Classification of atmospheric river events on the U.S. west coast using a trajectory model

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Introduction

There are different contributions of each trajectory type to precipitation:

- AT-only: high precipitation
- AT + AE: high precipitation
- AT + DE: high precipitation
- AT + AE + DE: high precipitation

Data and Method

- Method: K-mean clustering method in order to classify the trajectories. To remove the dry trajectories, we only select back-trajectories with specific humidity (q) larger than 1 g kg⁻¹ along the trajectory at the target region and time.

Results

Types of trajectories during AR events

Illustrative examples

1) Illustrative examples

- We designate the first type as Ascending near landfall and of Tropical Origin (AT), the second type as Ascending near landfall and of Extratropical Origin (AT+AE), and the third type as Descending or parallel near landfall and of Extratropical Origin (DE).

Classification

- The majority of AR events (about 85%, 120 out of 149 AR events) over the west coast of the U.S. are associated with three trajectory types.

Preliminary and AR Trajectories

- AT-only: high precipitation
- AT + AE: high precipitation
- AT + DE: high precipitation
- AT +AE + DE: high precipitation

Precipitation and AR Trajectories

For all events, the minimum surface pressure (less than 990 hPa) from the northern Pacific basin penetrates further southward.

- AT-only precipitation
- AT + AE precipitation
- AT + DE precipitation
- AT + AE + DE precipitation

Characteristics of meteorological fields

- A plume of large tropospheric and extratropical origin
- AT-only trajectories

Anticyclonic RWB types (73 events)

- AT-only: high precipitation
- AT + AE: high precipitation
- AT + AE + DE: high precipitation

Vorcore integrated water vapor fluxes

- The vertically integrated water vapor fluxes are large for AT-only precipitation

Summary and Conclusions

- The majority of AR events (86%) in the western U.S. are related to one of the three trajectory types.

References