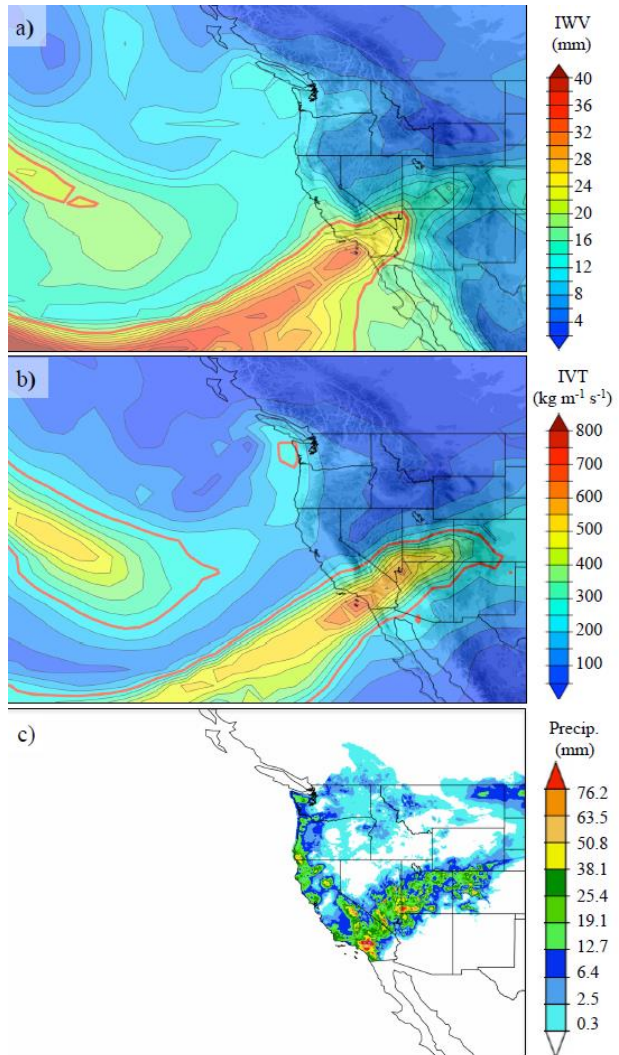


## Atmospheric Rivers and the Colorado Basin

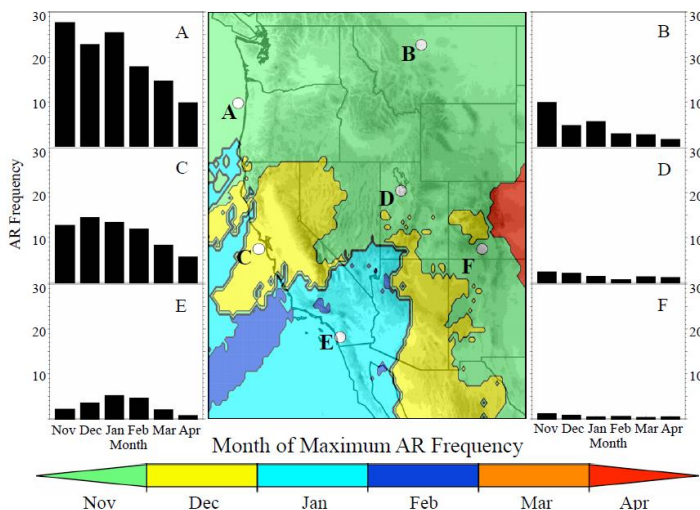
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- Atmospheric rivers (ARs) are long (>2000 km), narrow (>1000 km), low-level (below ~600 hPa) plumes of enhanced water vapor flux
- Research suggests the importance of water vapor channeling up the Colorado River basin
- Associated with severe weather across the western US
- Lessening influence of the AR deeper into the interior of the continent.

Atmospheric Rivers (ARs) historically...	Quantitative Finding	References
<b>Cause the heaviest West Coast rains</b>	92% of West Coast's heaviest 3-day rain events fed by ARs	Ralph & Dettinger, BAMS, 2012
<b>Fill CA reservoirs &amp; provide supplies</b>	30-50% of Sierra Nevada rain, snow & streamflow from ARs	Guan et al., GRL, 2010; Dettinger et al. Water, 2011
<b>End West Coast droughts</b>	40% of droughts in northern California ended by an AR	Dettinger, JHM, 2013
<b>Cause CA floods</b>	80-100% of major floods in central California rivers have been fed by ARs	Ralph et al., GRL, 2006; Dettinger & Ingram, Sci Am, 2013
<b>Sustain wetlands, floodplains &amp; fisheries</b>	ARs initiated 77% of ecologically significant inundations of Yolo Bypass, Central Valley	Florsheim & Dettinger, book chapter, 2014
<b>Breach levees</b>	81% of Central Valley levee breaks have happened during landfalling ARs	Florsheim & Dettinger, book chapter, 2014
<b>Can cause catastrophes</b>	"ARkStorm" California flood scenario yields estimated >\$500B impacts	Porter et al., USGS OFR 2010-1312
<b>Sometimes penetrate far inland</b>	ARs have caused major storms in Arizona, Utah, and other Western states	Rutz & Steenburgh, ASL, 2012; Neiman et al., JHM, 2013
<b>Occur over all extra-tropical ocean basins</b>	More than 129/yr detected globally, May 2008-April 2010	Waliser et al., BAMS, 2012
<b>Can be monitored usefully</b>	Multiple methods are available, including in situ, radar, aircraft & satellite	White et al., JAOT, 2013
<b>Can be forecast</b>	ARs can be seen >5 days ahead; landfall position error is still large	Wick et al., WAF, 2014
<b>Need improved forecasts</b>	Of 16 AR storms that caused >5 inch of rain, only 2 forecast	Ralph et al., JHM, 2010



### Summary of AR research by Mike Dettinger



(a) IWV and (b) IVT at 0000 UTC 21 December 2010. Thick red line in (a) and (b) denote threshold values of 20 mm and 250 kg m<sup>-1</sup> s<sup>-1</sup>, respectively. (c) Advanced Hydrological Prediction Services Accumulated precipitation analysis for 24-h period ending 1200 UTC 21 December 2010 (Rutz et al. 2013 Monthly Weather Review).

Month of maximum AR frequency based on IVT250. Histograms of IVT250 AR frequency by month at selected coastal (left) and interior locations (right) (Rutz et al. 2013 Monthly Weather Review).