The Gulf of California surges and the summer precipitation over the Colorado basin

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Abstract

The Colorado river streamflow is fed by winter snow accumulation and subsequent melt during spring, and by summer convective storms related to the North American monsoon. As a result, the river discharge exhibits two maxima during the year, the first one during spring and the second one during late summer. This presentation will focus on the summertime processes leading to the second peak, and, in particular, on the mesoscale circulations and the diurnal cycle that are crucial for describing the monsoon rainfall. Moist surges progressing along the Gulf of California are an important mechanism that supplies moisture to the southwestern United States: a large portion of the precipitation over Arizona, western New Mexico and southern Utah develops after the passage of a Gulf surge.

Another feature of the Gulf of California is the presence of a Low-level Jet (LLJ) that flows along the Gulf. While this LLJ is stronger during the passage of a moist surge, it is not clear what its intensity, structure and evolution are in the absence of surges. The variability of the along-the-Gulf moisture flux shows significant spectral peaks for both the diurnal cycle and synoptic scale modes, the first one probably resulting from the development of the LLJ due to heating and topographic effects, and the latter resulting from the recurrent passage of Gulf surges. Typically, the diurnal cycle of the moisture transports over the Gulf of California accounts for about 5% of the total variance, which is a significantly less than the Great Plains LLJ diurnal cycle that accounts for 25% of the total variance.

The objective of this research is to investigate the contribution of moisture to precipitation processes during surge and no-surge events, and particularly to examine whether the LLJ in the absence of surges is strong enough to supply moisture needed for the southwest precipitation. To achieve this, we analyzed 3-h Eta Data Assimilation System (EDAS) analyses prepared from NCEP's operational Eta model suite, complemented with raingauge observations and high-resolution satellite products. Specifically, the discussion will center on the main local and nearby components of the water cycle. A discussion will follow on the difficulties and limits of conventional estimates of the moisture budget for the Colorado basin.