

AR Science, Natural Hazards Risk Reduction, and ARkStorm

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The ARkStorm Scenario project began in 2008, led by the USGS Multi-Hazards Demonstration Project (now USGS Science Application for Risk Reduction SAFRR) in an effort to innovate the application of science for the purpose of societal reductions of natural-hazard risks associated with large atmospheric river (AR) storms on the West Coast of the US, specifically focused on California. The effort involved participation and contributions from many federal, state and academic organizations including NOAA's Environmental Systems Laboratory. The ARkStorm project used new understanding of atmospheric river physics, combined with the downscaled meteorological data describing two recent ARs (in 1969 and 1986), to describe and model a prolonged sequence of back-to-back storms similar to the those that bankrupted California in 1862.

With details of this scientifically plausible (but not worst-case) scenario in hand, the ARkStorm team engaged the flood and levee community to identify plausible flooding extents and durations, created a coastal-storm inundation model (CoSMoS), and the California's first landslide susceptibility map (CGS), to better understand secondary meteorological and geophysical hazards (flood, wind, landslide, coastal erosion and inundation) across California. Thenceforth, physical damages to homes, infrastructure, agriculture, and the environment were estimated to calculate the likely social and economic damages to California and the Nation.

Across California, property damage from ARkStorm scenario was estimated to exceed \$300 billion, mostly from flooding. Additional demand surge, damage and losses, lifeline damages and business interruptions, brought the total cost of an ARkStorm-sized series of to nearly \$725 billion, nearly three times the losses estimated from another SAFRR scenario describing a M7.8 earthquake in southern California. Thus, atmospheric rivers have the potential to be California's other "Big One."

Since its creation, ARkStorm scenario has been explored in preparedness exercises by the NASA, the US Navy, the State of California, the County of Ventura and the cities therein, and the cities and counties in the Tahoe Basin and downstream into Reno, Carson City and the State of Nevada. These efforts have examined how the earthquake could plausibly impact a variety of aspects of society and environment, and has

informed these communities about practical resilience options that might avoid the worst of the disaster outcomes.