Introduction

Tropical Cyclones (TCs) are key atmospheric phenomena in the hydrological cycle of several tropical regions around the world [Trenberth and Fasullo, 2007]. For instance, Shephard et al. [2007] found that TCs accounted for 8 to 17% of cumulative rainfall during hurricane seasons at different locations along the coastal southeastern United States. Wu et al. [2007] pointed out that TCs produce more than one third of the total precipitation between June and November at Hainan Island in China. A TC that is close to the Pacific coast of Mexico may contribute from 20 to 80% of seasonal rainfall along coastal regions of Mexico, and up to 30% in landmass of western Mexico [Englehart and Dougalls, 2001]. Hence, TCs are essential climatic elements of summer rainy seasons in Mexico. An important part of water availability in northern Mexico is related to TC rainfall, which is used to fill reservoirs up.

For instance, Hurricane Alex made landfall on July 1st, 2010 and its associated maximum precipitation was 446.5 mm in 24 hours, which is close to the mean summer precipitation in parts of northeastern Mexico. The water level at dams raised enough for providing this resource to several regional socioeconomic activities during the prolonged 2010-2012 drought in northern Mexico [Magaña and Neri, 2012]. The impacts of TCs in water balances and management is not a simple task, since seasonal forecasts of TC activity [Camargo et al., 2010] do not provide any information of likely future tracks and affected regions. Even when tropical cyclone activity is normal or above-normal, negative anomalies of monthly precipitation may still appear at the regional level if most TC trajectories are not close enough to Mexico.

Can CFSv2 predict the impact of TCs in regional precipitation?

Predicting tropical cyclogenesis, and subsequent TC tracks and precipitation remain a big challenge in climate models. A typical case of precipitation amounts produced by a climate model is shown. However, the CFSv2 Reforecast of Hurricane Alex (2010) did not capture the precipitation extreme that happened in Northern Mexico due to the coarse resolution of the model. The CFSR did capture the event. Precipitation amounts for Alex are shown for lead times of 2.5, 2.0, 1.0 and 0.5 month.

CONCLUSIONS

The effect of TCs in the hydrological cycle of northern Mexico is missing in most global or regional climate models even when they play a relevant role. Even though TC activity and characteristics should be included in the water management planning process in Mexico, there are no predictive schemes aimed at meeting such goal. Seasonal or even monthly outlooks of TC activity over Intra Americas Seas may not be enough to estimate the TC impact in the hydrological cycle since subtle elements, such as the track and size, are not forecast at least one month in advance. This problem is even more complicated when regional climate change scenarios for the water sector are used to make projections of the potential impacts of such extreme phenomena. Future work should consider the role of large scale forcing in determining predicted TC tracks and ensembles of projections on what their effect could be at regional scale. One possible approach to this problem is to seed TC-like vortices in predicted cyclogenesis regions and explore their development and tracks in high resolution climate models.