Monitor atmospheric river initiation, evolution and impacts on N. America from joint satellite moisture, wind vector and precipitation information

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Atmospheric river in North America has significant impact on water resources over the coastal region. Currently, three different variables are closely related with AR and are observed by multiple satellite platforms: the integrated water vapor (IWV), the surface wind vector, and the precipitation. These variables, being put together, will describe the full process of the AR events. This study aims to provide a comprehensive satellite-oriented information for monitoring the Atmospheric River processes from the initiation to the landfall dissipation. This study focuses on the AR events since 2000 March till 2015 December and especially the three aspects of AR events:

1. **The start date-time and ending date-time of the AR event.** Each AR event has an initiation time and ending time, therefore it is critical to identify these timings for each AR events.
2. **The amount of precipitation introduced by AR**. Over the coastal region and inland region, it is desirable to discriminate AR-related precipitation and non-AR related precipitation amount each year.
3. **The water vapor transport (WVT) amount.** The water vapor transportation rate and transportation amount is an important indicator for estimating the intensity of an AR event.

For the first and second aspects of AR, the PERSIANN-CONNECT, an object-oriented global precipitation extreme database, is used to classify AR and Non-AR events over N. America.

Subsequently, when AR event is identified in the PERSIANN-CONNECT database, its initiation time and ending time are identified and the AR-introduced precipitation can be quantified.

For the last aspect, because AR event usually last one days to three days, it requires hourly sampled and gap-free water vapor imageries for estimating the WVT. There are two major obstacles in getting water vapor observations in high resolution and frequently sampled for studying AR events: first, the infrequent orbital observations from the microwave sensors (about 4-5 orbiting platform with scanning rate of twice a day). Second the microwave sensors have limited swath width and has considerable portion of "gap". To overcome this low sampling-rate from satellite, we apply the 3D nearest-neighbor interpolation method to get the gap-free IWV image with higher sampling rate (hourly).

Our results summarize characteristics of the 576 identified AR events for the past 16 years. As for the timings of AR, the most frequent AR year is 2005 and 2010, whereas the most AR precipitation month is December and January. For the duration of AR events, more than 70% percent of the AR event lasted less or equal than five days. The accumulative WVT during AR event is highly correlated with the AR introduced accumulative precipitation. Lastly, our results find the AR event is highly correlated with the dominant patterns of precipitation in western US.