CASE STUDY 1: Climate Data Science

Understanding the Role of Extremes in Variability in Water Resources

Participants

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Introduction

Our research topic was focused on climate variability and extremes given the high year-to-year variability in annual precipitation across much of the southwestern US and northern Mexico. Large interannual to decadal variability in precipitation leads to significant challenges for water management—particularly given the importance of water resources for agriculture in these areas. These regions are at the southern edge of the mid-latitude jet stream and commonly see a narrower window for cool-season precipitation to contribute to annual totals, meaning that a few precipitation events have an outsized impact on annual totals and variability (e.g., Dettinger et al., 2011). California and northern Baja California are heavily reliant on atmospheric rivers for total precipitation totals (Gershunov et al., 2017), while other portions of Mexico receive a large portion of their annual precipitation in tropical cyclones (Khouki et al., 2015). As a result, the variability of extreme precipitation events likely is a significant driver of interannual to decadal variability of water resources.

Understanding how this variability plays out across the southwestern US and Mexico is critical given that these areas have existing water scarcity challenges that will be exacerbated by anthropogenic climate change (Cook et al., 2020). Further, less attention has been paid to changing hydroclimate variability which may impose significant impacts to communities. In California, there has been an increase in the variability of hydroclimatic extremes (e.g., Swain et al., 2018) with climate change expected to further increase interannual variability (e.g., Gershunov et al., 2019). The means through which has played out in Mexico and is projected to under climate change is less well known. Moreover, the influence of changes in extremes on changes in hydroclimate variability is generally not well evaluated in the region.

Objectives

- Analyze changing hydroclimate variability to understand potential impacts on communities, specifically patterns in atmospheric river events.

Hypothesis/Expected Outcomes

- Understanding the drivers of interannual variability in water resources for California and Mexico can serve as support to creating long-term, community-focused solutions for the advancement of environmental, economic, and social sectors in both rural and urban regions.