Relationships between Sea Surface Temperature Anomalies in the Pacific and Atlantic Oceans and South Texas Precipitation and Streamflow Variability

Dorina Murgulet[1], Valeriu Murgulet[1], Richard Hay[2], and Alberto Mestas-Nuñez[1]

[1]Department of Physical and Environmental Sciences, Texas A&M University–Corpus Christi, 6300 Ocean Dr., NRC 3103, Unit 5850, Corpus Christi, Texas 78412–5850

[2]Center for Water Supply Studies, Texas A&M University–Corpus Christi, 6300 Ocean Dr., Corpus Christi, Texas 78412–5850

GCAGS Explore & Discover Article #00154*
http://www.gcags.org/exploreanddiscover/2016/00154_murgulet_et_al.pdf
Posted September 13, 2016.

*Abstract published in the *GCAGS Transactions* (see footnote reference below) and delivered as an oral presentation at the 66th Annual GCAGS Convention and 63rd Annual GCSSEPM Meeting in Corpus Christi, Texas, September 18–20, 2016.

ABSTRACT

While many studies have described linkages between large-scale climate phenomena and precipitation and streamflow, fewer studies explicitly address the climatic modulations of at regional scales. Here we investigated temporal variances in warm and cold season precipitation and streamflow in South Texas associated with El Niño–Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), and Atlantic Multidecadal Oscillation (AMO) climatic indices. Statistical relations were derived from significant correlations at the 95%. We found a stronger modulation of ENSO and PDO on cold season rainfall and streamflow variability than the warm season. ENSO shows significant influence on precipitation and it affects streamflow variability more during the warm season than the cold season, comparatively. Coupled analyses indicate that the effects of ENSO-cold (when precipitation is below the mean) are intensified by PDO-cold, resulting in much lower rainfall amounts during the cold season. On the other hand, PDO-cold seems to modulate strongly cold season precipitation and streamflow (i.e. the lowest discharge) during the ENSO-warm. PDO-cold/ENSO-warm has a strong influence on warm season streamflow although there is no modulation on precipitation depths. No significant impact of AMO is observed on the area's precipitation depths. Interestingly, streamflow is consistently below the mean across the seasons and annually during PDO-cold/AMO-warm. Coincidently, Texas draughts are more intense or frequent during this condition suggesting a strong modulation of the coupled PDO-cold/AMO-warm. Overall, the response of streamflow to climate phenomena is stronger and more defined both annually and seasonally when compared to precipitation, which could result in improved predictions. These statistical relations provide decisions makers tools and knowledge to better assess current resources while proactively mitigating future supply issues before they become environmental and economic burdens within the region of study and other regions.

Originally published as: Murgulet, D., V. Murgulet, R. Hay, and A. Mestas-Nuñez, 2016, Relationships between sea surface temperature anomalies in the Pacific and Atlantic oceans and South Texas precipitation and streamflow variability: Gulf Coast Association of Geological Societies Transactions, v. 66, p. 1027.