

# The Modulation of Atmospheric Rivers by Circulation Regimes in the ECMWF Coupled Model: Fidelity and Resolution Dependence

Presenter: Mary H. Korendyke  
 Advisor: David M. Straus

## BACKGROUND

Large scale circulation has significant influence on storminess and precipitation extremes. Atmospheric rivers are related to extreme precipitation. What is the impact of enhanced resolution on simulating circulation regimes? On the regime dependent atmospheric rivers?

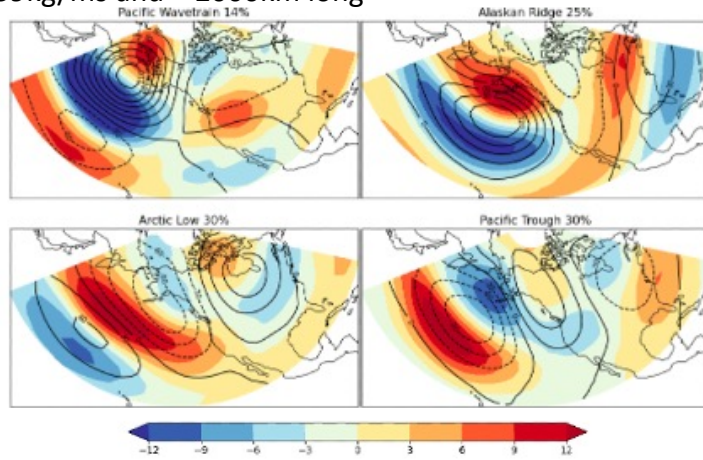
## DATA

- PacNA region 1986-2016 NDJFM, ND
- ERA5 reanalysis
- ECMWF Coupled Model Metis, November initialization
  - 3 resolutions: Tco199 (100km), Tco639 (31km), and Tco1279 (16km)

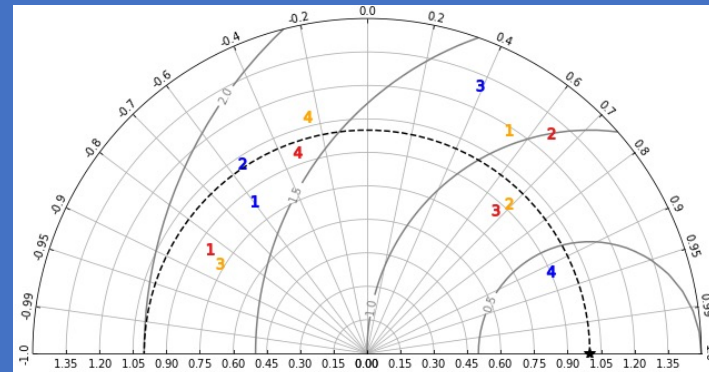
## METHODS

- Interpolate all data onto Tco199 grid
- Regimes: Principal Component Analysis on z500, u250, K-means clustering on 12 leading PCs
- Total moisture flux representation
- Rivers: Contiguous points of column-integrated moisture flux above 259kg/ms and > 2000km long

ERA5 ND regimes. Anomalies: Z500 (30m) shading, U250m/s (3m/s) contours.



**Regimes and the Three Resolutions:**  
 Given coarse, medium, and high-resolution ECMWF Metis reforecasts:  
*The medium resolution best represents Pacific North American circulation regimes.*



4 regimes calculated in **Metis199**, **Metis639** and **Metis1279**, shown in a Taylor Diagram. **Metis639** reproduces **ERA5** regimes the best.

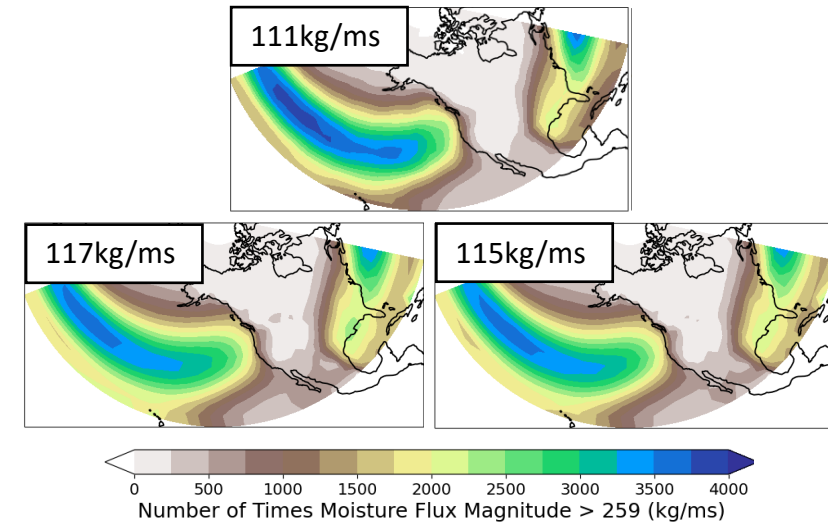
mkorendy@gmu.edu  
 Paper and Github:



## RESULTS For Moisture Flux Distribution

- Although Metis moisture flux magnitude on average is larger than ERA5, Metis moisture flux does not cross the atmospheric river threshold (259kg/ms) as often as ERA5.
- This leads to some undercounting of the atmospheric rivers in Metis.

NDJFM. Top: ERA5. Bottom: Metis199 and Metis639 ensemble-weighted times (25 ensembles), left and right respectively. Average moisture flux in top left corner.



## ONGOING WORK

- **Atmospheric River Algorithm:** Inclusion of width and directional requirements leads to unacceptable sensitivity to interpolation of circulation and moisture fields. Current work to identify regime atmospheric river characteristics involves the new algorithm detailed in the Methods section.