

Diurnal to Intraseasonal Variability and the Central American Drought

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Outline

- The most recent Central American drought and its relationship to global SST forcing
- Important processes that impact rainfall over the Central American region, including Easterly Waves, the CLLJ, the MSD and topography
 - How are these processes modulated by the larger scales?
 - How are they related to one another?
- Does the current observing system for the region permit investigation of these issues?

Ongoing Drought In Central America

12 December 2014

United Nations News Centre

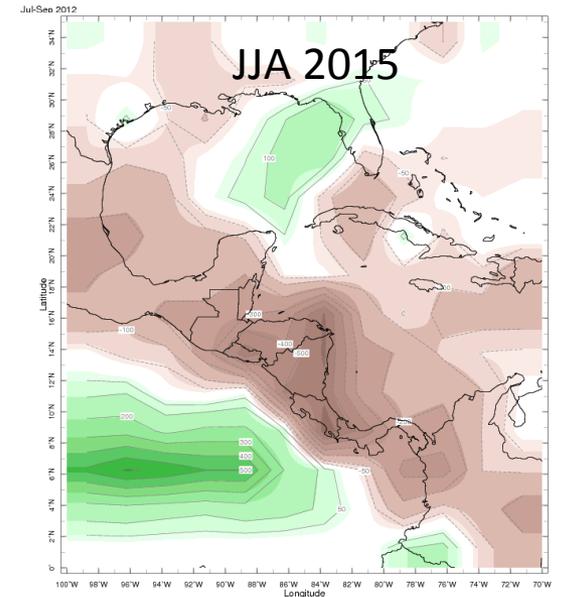
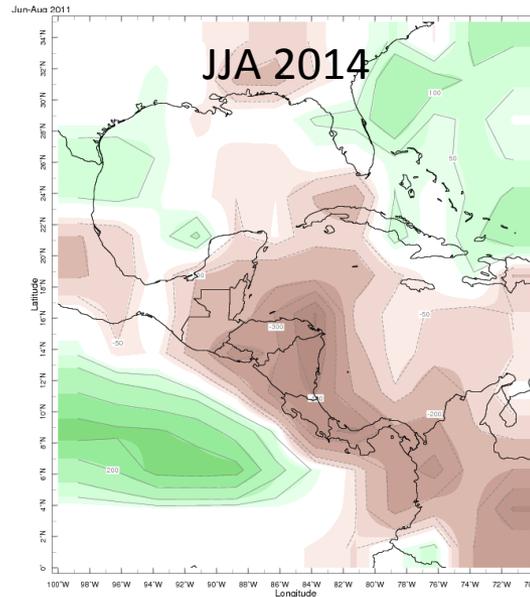
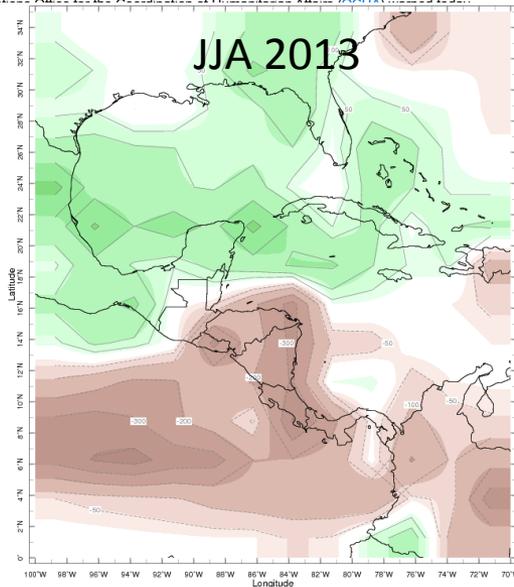
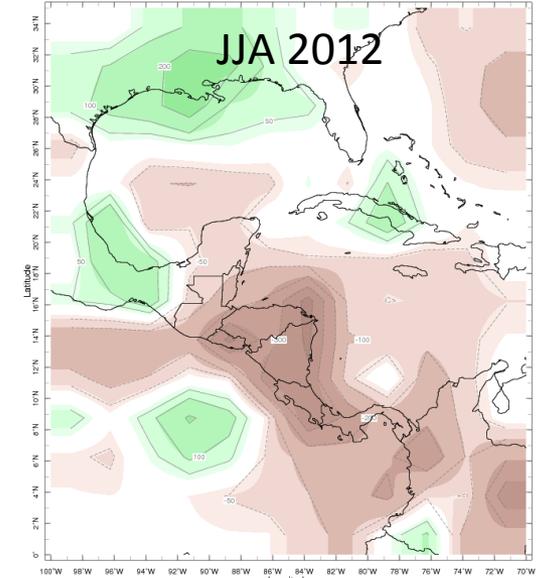
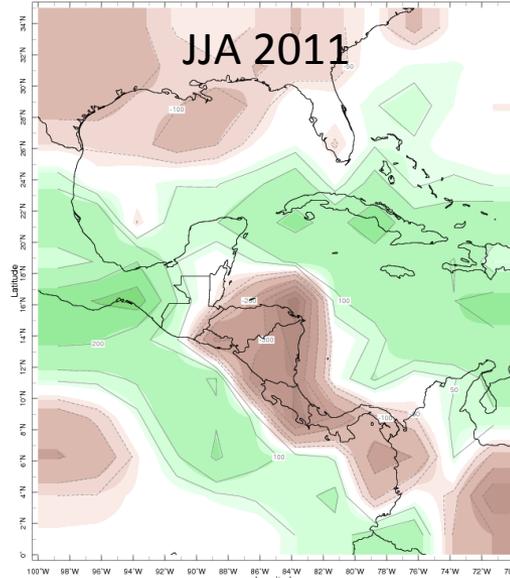
un.org/apps/news/story.asp



Central America drought turning into humanitarian crisis, UN warns

Photo: OCHA/Dan DeLorenzo

12 December 2014 A prolonged drought in Central America is turning into a humanitarian crisis for nearly two and a half million people affected by food insecurity in Honduras, Guatemala and El Salvador, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) warned today.



Jul-Sep 2013

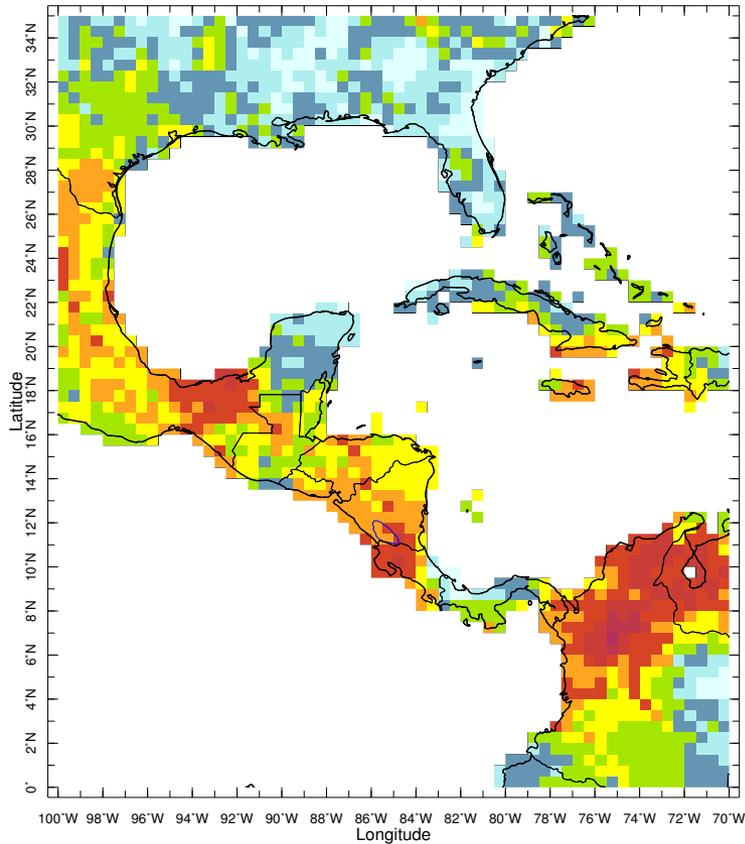
Jul-Sep 2014

Jun-Aug 2015

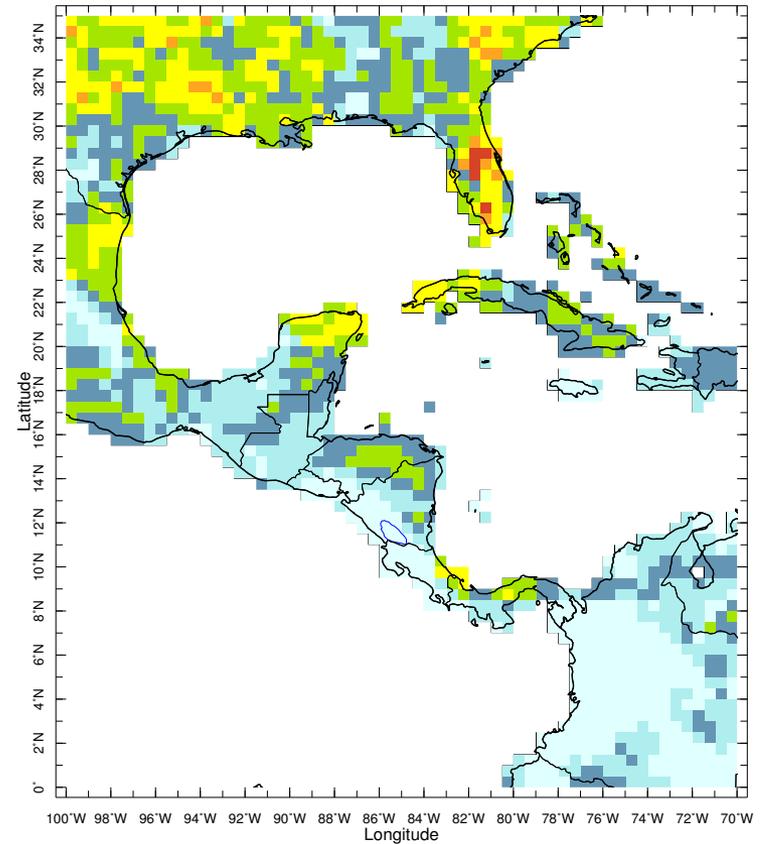
<http://iridl.ideo.columbia.edu/maproom/Global/Precipitation/Seasonal.html>

ENSO and Central American Drought Probability

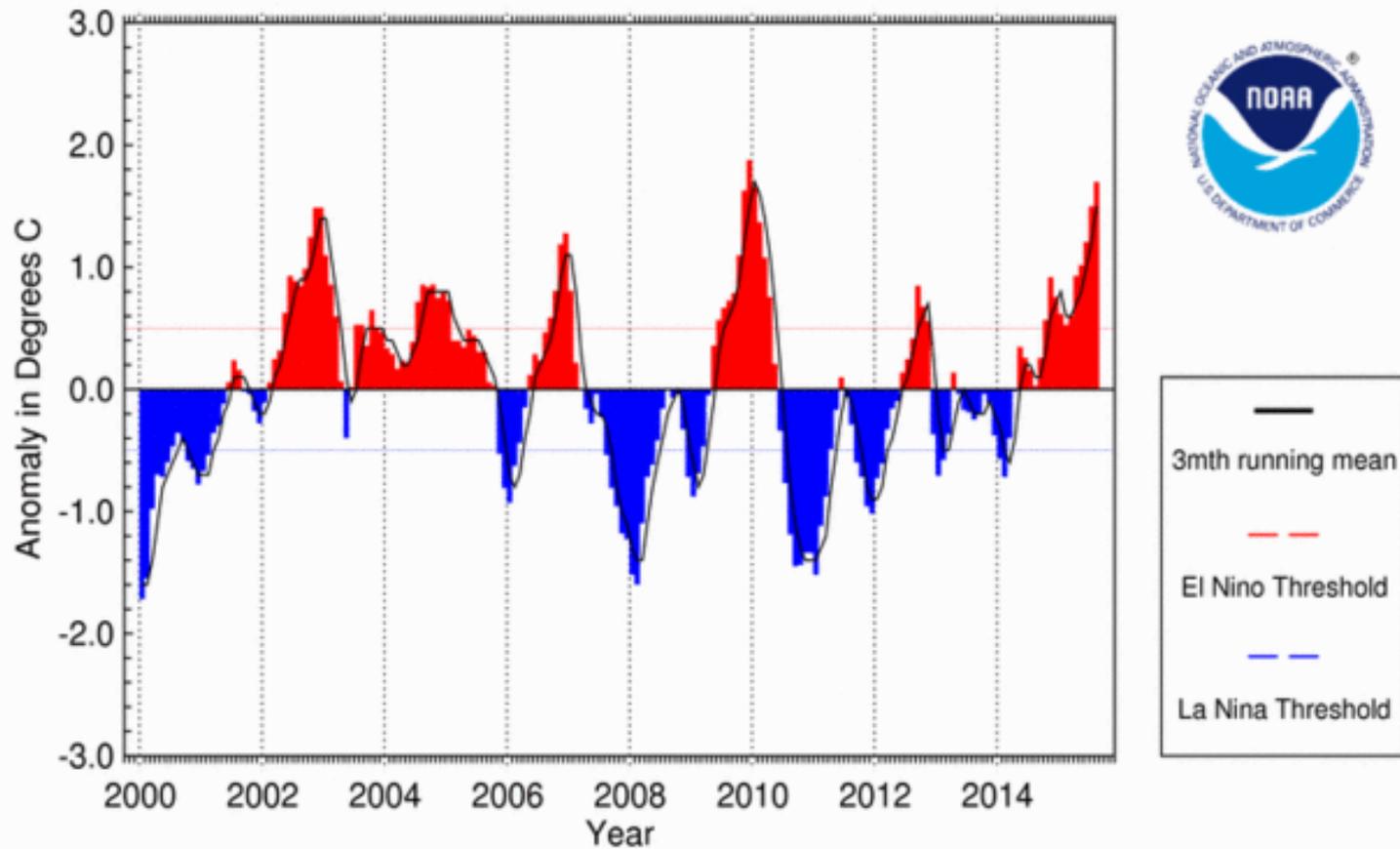
Dry Tercile for El Niño JUN-AUG



Dry Tercile for La Niña JUN-AUG



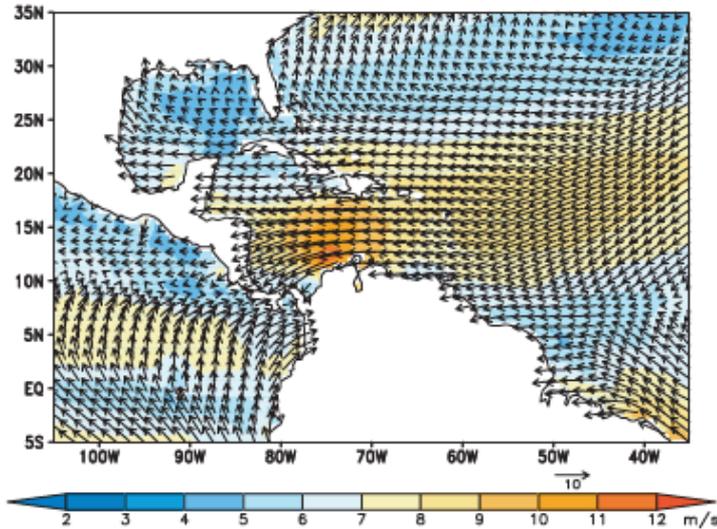
SST Anomaly in Nino 3.4 Region (5N-5S,120-170W)



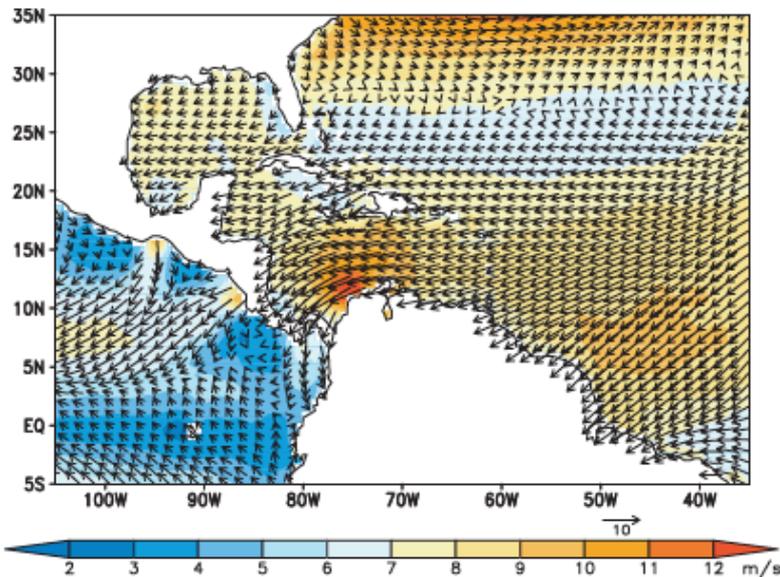
National Climatic Data Center / NESDIS / NOAA

Caribbean Low-Level Jet (CLLJ) and El Niño

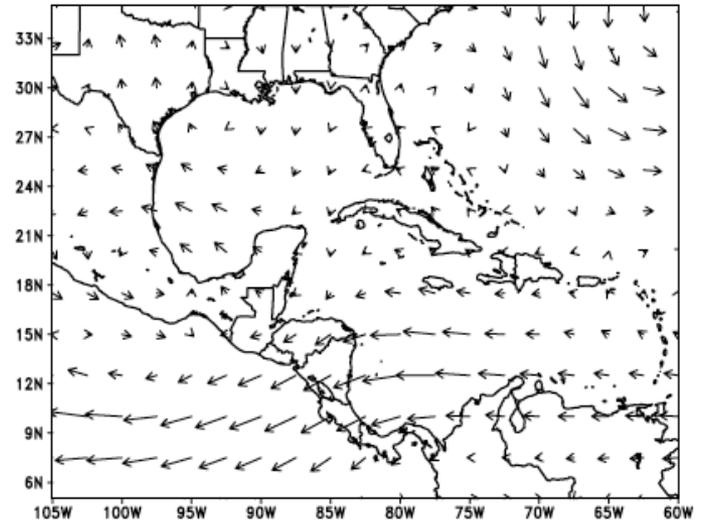
A July Surface Wind Stress



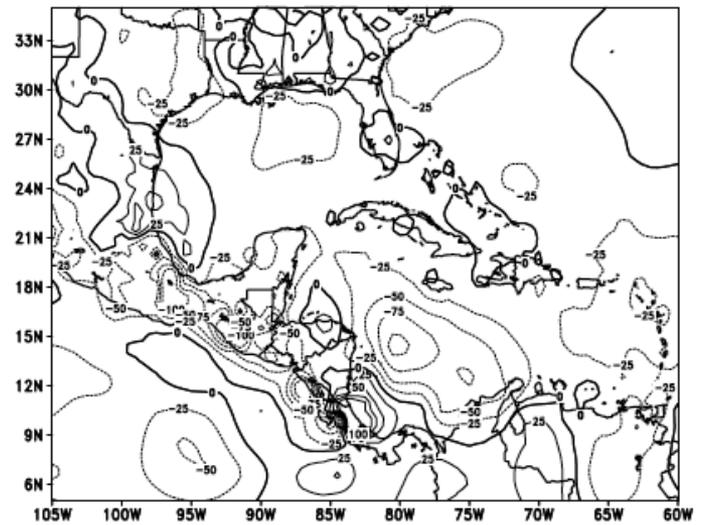
B February Surface Wind Stress



A El Niño 925hPa Wind Anomalies

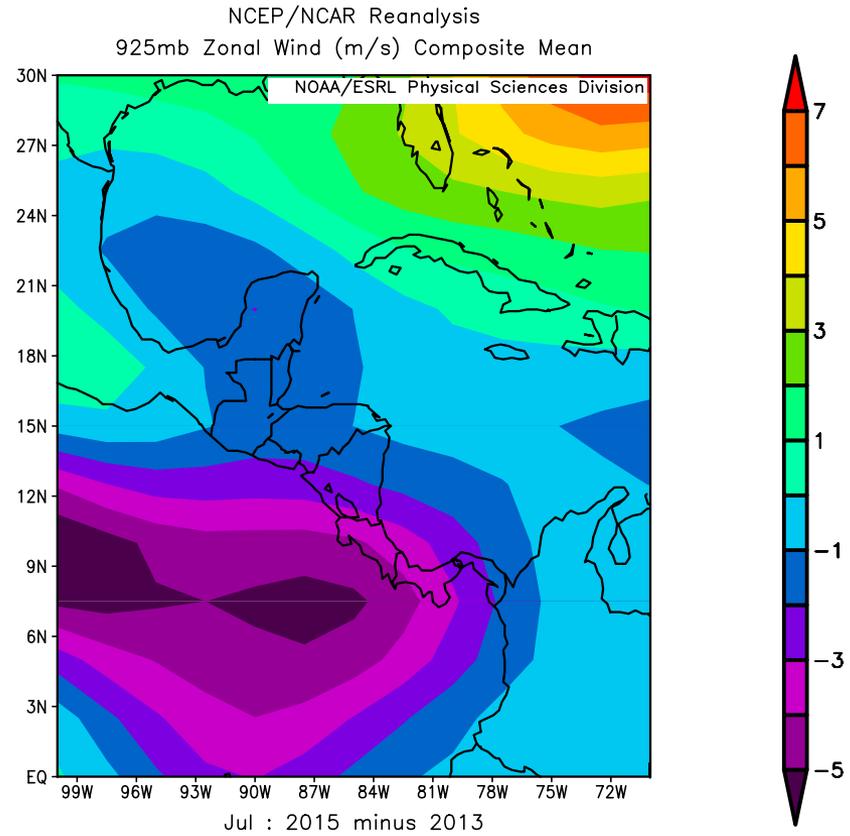
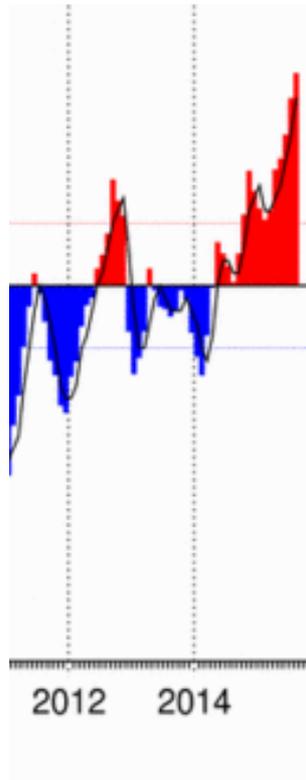
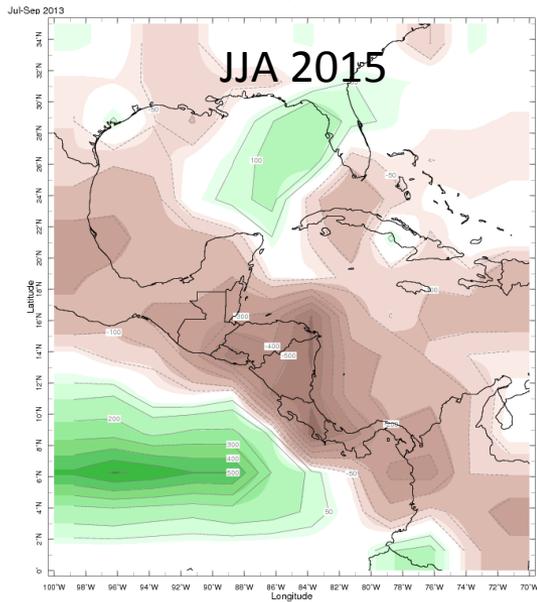
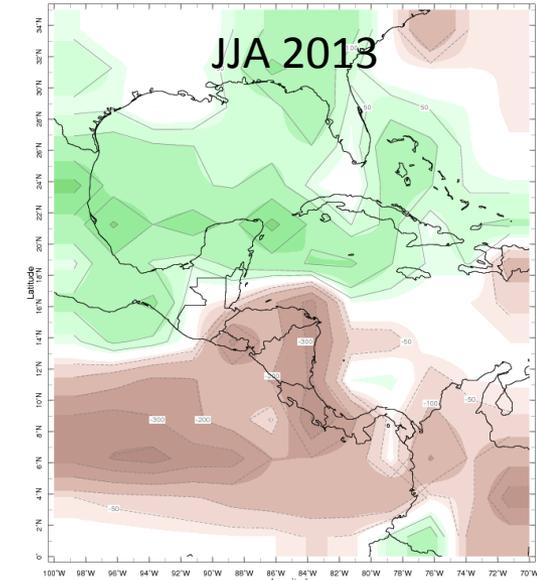


B El Niño Precipitation Anomalies



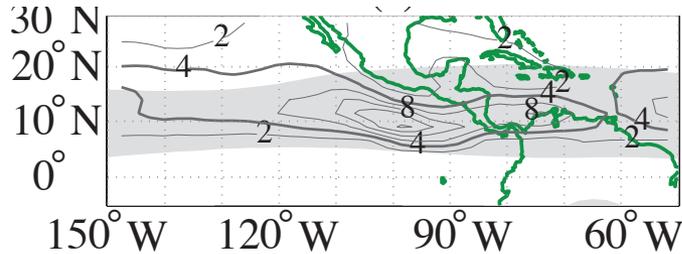
Amador (2008)

ΔU_{925} July 2015-2013

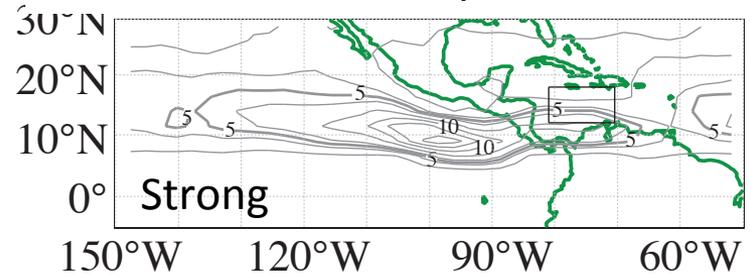


Variability of Easterly Waves and the Caribbean Low-Level Jet (CLLJ)

EW Tracks and TD-filtered OLR

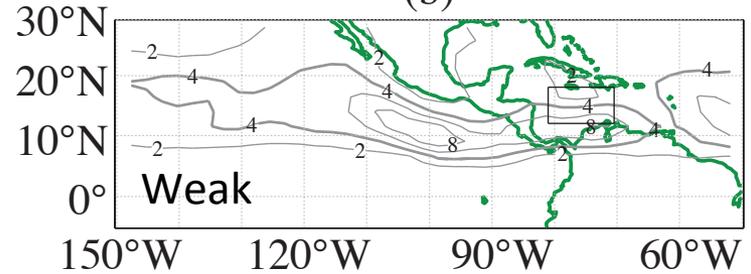
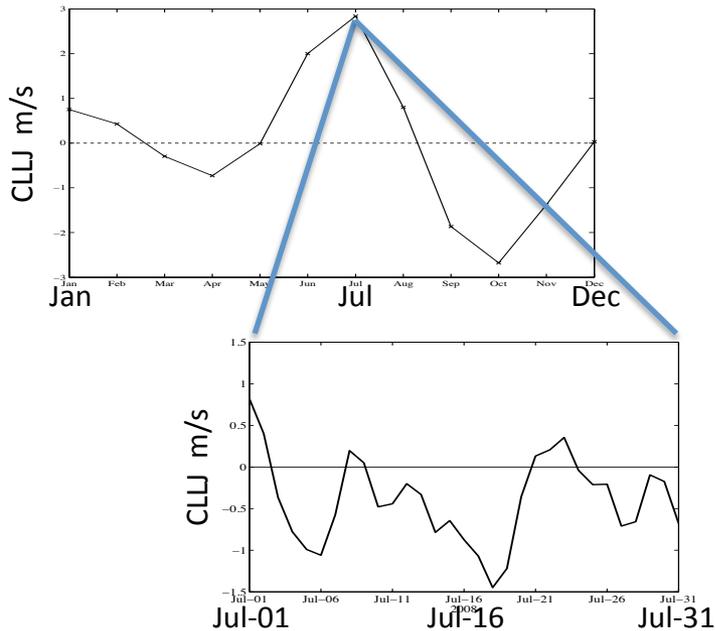


EW Tracks Composited By Phase Of CLLJ – May-Nov

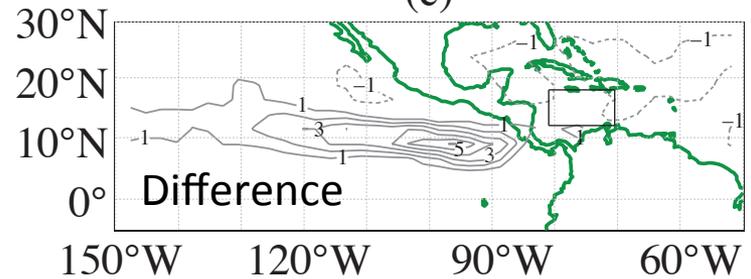


(b)

CLLJ Index – ERAI U at 925 hPa

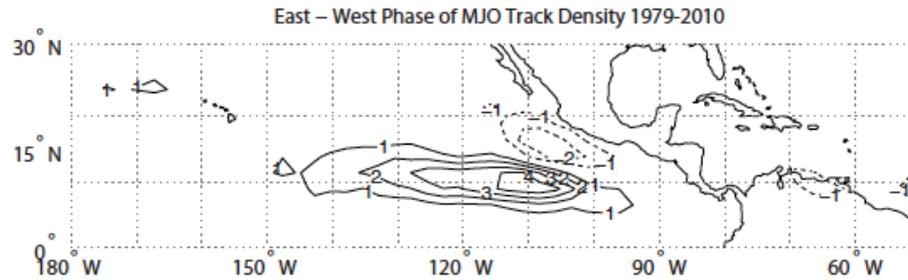


(c)

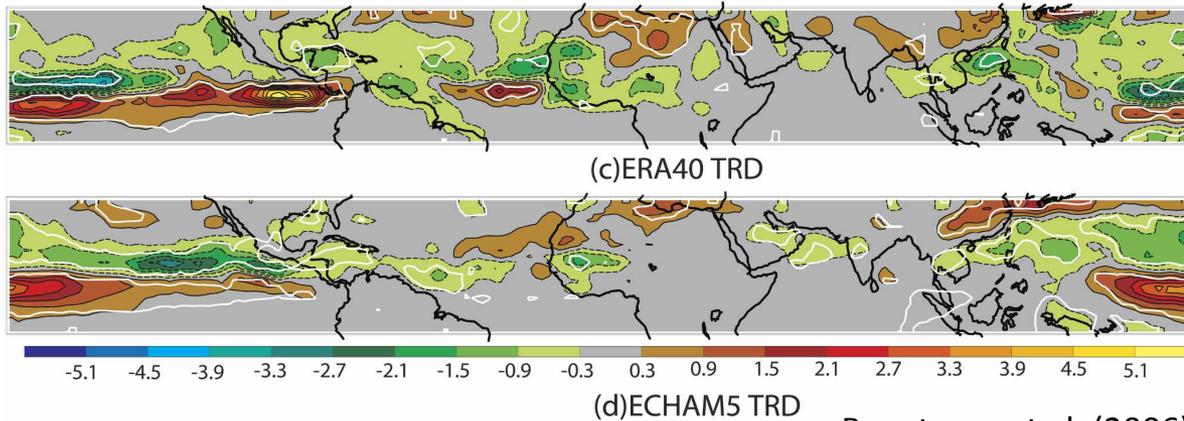


Modulation of EW Track Location and Density

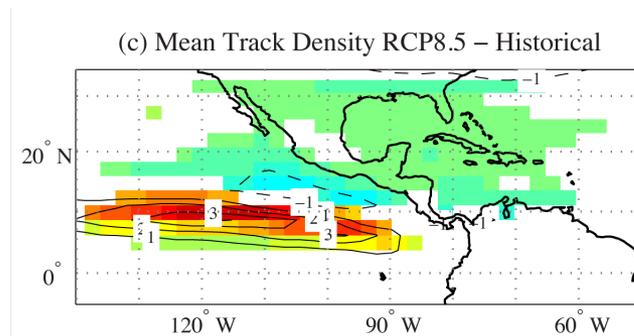
MJO East –
West Phase



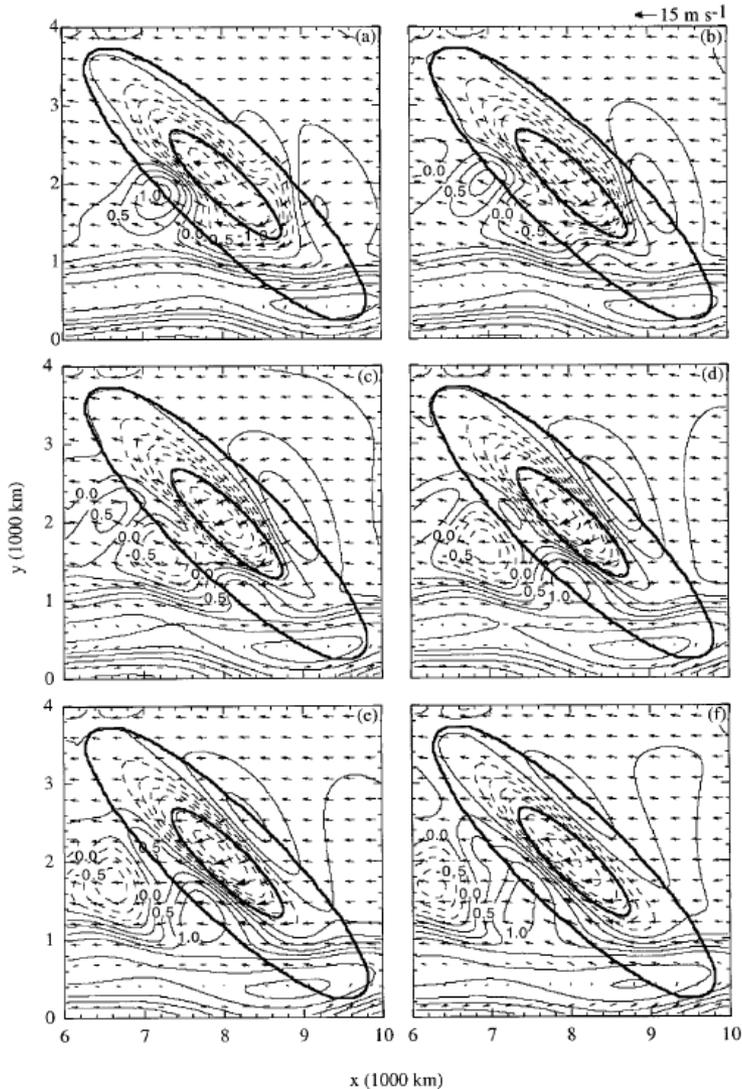
ENSO Warm –
Cold Phase



Future RCP8.5 –
Historical Period



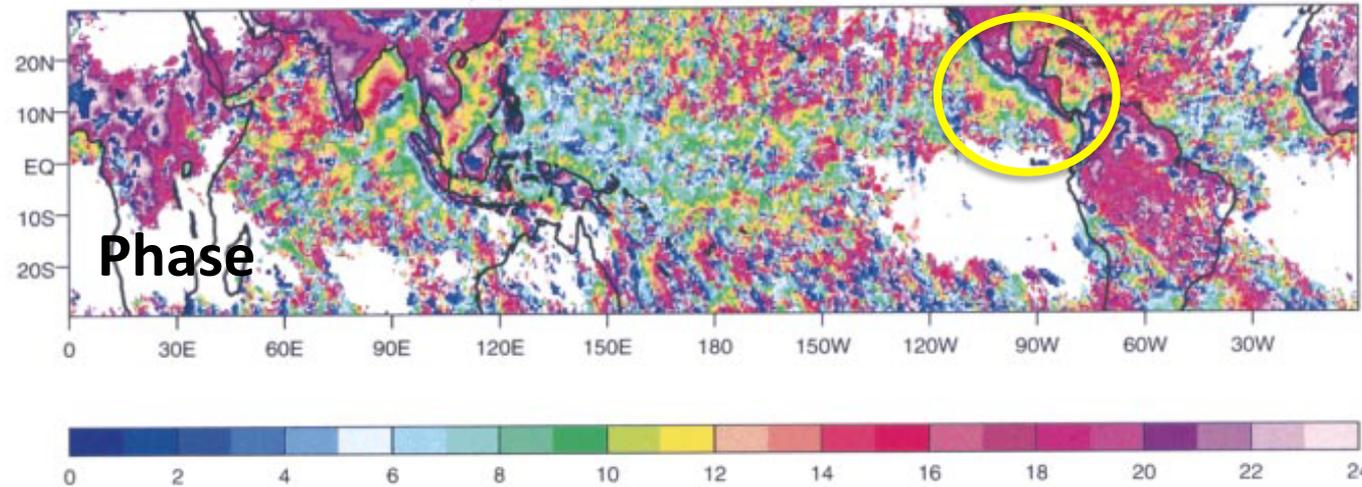
Pacific EW Growth Mechanism: Topography, EW and ITCZ Interaction



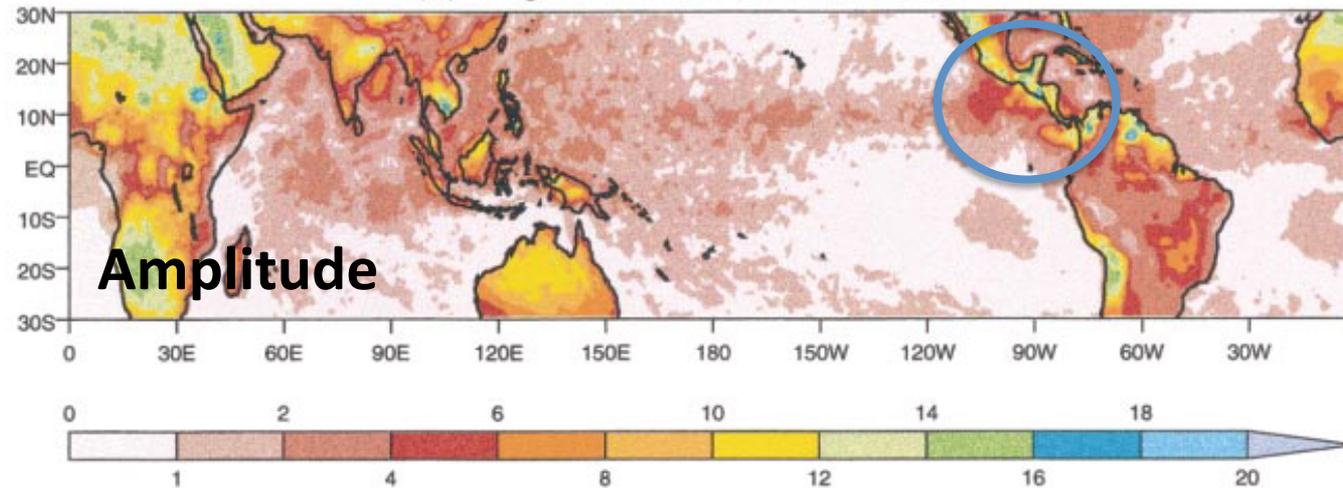
- Equatorial β -plane model
- Easterly wave impinges on topography oriented SE to NW
- ITCZ is seen as positive relative vorticity contours centered on $y=500$
- Wave intensifies on leeside of the mountains.
- Removing the ITCZ reduces the intensification of the wave, so both the ITCZ and topography are important to this growth mechanism.

Diurnal Cycle Over Central America

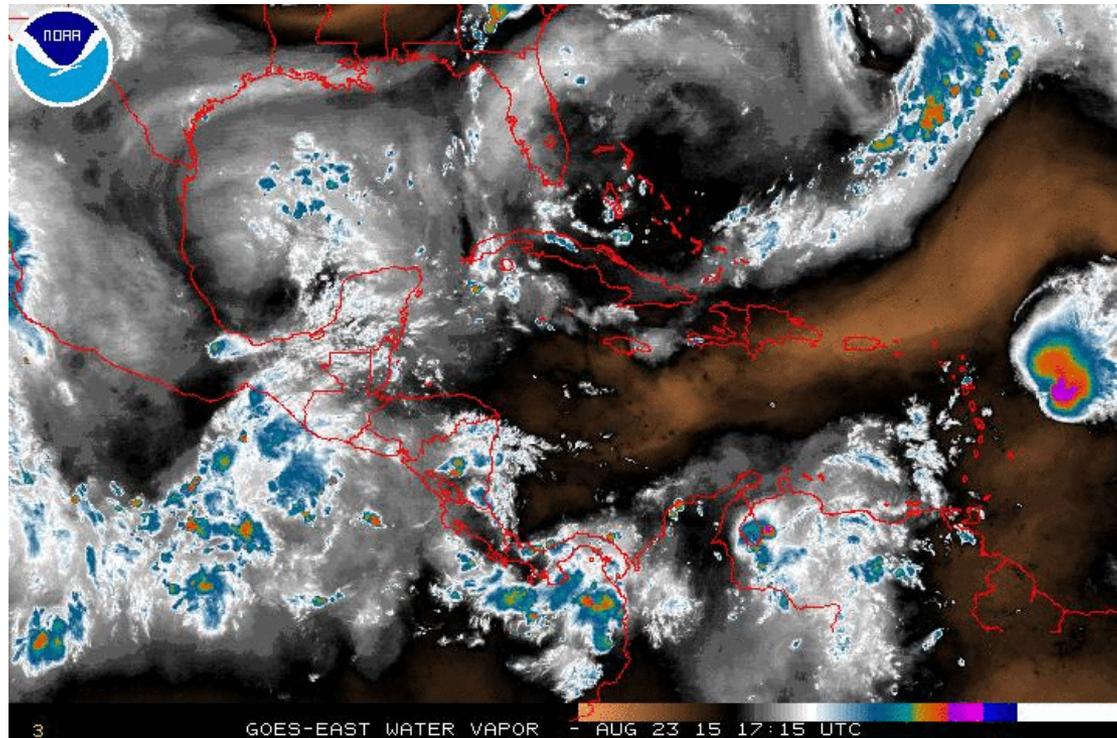
(d) Estimated precipitation: JJA



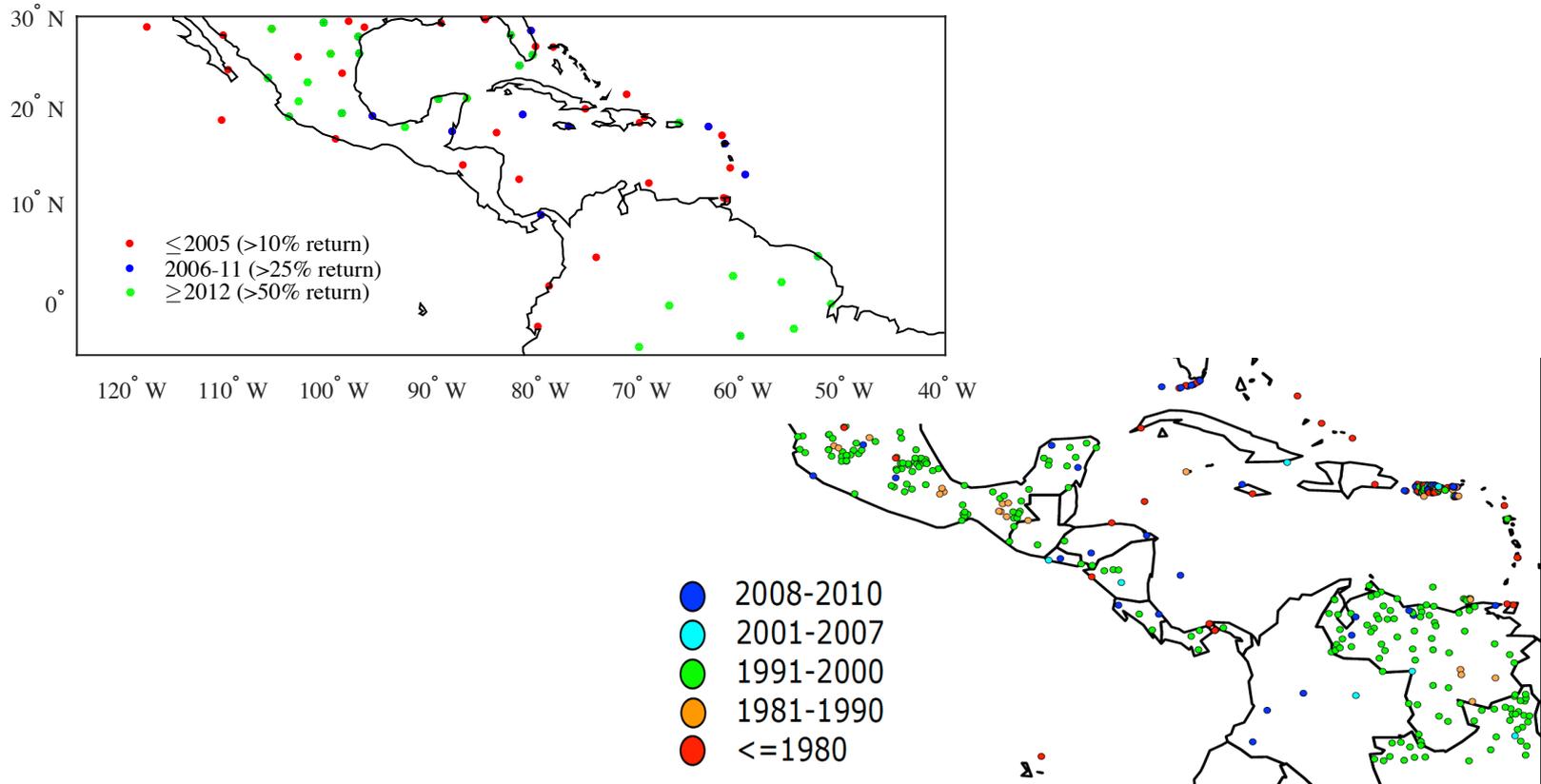
(b) Brightness temperature (K): JJA



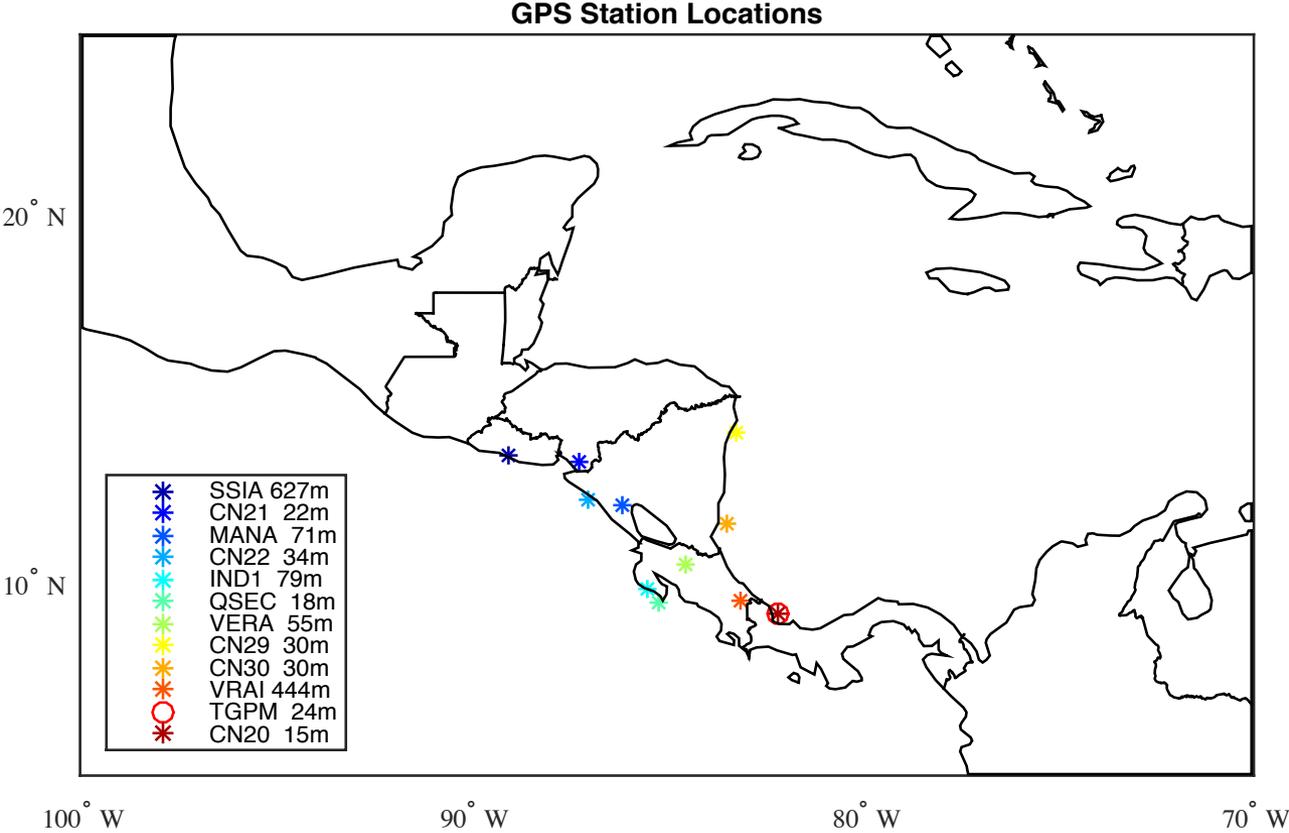
Water Vapor Imagery 23 Aug 2015 17:15Z (11:15LT) to 24 Aug 2015 00:15Z (18:15LT)



Radiosonde and Surface Rainfall Observations In Central America

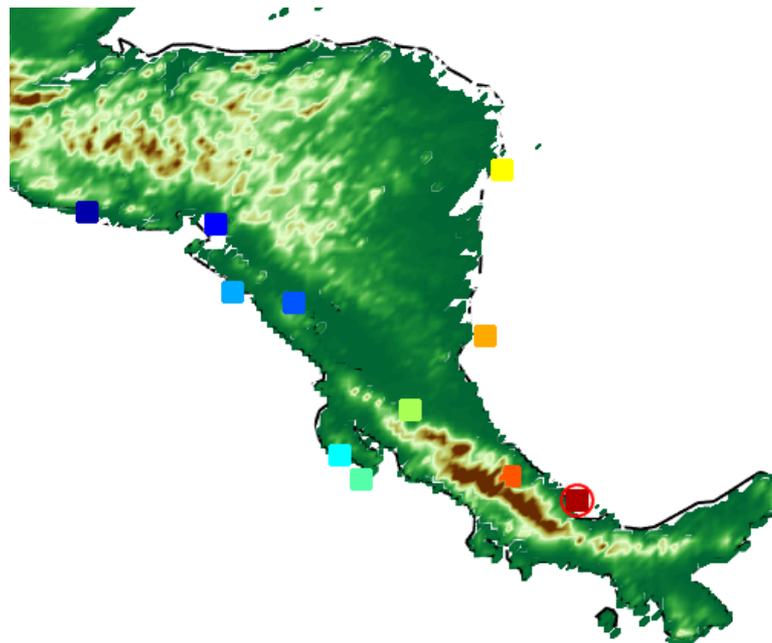
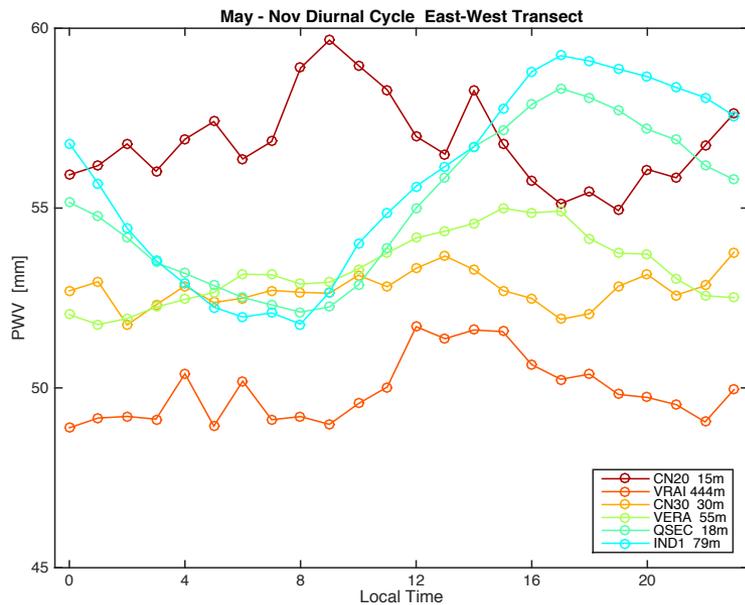
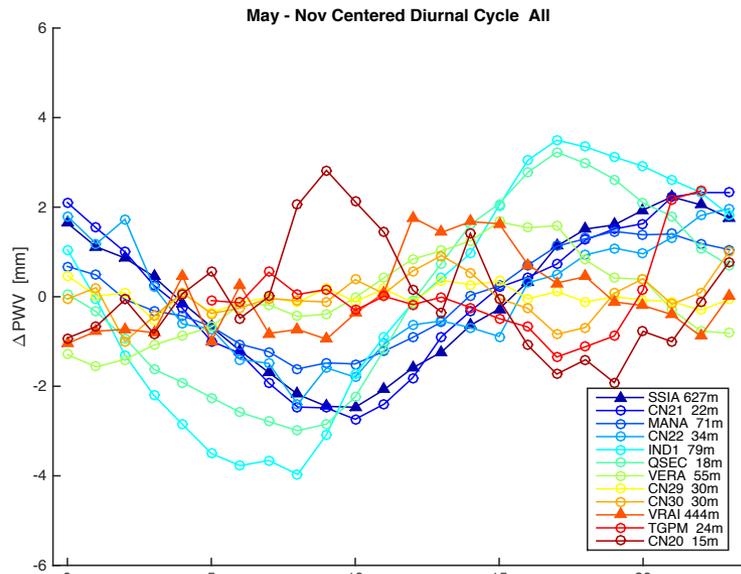


COCONet Precipitable Water

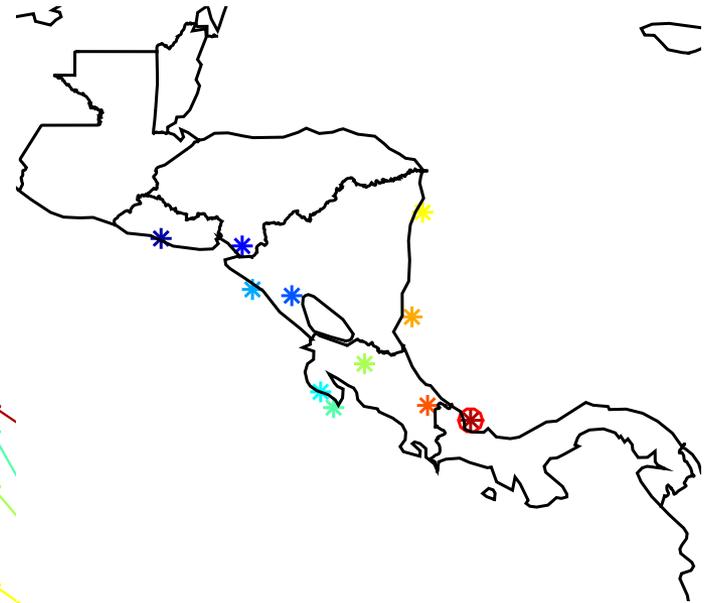
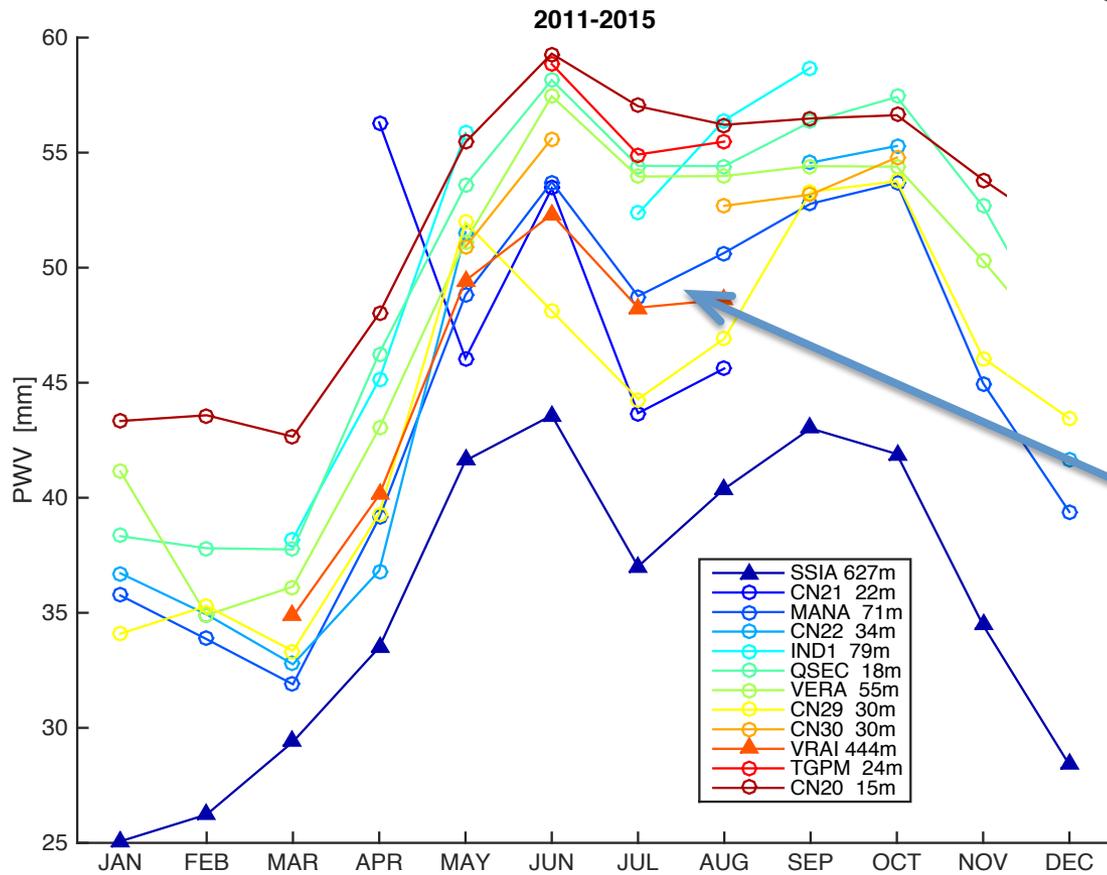


<http://coconet.unavco.org>

PWV Diurnal Cycle May-Nov 2011-2015

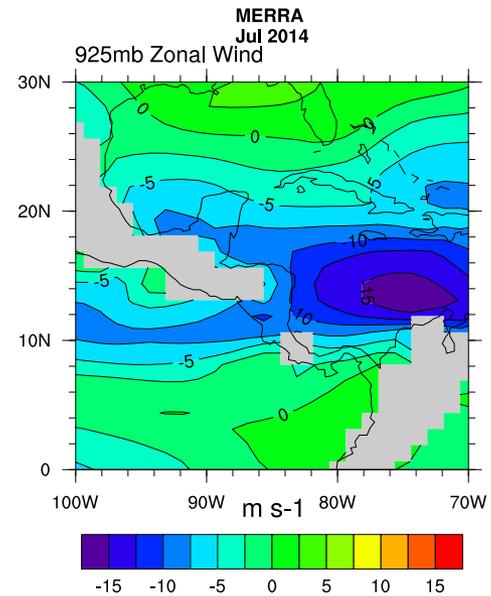
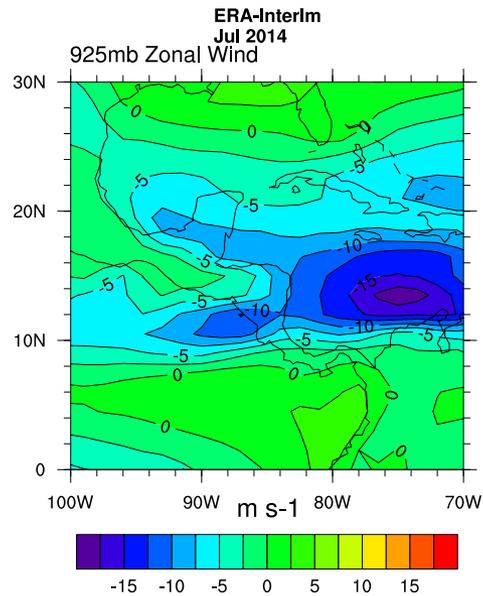
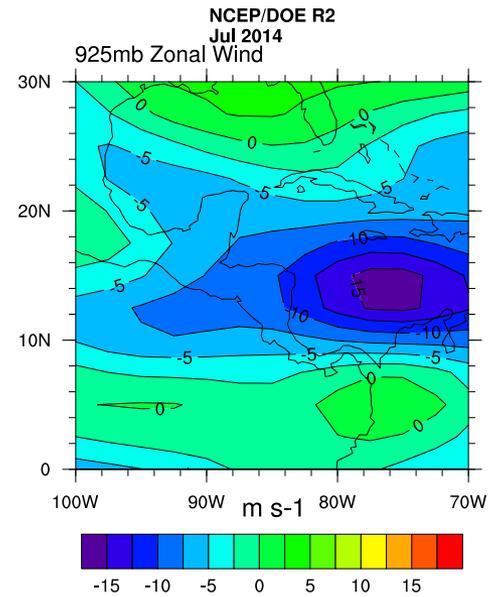
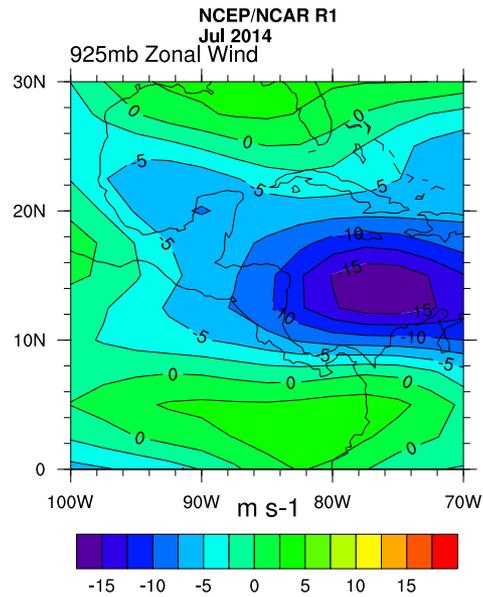


PWV Seasonal Cycle 2011-2015

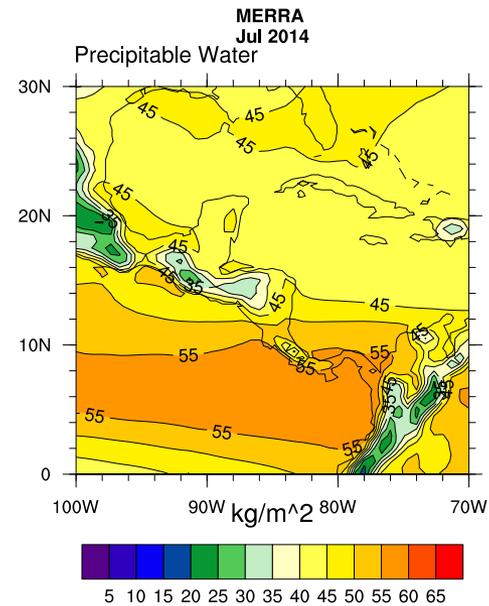
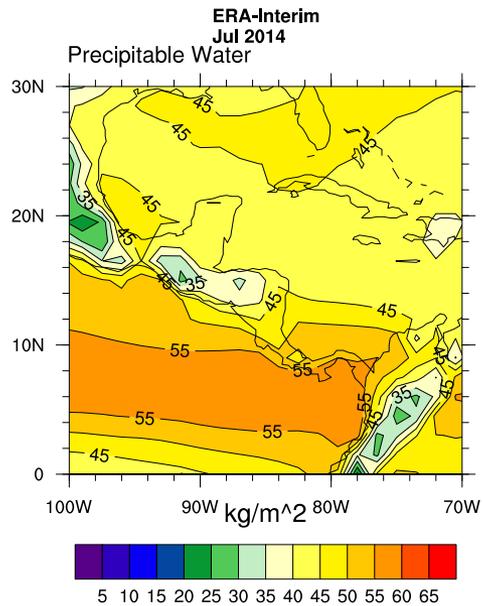
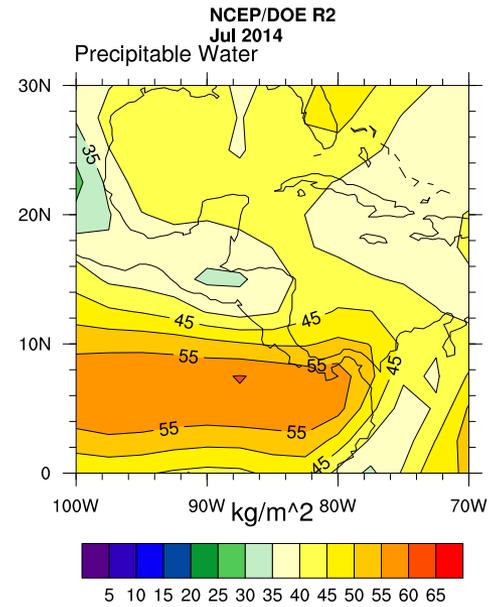
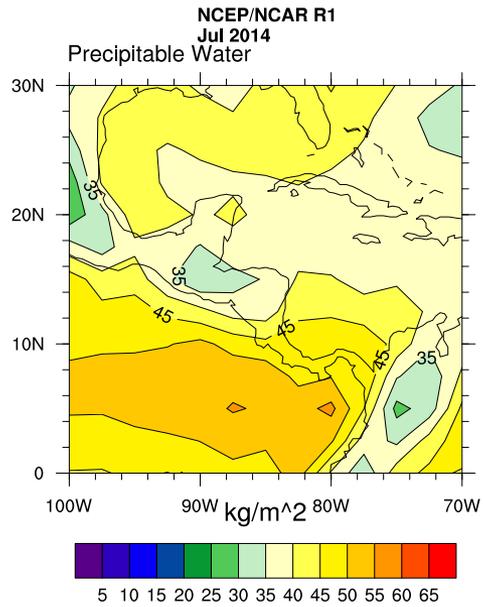


Mid Summer Drought (MSD)

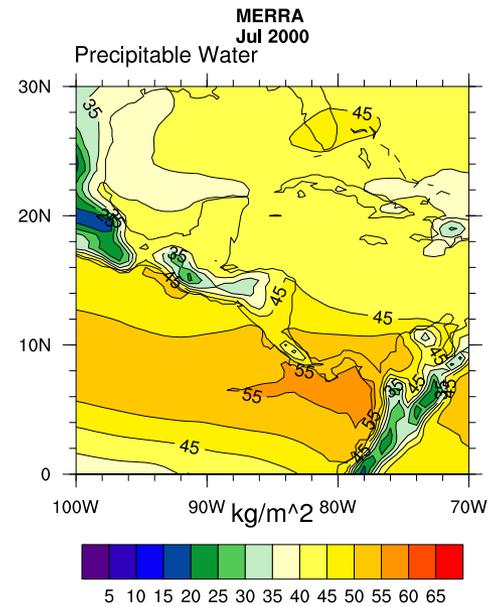
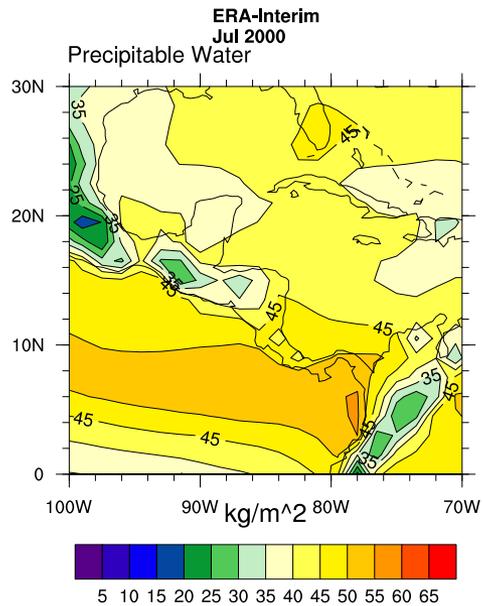
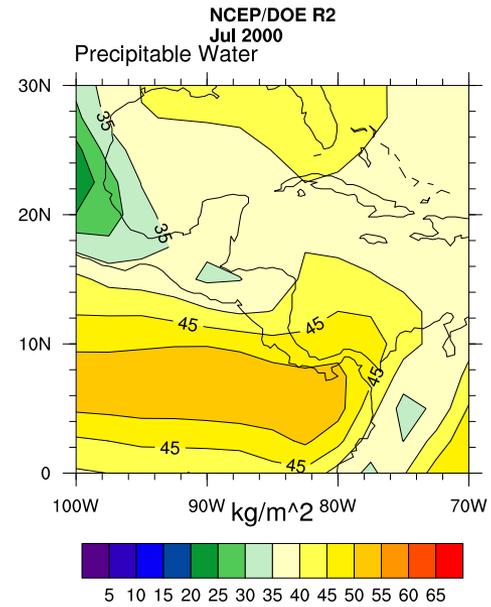
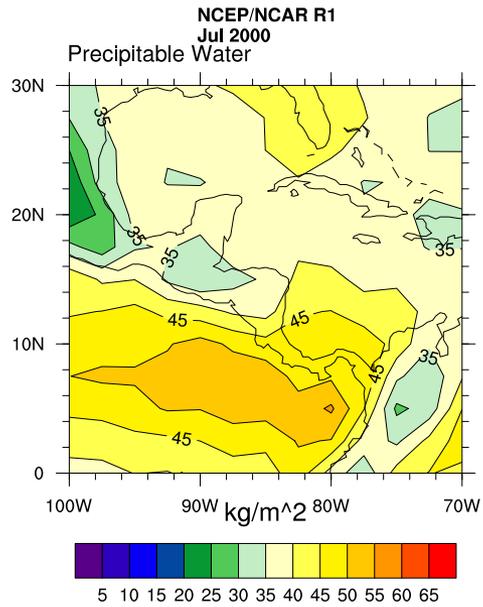
Representation of CLLJ in Reanalyses



Representation of PWV in Reanalyses



Representation of PWV in Reanalyses



Summary

- The Central American drought exhibits high spatial variability in rainfall from year to year (2011 to 2015).
- ENSO may explain some of this variability, but cannot explain the prolonged drought over the region since at least 2011.
- Easterly waves, the CLLJ and the MSD are some of the most important regional climate features that modulate rainfall over Central America. Their interactions and potential role in the current drought require more study.
- The role of EWs in promoting upscale growth and westward propagation of diurnally forced topographic convection over Central America also requires further investigation.
- Current in situ observations in the IAS are sparse and reanalyses vary in their representation of IAS regional climatic features (Misra et al., BAMS, 2015, submitted), making investigation of these issues difficult.