On the Prediction of Extreme Weather Events

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Abstract

The Center for Western Weather and Water Extremes (CW3E) mission is to provide 21st Century water cycle science, technology, and outreach to support effective policies and practices that address the impacts of extreme weather and water events on the environment, people, and the economy of Western North America. To fulfill its mission, CW3E scientists and engineers develop predictive capabilities based on physics-based, deep learning, and data-driven models. Those generate accurate and reliable estimates of precipitation and other atmospheric and hydrologic variables and are utilized by water managers across the Western US for reservoir operations, as part of the Forecast Informed Reservoir Operations Program. The goal is to maximize the water supply and reduce the risk of flooding, for an effective climate adaptation strategy. We will describe these prediction methods, which include a version of the Weather Research and Forecasting model tailored for the prediction of extreme weather associated with atmospheric rivers over the Western US (West-WRF), a 200-member ensemble at 9-km based on West-WRF, and a deep learning algorithm applied in a postprocessing framework to the 200-member ensemble. We will also present a recently developed, high-resolution (6-km), artificial intelligence (AI) data-driven weather model. We will discuss its ability to learn the underlying physical processes and how it can be used to generate very large ensembles (+1000 members), to better sample the tails of the distribution and more reliably predict extreme weather.

Luca Delle Monache's Bio

Dr. Luca Delle Monache is the Director of Research of the Center for Western Weather and Water Extremes (CW3E), Scripps Institution of Oceanography, University of California San Diego. Dr. Delle Monache oversees the research and development of the Center's modeling, data assimilation, postprocessing, artificial intelligence, hydrology, subseasonal and seasonal, and supercomputing capabilities, with the goal of maintaining state-of-the-art models and tools while actively exploring innovative algorithms and approaches. In close coordination with the Center Director and the management team, he develops new scientific and programmatic strategies to maintain and further expand CW3E leadership on understanding, observing, and predicting extreme events in Western North America and other regions across the world. His interests include predicting extreme weather and water events via numerical weather prediction, data assimilation, artificial intelligence, and the design of ensemble methods for probabilistic prediction and uncertainty quantification. He has also made several contributions to renewable energy and air quality. He earned an M.S. in Mathematics from the University of Rome, Italy, an M.S. in Meteorology from San Jose State University, U.S., and a Ph.D. in Atmospheric Sciences from the University of British Columbia, Canada.