Science and Technology Infusion Climate Bulletin
NOAA's National Weather Service
38th NOAA Annual Climate Diagnostics and Prediction Workshop
College Park, MD, 21-24 October 2013

Observed Trends in the Great Plains Low-level Jet and Associated Precipitation Changes in Relation to Recent Droughts

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ABSTRACT

Recent drought over the Great Plains has had significant impacts on agriculture and the economy, highlighting the need for better understanding of any ongoing changes in the regional hydroclimate. The Southern Plains peak rainfall season is in the spring (Fig.1 a-b), and the period 1996-present has been much drier than 1979-1995 in the highlighted region (Fig. 1c).

Trends in the Great Plains low-level jet (GPLLJ) during the months April-June (AMJ) and associated precipitation are analyzed using the North American Regional Reanalysis (NARR) for the period 1979-2012. Linear trends computed for meridional winds and precipitation intensity, frequency and total across the Great Plains (Fig. 2) show that (1) the GPLLJ has strengthened and expanded northward and (2) precipitation has decreased substantially in the Southern Plains while increasing in the Northern Plains. Particularly in May, the rainy season in the Oklahoma-Texas region, precipitation has migrated northward in correspondence to the shifted northern edge of the GPLLJ, leading to near 50% declines in precipitation since 1979. These observed changes are discussed in the context of recent droughts and projected climate for the region.

This work has been published in Geophysical Research Letters in 2013.

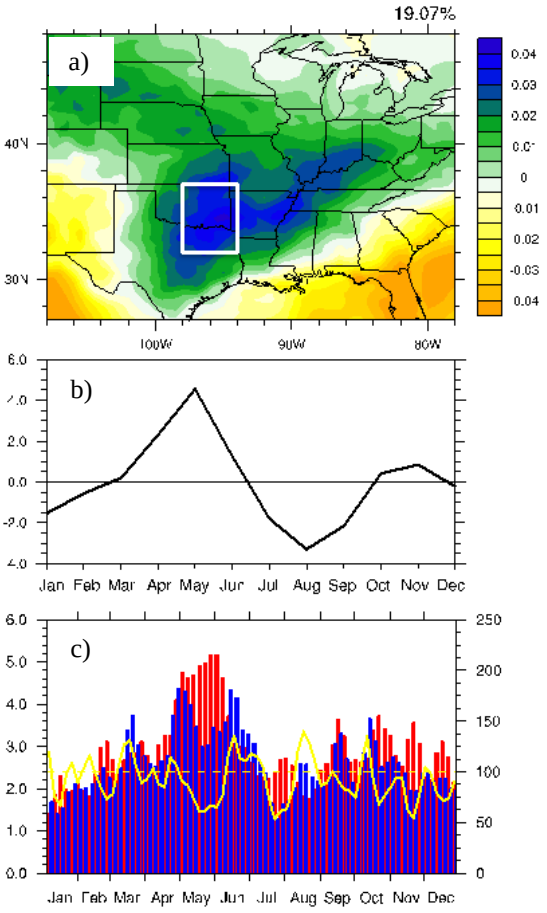

Fig. 1 a) EOF 2 of precipitation climatology for Central U. S. White box highlights center of action, and is used for calculations for panel c. b) PC2 of precipitation climatology for Central U.S., showing the springtime peak of rainfall for the region. c) Climatology of average pentad precipitation within averaged over the box shown in panel a. Red bars are for the period 1979-1995, blue bars are for the period 1996-2012. Yellow line indicates percent difference between the two time periods.

References

Barandiaran, D., S.-Y. Wang and K. Hilburn, 2013: Observed trends in the Great Plains low-level jet and associated precipitation. *Geophys. Res. Lett.*, DOI: 10.1002/2013GL058296

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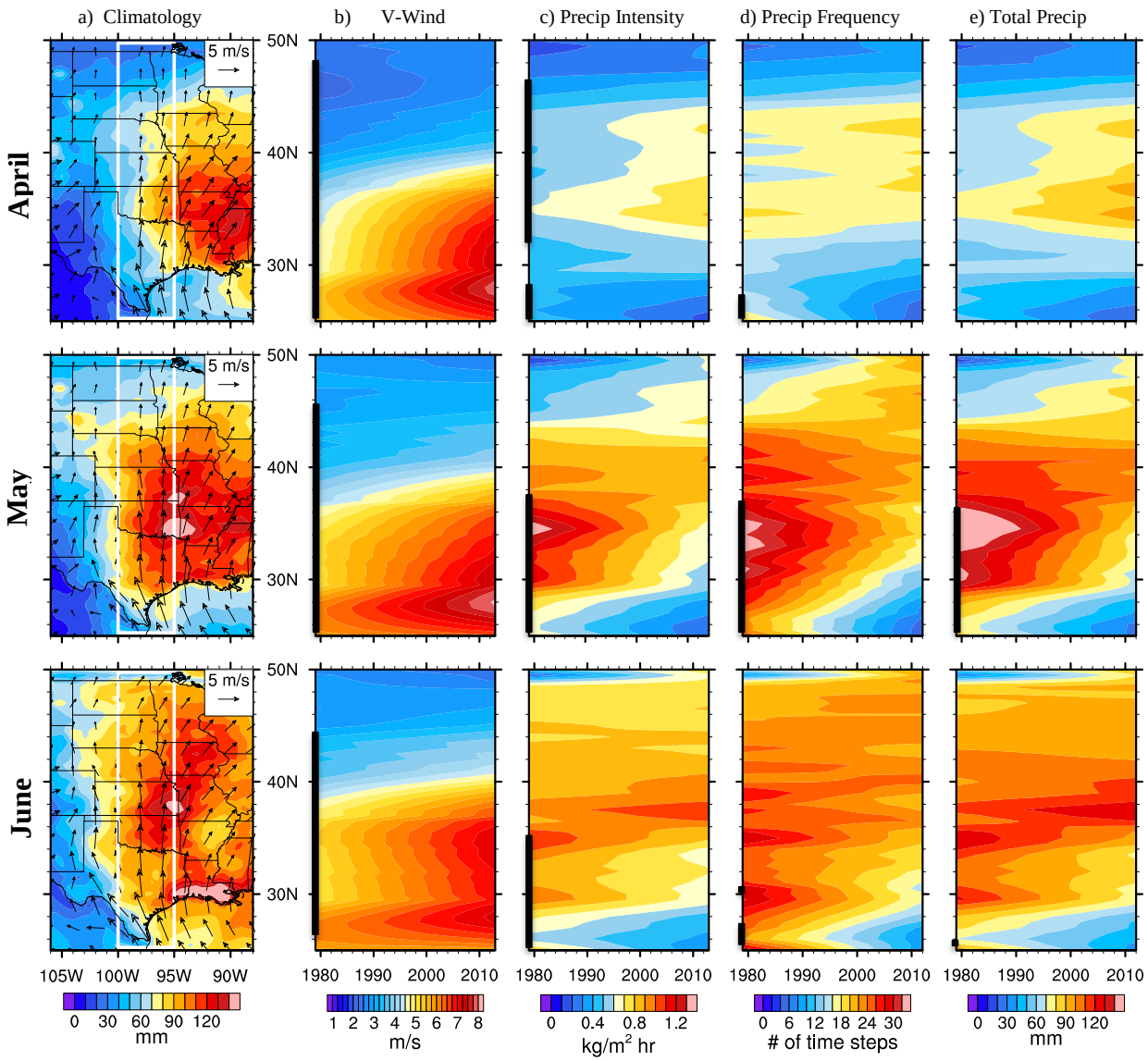

Fig. 2 a) Monthly climatology for precipitation (shaded) and 925 mb wind field (vectors) and Latitude-time Hovmöller trend plots for b) 925 mb v-wind, c) precipitation intensity, d) precipitation frequency and e) monthly total precipitation, zonally averaged along the longitude range indicated by the white boxes within monthly climatology plots. Data plotted consists of regressed linear trend added to climatological mean. Thick bars along latitude axis on trend plots indicate latitudes for which regression coefficients are statistically significant at 95% confidence.