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Flooding in the Russian River Basin, CA. Photo by Dave Gatley, FEMA

Atmospheric Rivers

Atmospheric Rivers (ARs) are narrow corridors of concentrated moisture transported in the atmosphere, and are a key process linking weather and climate. ARs provide beneficial water supply and snowpack. When fewer than the normal number of ARs occur, drought often results. But ARs can also produce flooding rains that disrupt travel, induce mud slides, and cause catastrophic damage to life and property. Satellites help us detect ARs around the globe. However, once an AR hits land, other instruments and methods are needed for continued monitoring.

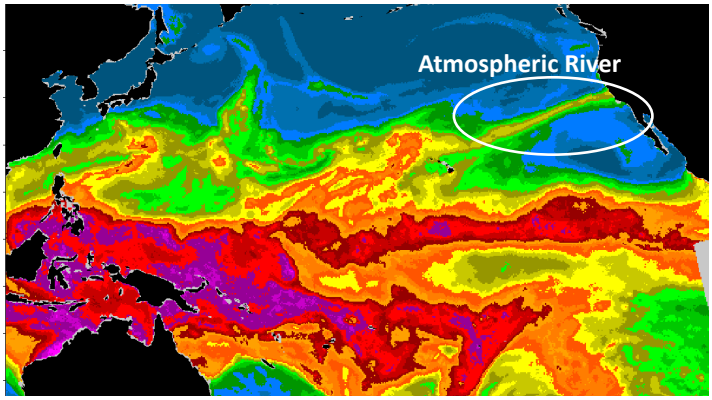
What is the role of atmospheric rivers in creating floods?

Research at NOAA's Earth System Research Laboratory (ESRL) used satellite data to show that during the winters (November – April) from 1997-2013, there were 164 days on which an AR impacted the California coast. The precipitation caused by these ARs can be beneficial to water supply, but can also lead to devastating floods. Collaborative research between ESRL and Scripps Institution of Oceanography indicates that ARs are responsible for 30-50% of all the precipitation that occurs in CA, OR, and WA.

Flooding caused by ARs will become increasingly important as costs associated with extreme weather events continue to increase. In 2011 and 2012 alone, weather-related disasters across the U.S. caused 1,107 fatalities and $188 billion in economic damages. Between 1954 and 2013, CA had received 79 presidential disaster declarations, of which more than half (46) were related to flooding.

How is this being addressed?

Research experiments performed by NOAA ESRL in the 1990's to better understand landfalling Pacific winter storms led to the development of the NOAA Hydrometeorology Testbed (HMT). HMT conducts research on precipitation and weather conditions that can lead to flooding, and fosters transition of scientific advances and new tools into forecasting operations.



Satellite image of an atmospheric river in February 2014

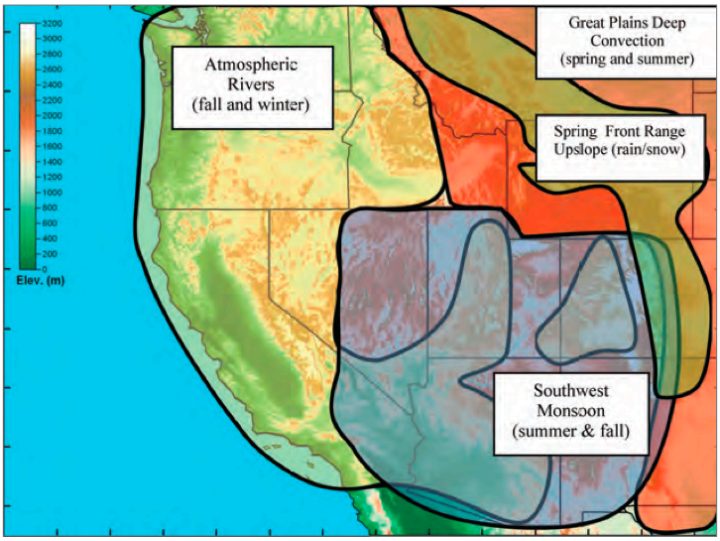
Within HMT, scientists have developed and prototyped an atmospheric river observatory (ARO) designed to further our understanding of the impact of ARs on enhancing precipitation in the coastal mountains and the high Sierra of California. A picket fence of these AROs is currently being implemented along the CA, OR, and WA coastlines with funding from the CA Department of Water Resources and the U.S. Department of Energy.

What are the benefits?

The community of flood control, water supply and reservoir operators of California sees ARs as a key phenomenon to understand, monitor and predict as they work to mitigate the risks of major flood events. Long-term monitoring using satellite measurements, offshore aircraft reconnaissance, and land-based AROs will allow better coupling of climate forecasts with seasonal weather forecasts to improve water management decisions.

For more information, visit:

www.esrl.noaa.gov/psd/atmrivers/
www.esrl.noaa.gov/psd/data/obs/
hmt.noaa.gov



Regional variations in the primary sources of Western extreme precipitation.

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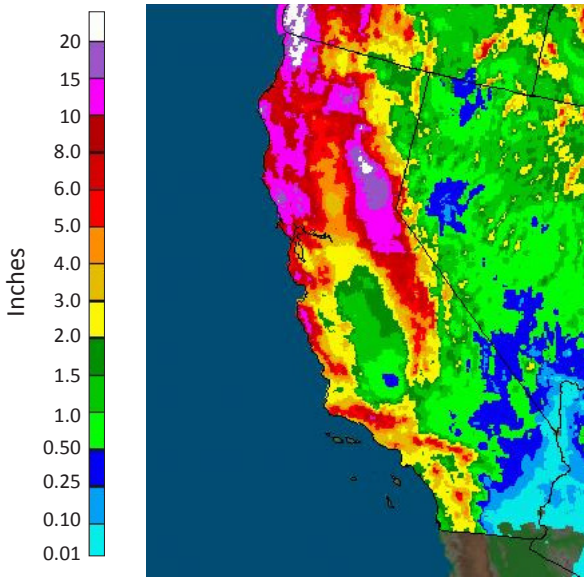
NOAA electronics engineer Tom Ayers installs equipment for an atmospheric river observatory in Bodega Bay, California.(Credit: California Department of Water Resources)

Torrential rain from a severe winter storm causes the Russian River to spill over into this vineyard in Sonoma County, CA. (Credit: Adam DuBrowa, FEMA)



Monthly observed precipitation for Feb 2014. Three atmospheric rivers were responsible for delivering most of this precipitation. (Credit: NOAA/NWS Advanced Hydrologic Prediction Service)