Visualizing Drivers Associated with West Coast Atmospheric Rivers using a Deep Learning Framework

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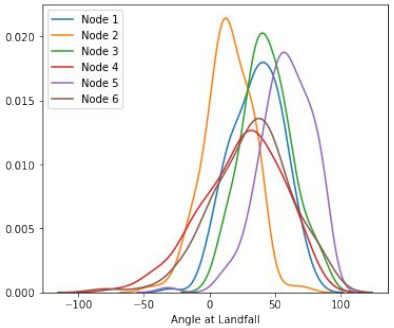
Goal: To find sources of predictability for distinct west coast AR large-scale meteorological patterns (LSMPs) impacting different latitudes and with different angles of approach at landfall.

Generating the Categorization Labels

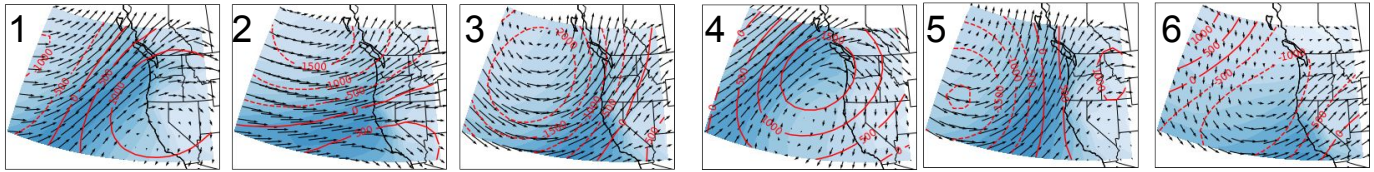
Atmospheric river days are selected using version 1.1 of the algorithm described in Goldenson et al (2018).

We group historical days with AR conditions using a self-organizing map (SOM) based on large-scale fields.

The patterns vary with latitude and also angle and IVT at landfall.

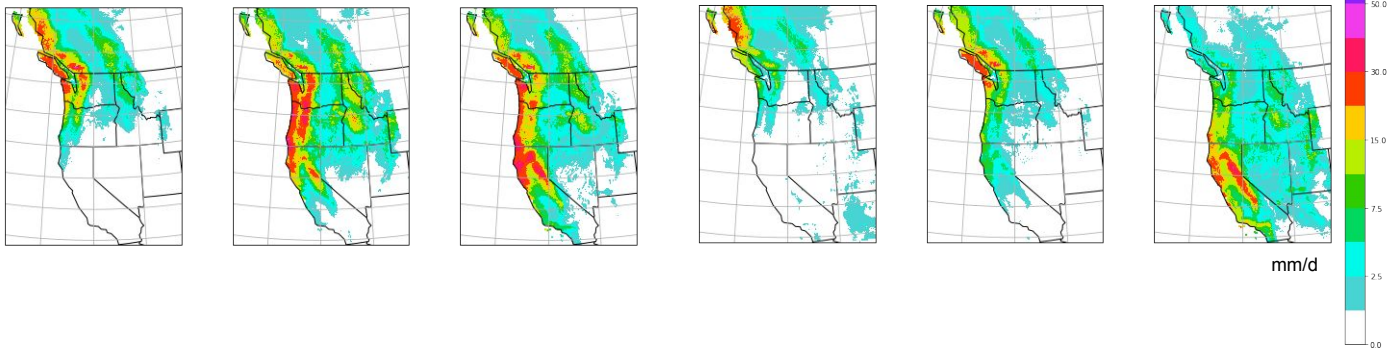


SOM-derived Large-scale Meteorological Patterns (LSMPs) for atmospheric river days:



(blue shading is TMQ, red contours are 500 mb height anomalies, vectors are 700mb winds)

Daymet precipitation composites for historical days assigned to each LSMP:



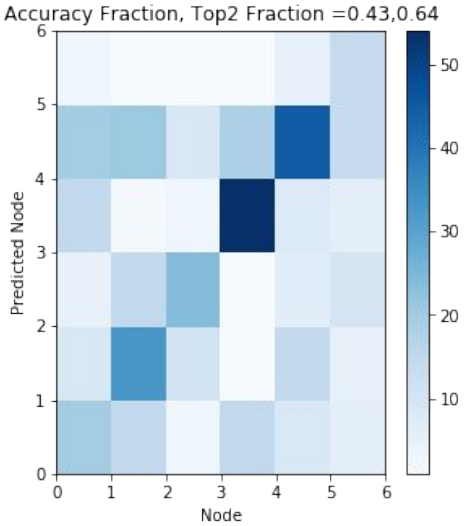
PART 2: the neural net

To understand the drivers of these patterns, we use a neural net to predict them based on upsteam winds with various lead times, using a 20-day running mean of the 850 mb zonal winds to represent the eddy-driven jet.

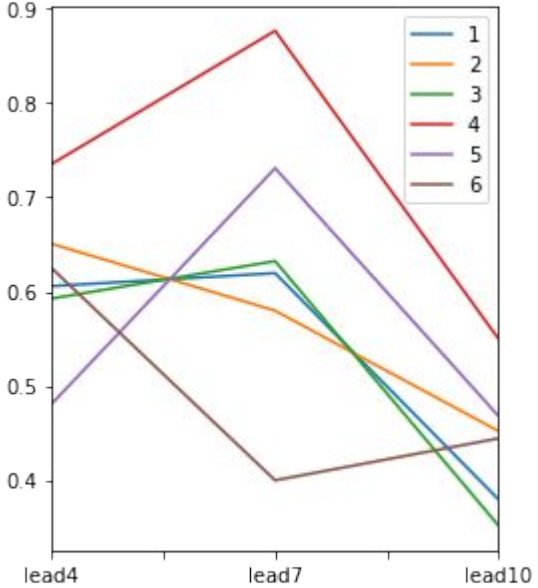
Data is divided in half for training and testing. In the testing data, predictability various across patterns 1-6.

This is called “semi-supervised” learning because it predicts the label when the labels themselves are the result of an algorithm instead of manually-generated.

Fraction of the time that the correct node is deemed the most likely for 7-day lead:



Mean probability assigned to the correct node:

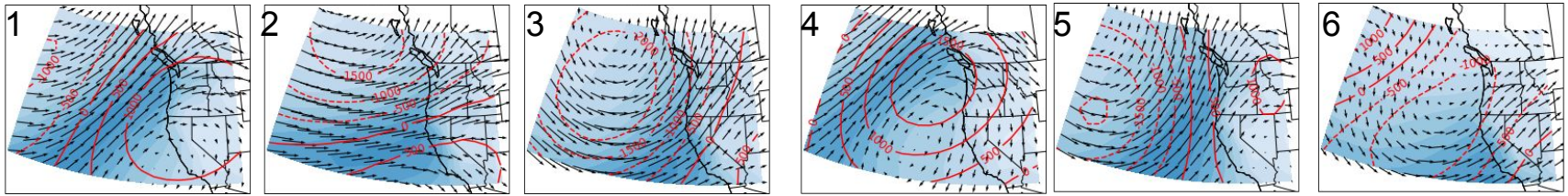


Jet exit region often has the highest relevance, with specifics depending on the pattern

HYPERFACETS

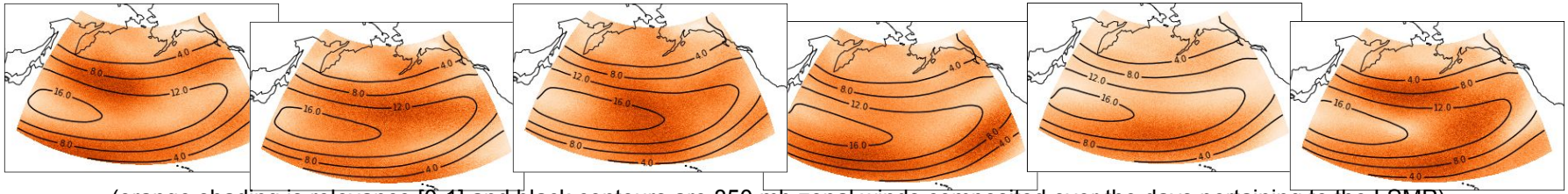
UCLA Center for Climate Science

SOM-derived patterns for AR days:



(blue shading is TMQ, red contours are 500 mb height anomalies, vectors are 700mb winds)

LRP relevance heatmaps:



(orange shading is relevance [0-1] and black contours are 850 mb zonal winds composited over the days pertaining to the LSMP)