About the influence of the African Easterly Waves in northern South America

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Introduction

- AEW are some of the principal climatic features over northern South America (Poveda, 2002; IDEAM, 2005).
- AEW are characterised as the principal modulator of precipitation in Puerto Rico during boreal summer (Levine, 2008).
- AEW are frequent during northern Colombia rainy seasons (Esperanza et al., 2001).
- Strong AEW signal on precipitation wavelet spectrum for El Niño years in Colombia (Salas et al., 2012).
- Possible influence of El Niño events over AEW behaviour over northern South America (Salas et al., 2012; Poveda, 2004).

Datasets

- Relative vorticity computed from U and V components of winds from ERA Interim reanalysis, smoothed as in Serra et al. (2010).
- Daily TRMM precipitation (from 1999 to 2010).
- Daily Persiann Precipitation (from 1983 to 2014).
- Modis Aerosol Optical Depth.
- Daily NOAA Interpolated Outgoing Long wave Radiation (OLR).
- Sea Level Pressure from the NCEP-NCAR reanalysis.
- NOAA OI Sea Surface Temperature (SST v2).

AEW and Precipitation

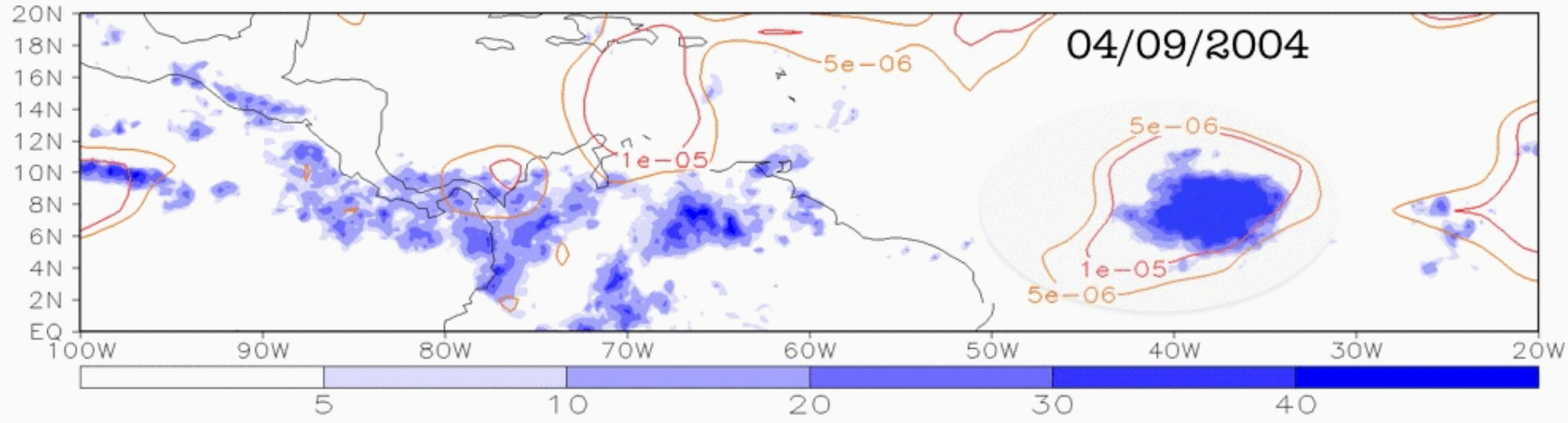


Fig 1. September 04 - Sep 12 2004. Persiann precipitation anomalies (blue shades) related to an AEW displacement as seen on the smoothed ERA Interim relative vorticity (red contours).

Precipitation anomalies alternate following the AEW trough, decreasing while approaching the continent.

- Precipitation reduction is related to the divergence over the continent to the east of the wave trough. Once the AEW reaches the continental landmass, precipitation increases.
- To the west of the wave, a non precipitation zone appears again due to the related divergence.

AEW and Precipitation

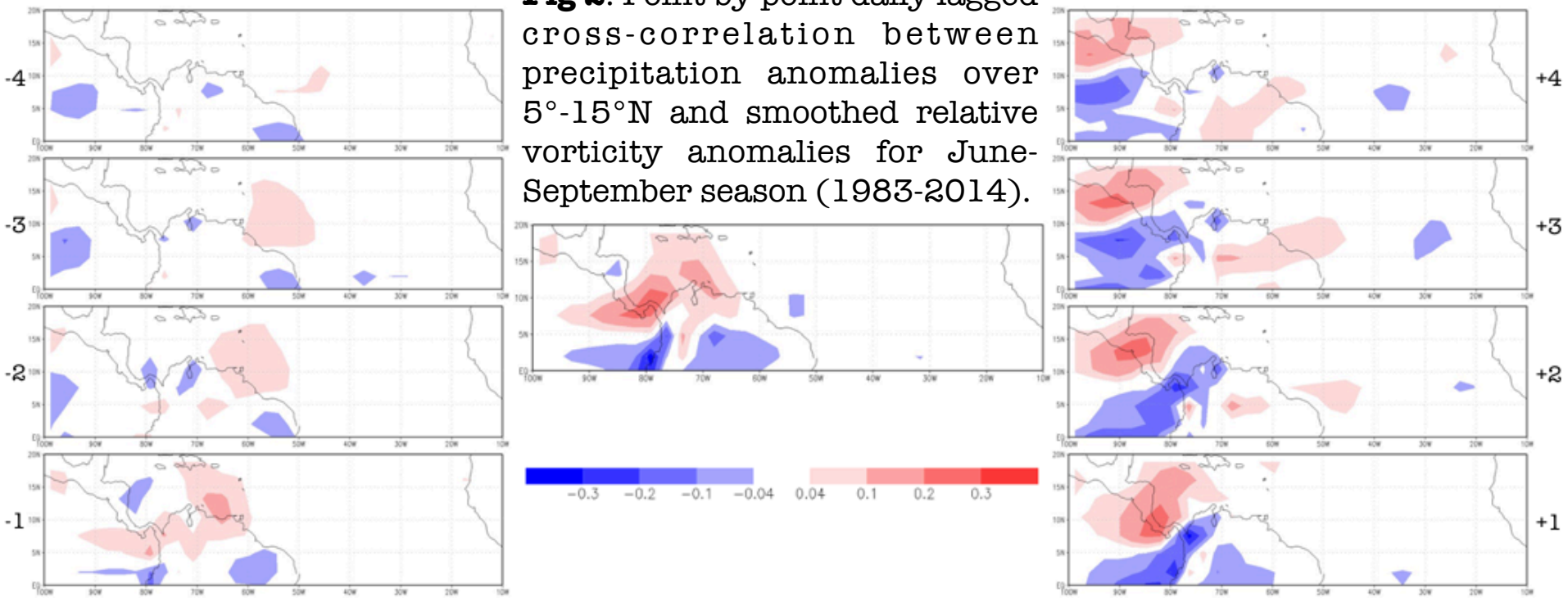


Fig 2. Point by point daily lagged cross-correlation between precipitation anomalies over 5°-15°N and smoothed relative vorticity anomalies for June-September season (1983-2014).

Region of influence of AEW on precipitation over northern South America is located between 50°-90°W and 0°-20°N, as suggested by PPT – Relative Vorticity cross-correlation patterns for daily lagged Persiann precipitation and TRMM data (not shown).

Correlation patterns exhibit the effect of the westward propagation of the AEW and the related enhanced convection activity.

AEW dust transport

- June 27 2014. Medellín-Colombia exhibited an anomalous concentration of PM10 and was covered by a thick cloud of pollution all day long.
- Local environmental authority (July 7, 2014): The pollution was in fact Saharan dust and is related to the passage of and AEW over Colombian territory… (AMVA, 2014).
- The role of AEW has been discussed for years and its importance has been pointed out not only on the transport, but on the genesis of the material to be transported (Westphal et al., 1987; Burpee, 1972; Jones et al., 2003, Zuluaga et al., 2003).

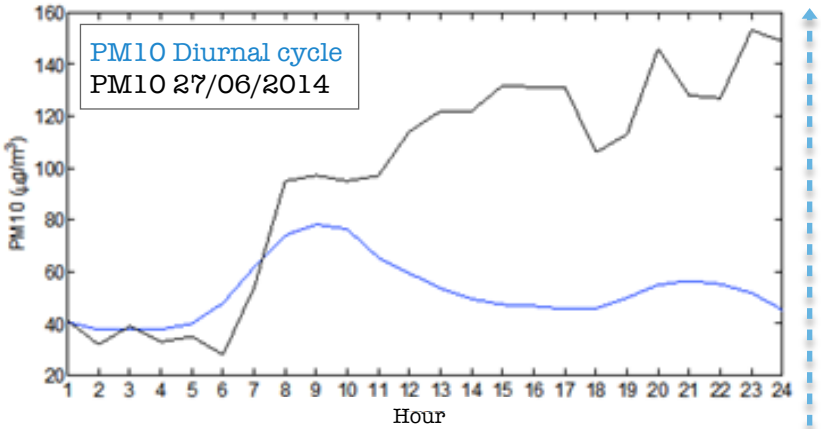
  - …It was the first Saharan dust transport event to be reported in Colombia, and until that moment, the first atmospheric pollution emergency to be seen at simple sight!!!

AEW dust transport

Medellín, June 27, 2014.
Source: Jorge Andres Peña [@JorgePC80].

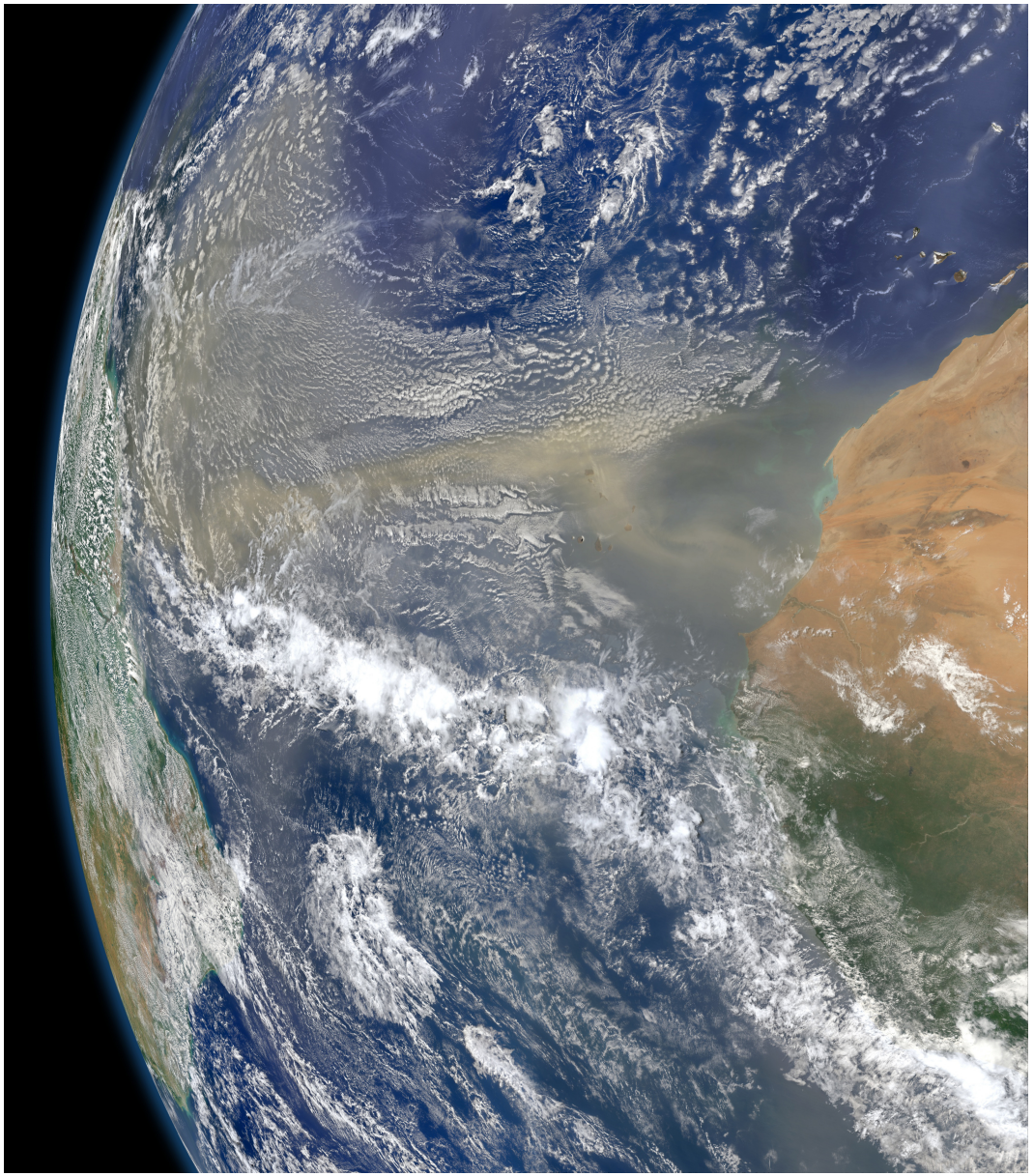
AEW dust transport

Satellite evidence of the dust transport event on June 24 2014.



Typical daily PM10 concentration behaviour in Medellín VS June 27 2014 PM10.

Source: Área Metropolitana del Valle de Aburrá [AMVA].



Source: Nasa Earth Observatory.

AEW dust transport

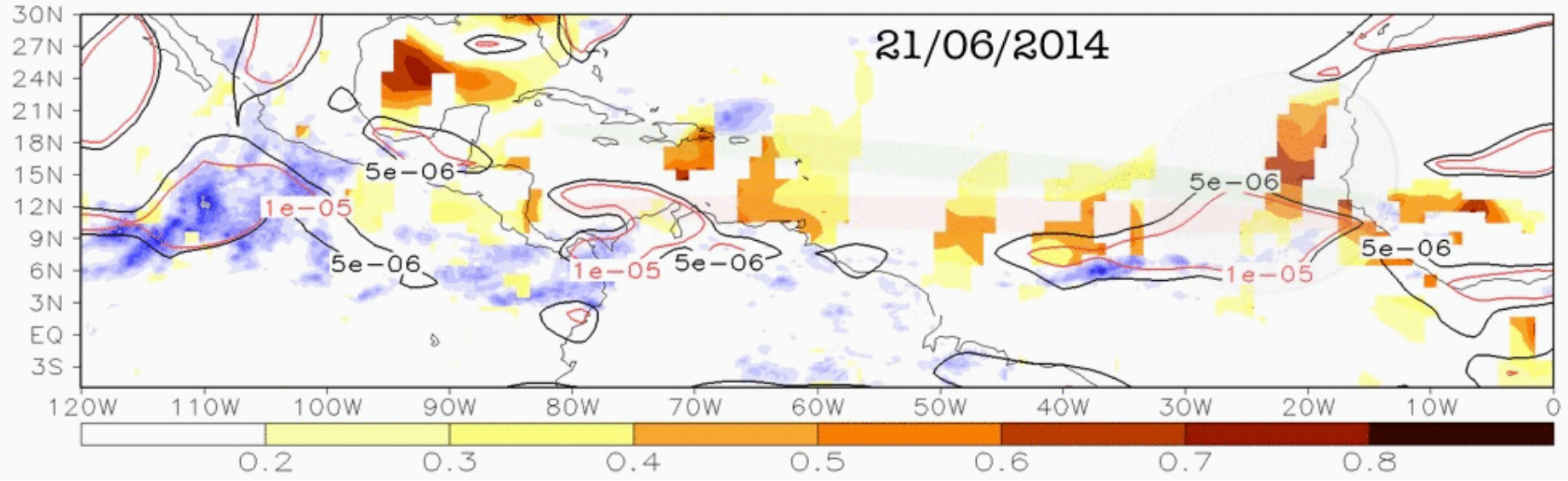


Fig 3. June 22 – June 30. Smoothed relative vorticity (black and red contour), Persiann precipitation (blues shades), and Modis Aerosol Optical Depth (orange shades).

- The mean AEW path is shown with a green shade, while the specific AEW related to the dust transport is shown with a red shade.
- The trajectory of the AEW is slightly different from the typical AEW pathway.

Climate Background

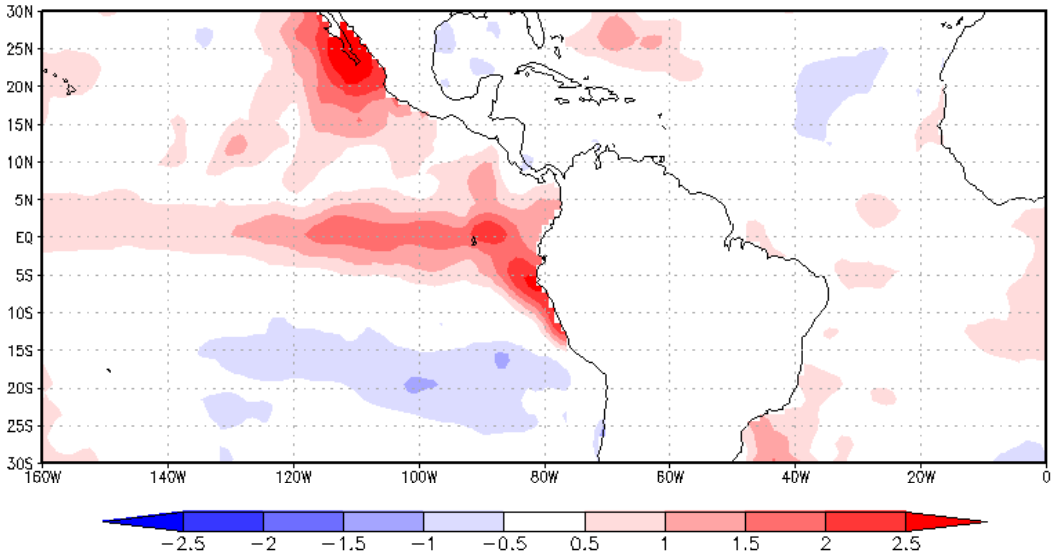
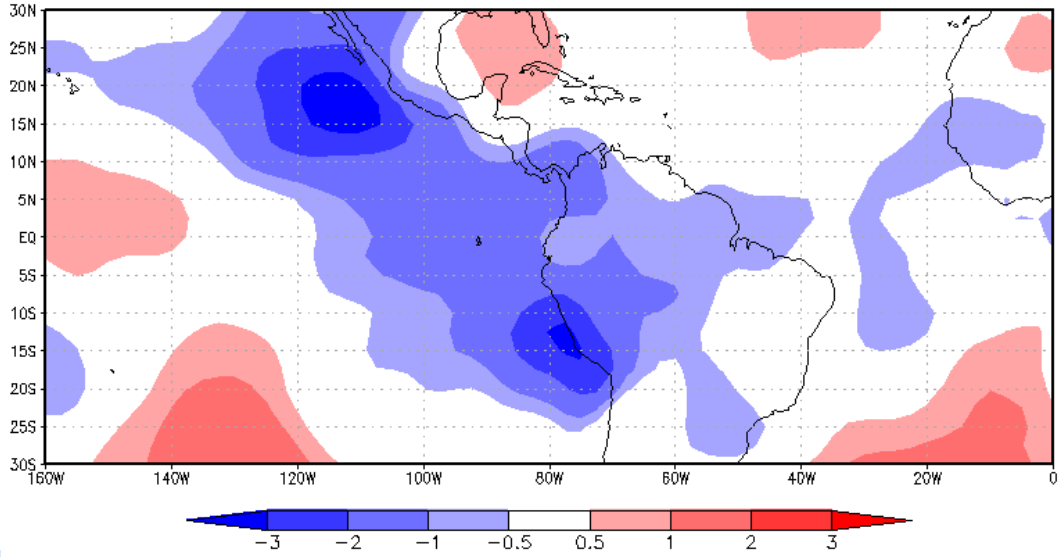


Fig 4. El Niño advisory: NOAA OI SST anomalies, June 2014.

Fig 5. El Niño advisory: NCEP-NCAR Sea level pressure anomalies, June 2014.



Climate Background

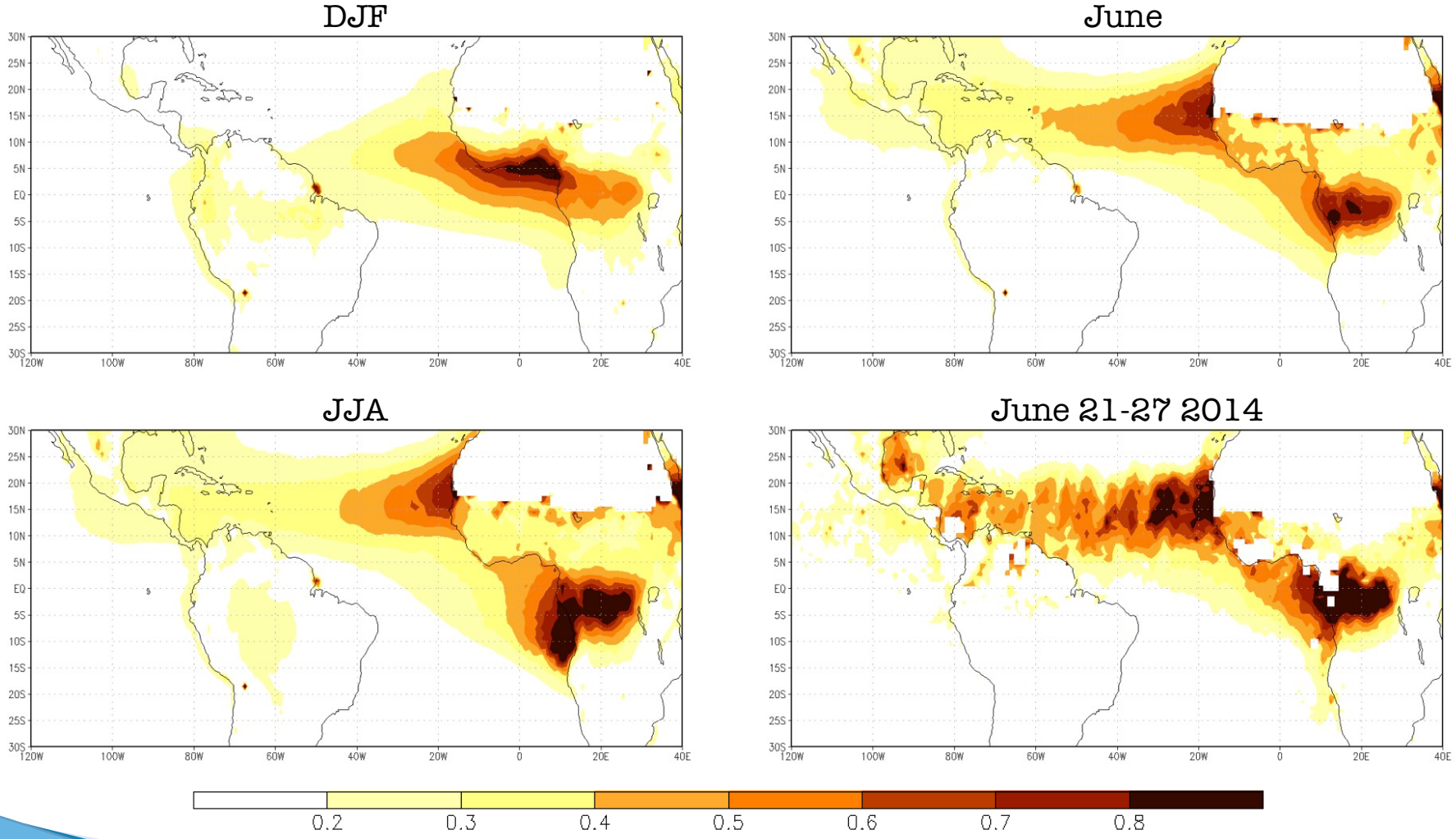


Figura 6. Mean Modis AOD for the DJF and JJA seasons as well as for all June months (2000-2015) and June 21-June 27 2014.

AEW over Northern South America

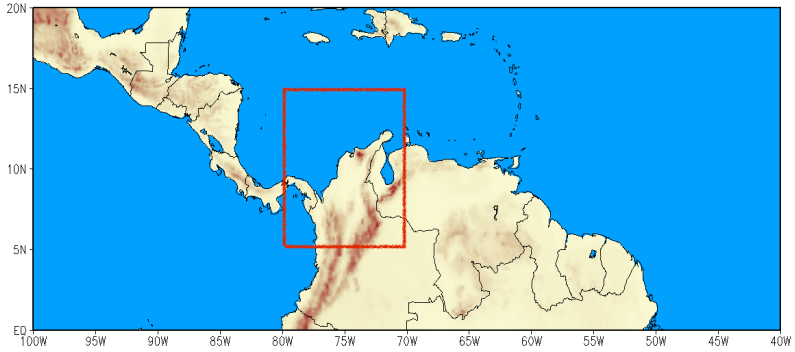
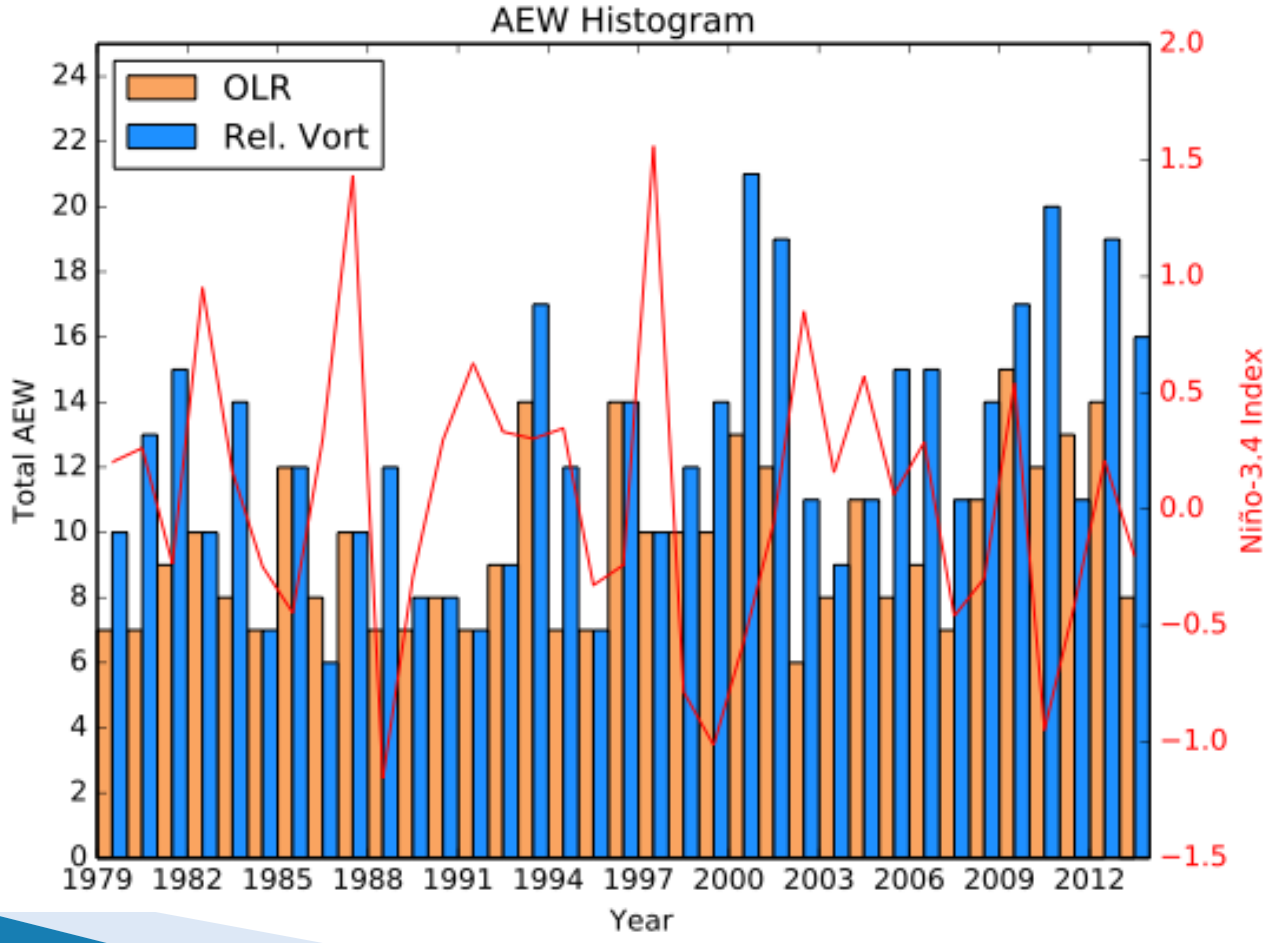


Fig 6. 5°N-15°N 80°W-70°W (red color highlighted region) histogram for AEW observed on the smoothed relative vorticity (blue charts), and NOAA OLR (orange charts), for the years 1979-2013.



What are we up to now?

- How is the AEW activity over northern South America during the different phases of ENSO?

- Is there a reduction on the total amount of AEW during El Niño years?

- Are the AEW trajectories modified due to El Niño atmospheric and oceanic atmospheric disturbances?

- Do convectively coupled AEWs show a temporal modification related to the occurrence of ENSO?

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