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

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## Introduction

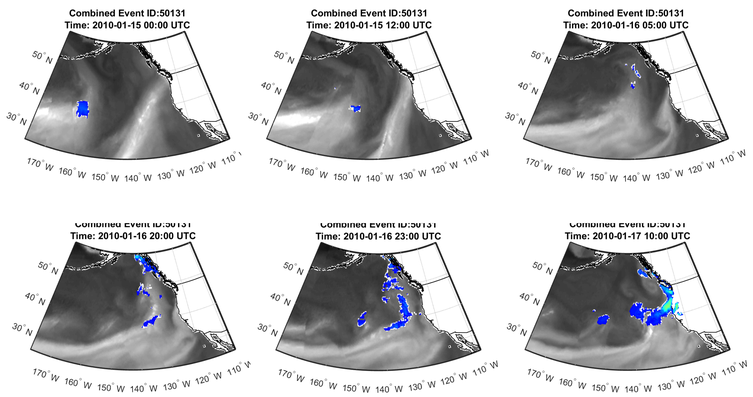
**The Background:**

• Atmospheric rivers (ARs) is a **fast evolving** phenomenon and require high sampling frequency to observe and study

• Popular classifier for AR events are based on column-integrated water vapor's shape and threshold **and they are usually based on daily data or 6-hourly.**

•The currently-available Satellite-observed **water vapor data** can be interpolated **into hourly resolution.**

• Combine Satellites CHRS-CONNECT database is available in **hourly resolution**. and **hourly water vapor imageries** provides unique insight on how water vapor "river" convert into precipitation over the land region.




**The goals of this study:**

1. Develop long-term high-resolution Satellite-based AR event database **with *both precipitation and water vapor*** for water resource study.
2. Study the basic statistical characters of these identified AR events
3. Explore the possibility of building global AR event database with high-resolution data.
4. Make visualization and education of AR events easily accessible to general public and water-resource management agencies.

## Data

**Study area:** Western United States

**Datasets:** Precipitation: GOES-based CHRS-CONNECT (Precipitation Estimation using Remote-Sensing Information – Artificial Nueral Network, PERSIANN) (http://connect.eng.uci.edu)

Water vapor: Water vapor (from GMI, TMI, SSM/I, AMSR, AMSR-E, AMSR-2), Downloaded from http://www.remss.com

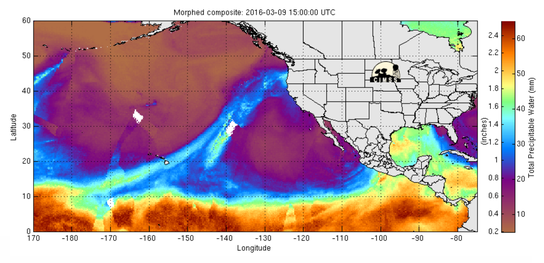
**Resolutions:** 0.25° × 0.25° and hourly,

**Study periods:** Mar. 2000 to July. 2015

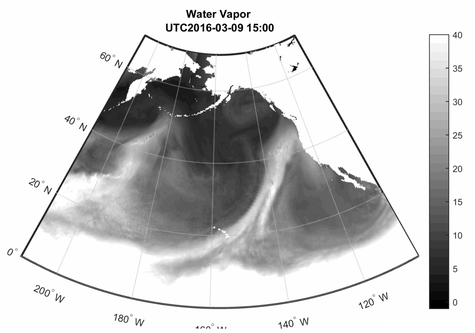
## Methodology

1. **Automatically classify AR event from CHRS-CONNECT**
   a. Caused precipitation in California region
   b. Moving from Pacific region to inland region
2. **Interpolate Multi-source Column-integrated water vapor data into hourly data.**
   - **In-house algorithm** and code was developed to complete the Water Vapor data interplotation
   - Code was optimized for **High Performance Computing**

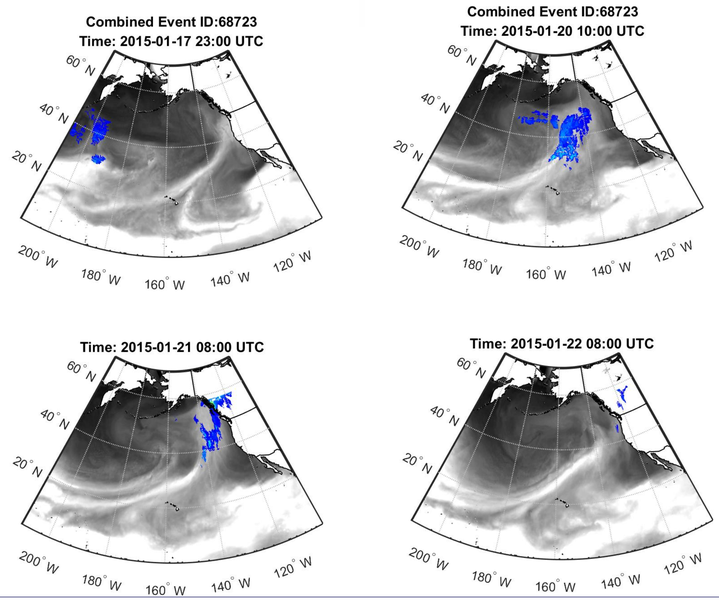
## Results (I) AR Visualization



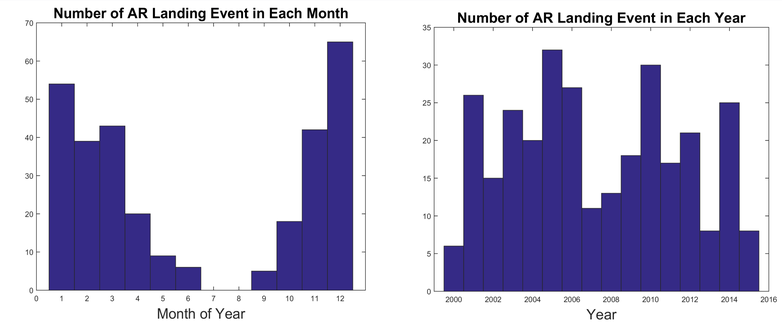

1. Gaps
2. Patches
3. No data
4. No code
5. Only imagery




1. No Gap
2. Smooth
3. Provide data
4. Open Source Code
5. Customizable imagery




## Results (II) AR statistics




**Results:**

1. Total of 301 CHRS – CONNECT event are classified as AR event for California region.
2. Monthly occurrence: AR has very significant seasonal pattern.
3. Annual occurrence: AR event's occurrence varies greatly from year to year, the resulted precipitation from AR also correlates with AR occurrences
4. After the AR landed (i.e., water vapor flux begin to form precipitation over the land region), the AR will continuously form precipitation for as long as 100 hours.

## Conclusions

1. **In hourly time-scale, AR event is still highly dynamic and fast-evolving.**
2. **Hourly Water Vapor and Precipitaion Imageried can be used for identify the Atmospheric River on-the-run**
3. **CHRS-CONNECT is effective for indexing the timing and accumulative rainfall over both land and ocean.**

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