Geophysical Research Abstracts
Vol. 21, EGU2019-1467, 2019
EGU General Assembly 2019


# Quantifying Moisture- vs. Wind-Dominated Atmospheric Rivers

Katerina Gonzales (1), Daniel Swain (2,3,4), Elizabeth Barnes (5), Noah Diffenbaugh (1,6)

(1) Stanford University, Earth System Science, Stanford, United States (kgonzal@stanford.edu), (2) Institute of the Environment and Sustainability, University of California, Los Angeles, Los Angeles, CA, United States, (3) The Nature Conservancy of California, San Francisco, CA, United States, (4) Capacity Center for Climate and Weather Extremes, National Center for Atmospheric Research, Boulder, CO, United States, (5) Department of Atmospheric Science, Colorado State University, Fort Collins, CO, United States, (6) Woods Institute for the Environment, Stanford University, Stanford, CA, United States

Atmospheric rivers (ARs) are narrow filaments of concentrated water vapor transport and low-level winds. Upon landfall, ARs can induce extreme amounts of precipitation and high surface winds, leading to an array of downstream impacts–ranging from beneficial water resource gains to devastating floods and debris flows. Understanding the characteristics of ARs and the physical mechanisms that produce these resultant impacts is thus critical. Integrated vapor transport (IVT) has been recognized as the defining characteristic of AR intensity, with AR strength often categorized by an event's IVT and storm impacts (e.g. precipitation) often scaling close to IVT. However, ARs associated with similar IVT may yield very different impacts. As IVT is defined as the vertically-integrated product of moisture and wind velocity, we argue that individual ARs with similar IVT values can be either moisture- or wind-dominated. This relative partitioning of IVT between underlying kinematic and thermodynamic components within a given AR could potentially affect the efficiency of orographic precipitation and/or ambient atmospheric static stability during such events. We introduce a novel quantification of AR events on normalized moisture and transport axes based on climatological AR event values of precipitable water and IVT transport component. Using an AR catalog spanning 1980-2016 and the ERA-Interim reanalysis, our quantification of ARs on moisture and transport spectrums results in classification of individual AR events into multiple "flavors" or types: 1) high moisture and high transport values ("wet & windy"), 2) high moisture and low transport ("wet"), 3) high transport and low moisture ("windy"), or none of the above. We quantify the climatological distribution of all AR types along the west coast of North America. We quantify the seasonal and geographic distribution of AR types, and assess the relative impacts of wet vs. windy ARs upon landfall by comparing composite precipitation and wind speeds resulting from AR events of each type. We also investigate pre-landfall characteristics that govern the resulting AR flavor, including AR track pathways from genesis to landfall, theoretical thermodynamic upper limits to AR moisture content, and composite large-scale upper-level wind patterns.