Atmospheric River Event over the Eastern Pacific in February 2014: Analysis and Climatological Context

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Atmospheric rivers (ARs) are narrow and intense plumes of water vapor that are known causes of heavy precipitation events. This is an analysis of the evolution, transport, and landfall of a significant AR event in February 2014 over the Eastern Pacific and West Coast of the United States, considered in a climatological context. Integrated Water Vapor (IWV) and Integrated Vapor Transport (IVT) values are calculated based on NASA MERRA and ECMWF ERA-Interim reanalysis datasets. The AR is characterized by high levels of IWV (~29 mm) as well as IVT (~759 $kgm^{-1}s^{-1}$) [Fig. 1 (a)]. Analysis of the synoptic-scale progression of upper-level extratropical cyclones and anticyclones [Fig. 1 (b)] shows the flow of vapor transport in a narrow channel approximately 450 km in width and 2600 km in length. The precipitation resulting from the inland penetration of this AR is also analyzed.

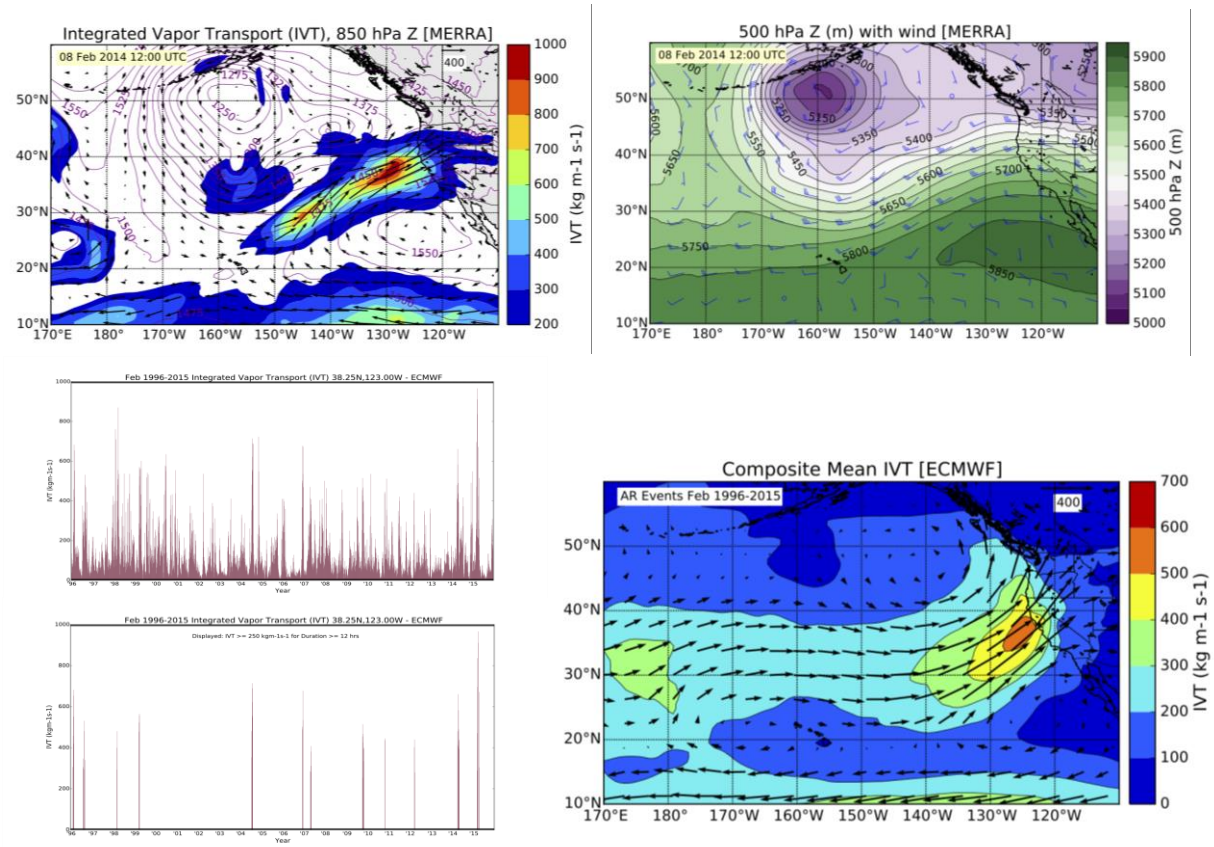

Fig. 1: (Clockwise from top left) (a) IVT and 850 hPa Z, 8 Feb. 2014; (b) 500 hPa Z and wind; (c) composite mean IVT, Feb. 1996-2015; (d) IVT, Feb. 1996-2015, at 38.25N,123.00W.

To consider this event in a climatological context, IWV and IVT data are derived from ECMWF for the month of February over the 20-year period from 1996-2015. Dates of observed landfalling ARs for water years (WYs) 1998-2008 that impacted the California coast (32.5N-41.0N) are obtained from SSM/I [Dettinger 2011]. Dates for February 1996-1997 and 2009-2015 are based on ECMWF with the constraint that IWV ≥20 mm for observations that are 12 hrs. apart. It is observed that the February 2014 AR event is one of five significant events in the 20-year period, as measured by IWV ≥30 mm. An algorithm was developed to filter the raw data in order to meet a threshold of ≥20 mm (IWV) and ≥250 $kgm^{-1}s^{-1}$ (IVT) for a duration of ≥12 hrs. to expose values that represent AR events [Fig. 1 (d)]. A composite mean of the IVT values is also calculated [Fig. 1 (c)], showing peak IVT of 500-600 $kgm^{-1}s^{-1}$ at the core of the composite AR.

References:

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