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Title: Coastal Salinity: a proxy for human and natural hydrological cycle change

Abstract: This talk presents an overview of the findings from a NASA-funded project on global coastal salinity and its linkages to natural and human-driven changes in the hydrological cycle. Ocean sea surface salinity (SSS) has been demonstrated to be a powerful indicator for monitoring changes in the global water cycle. Understanding variability in SSS also has important implications for regional air–sea interactions, ocean circulation, and marine biogeochemistry. In this study, for the first time, we aim to disentangle the contributions of natural climate variability and human driven changes to land hydrology and coastal SSS variability and trends. Using a combination of satellite, in situ, and reanalysis datasets, we show that the interannual and seasonal variability of coastal SSS is at least an order of magnitude greater than that of the open ocean. Across the global tropics, coastal SSS variability is quite sensitive to the river runoff, which is strongly influenced by ENSO, a major mode of natural climate variability originating in the tropical Pacific. However, at regional scales, the dominant modes of natural climate variability driving changes in land hydrology within major river basins and consequently coastal SSS can differ substantially. As case studies, we examine the Amazon and Congo River basins, demonstrating how their hydrology is influenced differently by Indo-Pacific climate modes and how these impacts propagate to coastal SSS variability. Additionally, we also assess the effects of human-driven deforestation and land cover change in the Amazon basin and show how these alterations have influenced the coastal SSS in the western tropical Atlantic Ocean over recent decades. Overall, the findings from this project advance our understanding of the linkages between the hydrological cycle and coastal SSS, highlighting how natural variability and human activities jointly shape atmosphere–land–ocean interactions at the land–sea interface.

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