 recurrent clusters (Fig.1 top) consisting of **two "dry" regimes (2&4)** and other **"wet" regimes typical of the NWwards propagation of convective anomalies (sequence 3-6-5)** (Fig.2), sometimes linked to Tropical Cyclones (TCs, Fig.1 bottom). Noteworthy all regimes are significantly related to Caribbean rainfall (Fig.3)

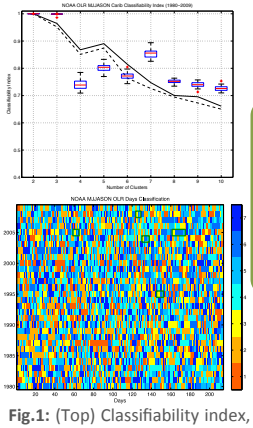

Fig.1: (Top) Classifiability index, (Bottom) Classes occurrences with green boxes for hurricanes Opal, Ivan, Dennis, Wilma & Ike

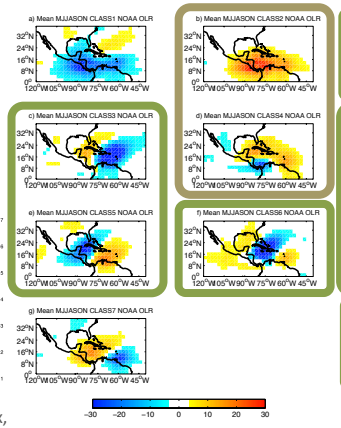

Fig.2: OLR anomalies associated to each regime (in W/m^2)

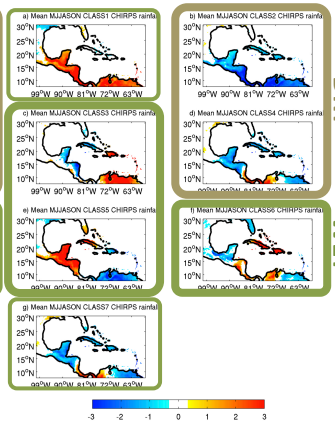

Fig.3: CHIRPS rainfall anomalies associated to each regime (in mm/day)

3) Related atmospheric circulation ("wet" regimes)

A composite analysis for the **sequence of "wet" regimes 3-6-5** using NCEP2 re-analyses reveals **potential interactions between mid-latitudes westerly waves in the upper-troposphere** and **easterly waves in the tropics at surface** (Fig.4)

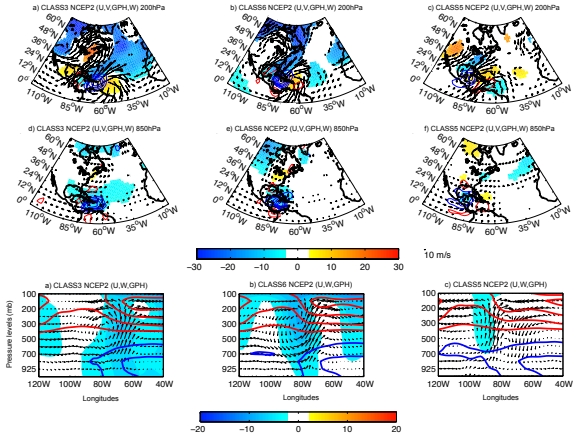

Fig.4: NCEP2 200/850hPa (a-c/d-f) GPH (shadings, m^2/s^2), (U,V) and vertical velocity W (red/blue contours starting at and every +/-10^{-2} m/s) anomalies for regimes 3, 6 and 5

Rising/descending motions behind/ahead of the cyclonic cell center (Fig.5) driven by an anomalous anticlockwise circulation resemble **shear-forced vertical circulations** in TCs (*Zhang and Kieu,* 2005).

A pattern similar to **PV streamers** (Fig.6) occurring during anticyclonic wave breaking (*Davis*, 2010) found to **establish with 3 days lead from regime 3** could advect vorticity southwards.

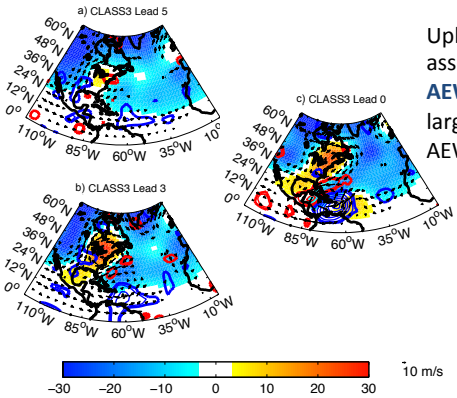

Fig.6: Lagged NCEP2 600hPa (U,V), W (red/blue contours starting at +/-5x10^{-2} and every 10^{-1} m/s) and 200hPa GPH (shadings in m^2/s^2) anomalies for regime 3

Uplift anomalies further east (Fig.6) suggest associations with **sub-seasonal modulations of AEWs synoptic-scale activity** characterized by a larger spatial scale, a slower propagation (half of AEWs speed) and higher periodicity (>10 days).

Relationships between "wet" regimes and island-scale floods (Fig.7) illustrate the potentials of weather typing approaches for risk management at subseasonal time-scales.

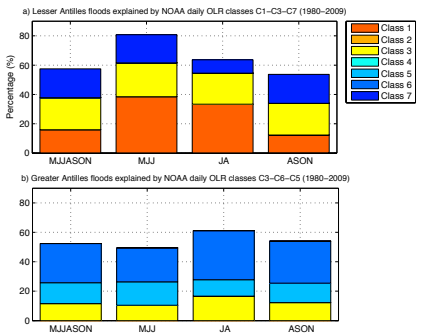

Fig.7: Percentage of floods reported in the Caribbean Disaster Impacts & Preparedness database for the last 30 years in the Lesser/Greater Antilles explained by "wet" regimes (a/b)

4) Conclusions

Convection regimes are associated with **distinct rainfall anomalies** in the Caribbean. A **sequence of "wet" regimes**, typical of the NWward propagation of rain-producing convective anomalies, sometimes related to TCs, exhibits relationships with **AEWs and the southward incursion of midlatitude westerly waves**. Overall **"wet" regimes are associated with historical island-scale floods** emphasizing their relevance 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; Davis (2010) Simulations of subtropical cyclones in a baroclinic channel model, *J. Atm. Sci.*, doi:10.1175/2010JAS3411.1; Zhang and Kieu (2005) Shear-forced vertical circulations in tropical cyclones, *Geophys. Res. Lett.*, 32, doi:10.1029/2005GL023146