

California DWR and WSWC 2018 Seasonal to Sub- Seasonal Workshop

CUT OFF LOW PRESSURE
SYSTEMS

ROGER V. PIERCE

NOAA &

WESTERN STATES FEDERAL
AGENCY SUPPORT TEAM
(WESTFAST)

WestFAST

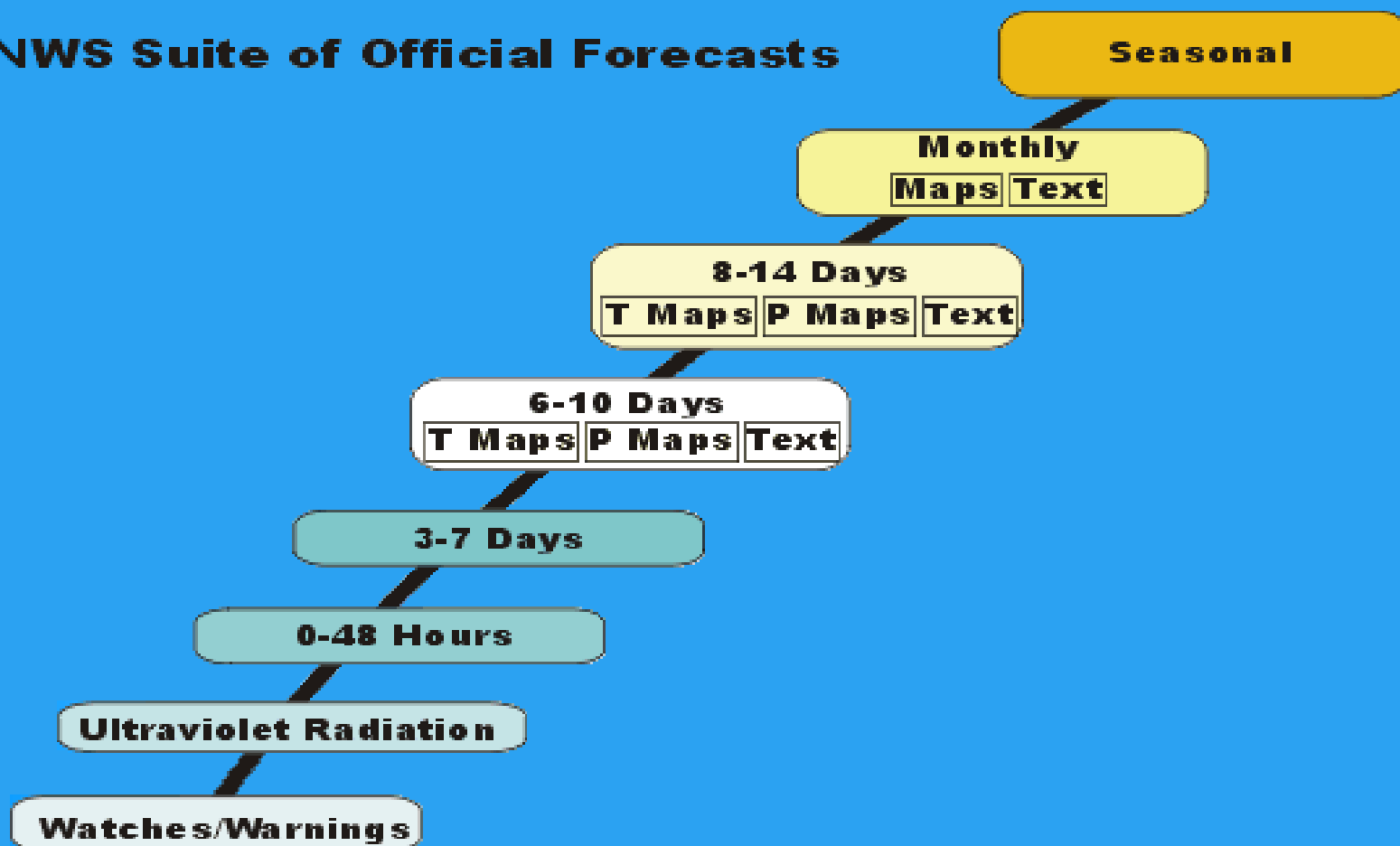
Environmental Protection Agency
National Oceanic Atmospheric Adm.
Bureau of Reclamation
Bureau of Land Management
U.S. Geological Survey
U.S. Fish and Wildlife Service
U.S. Forest Service
Natural Resources Conservation
Service
U.S. Army Corps of Engineers
U.S. Department of Defense
U.S. Department of Energy
National Aeronautics & Space Adm.

NOAA National Centers for Environmental Prediction

- ▶ Aviation Weather Center (AWC)
- ▶ **Climate Prediction Center (CPC)**
- ▶ Environmental Modeling Center (EMC)
- ▶ Weather Prediction Center (WPC)
- ▶ NCEP Central Operations (NCO)
- ▶ National Hurricane Center (NHC)
- ▶ Ocean Prediction Center (OPC)
- ▶ Storm Prediction Center (SPC)
- ▶ Space Weather Prediction Center (SWPC)

NWS Product Focus

NWS Suite of Official Forecasts



U.S. Hazards
Assessment

Base-Period
Means

Wind Chill
Index

Monthly & Seasonal
SST Forecasts
Nino 3.4

Official
SST
Forecast

SST
Base-Period
Means

Climate Prediction Center

ORIGIN OF THE FORECAST PRODUCTS...

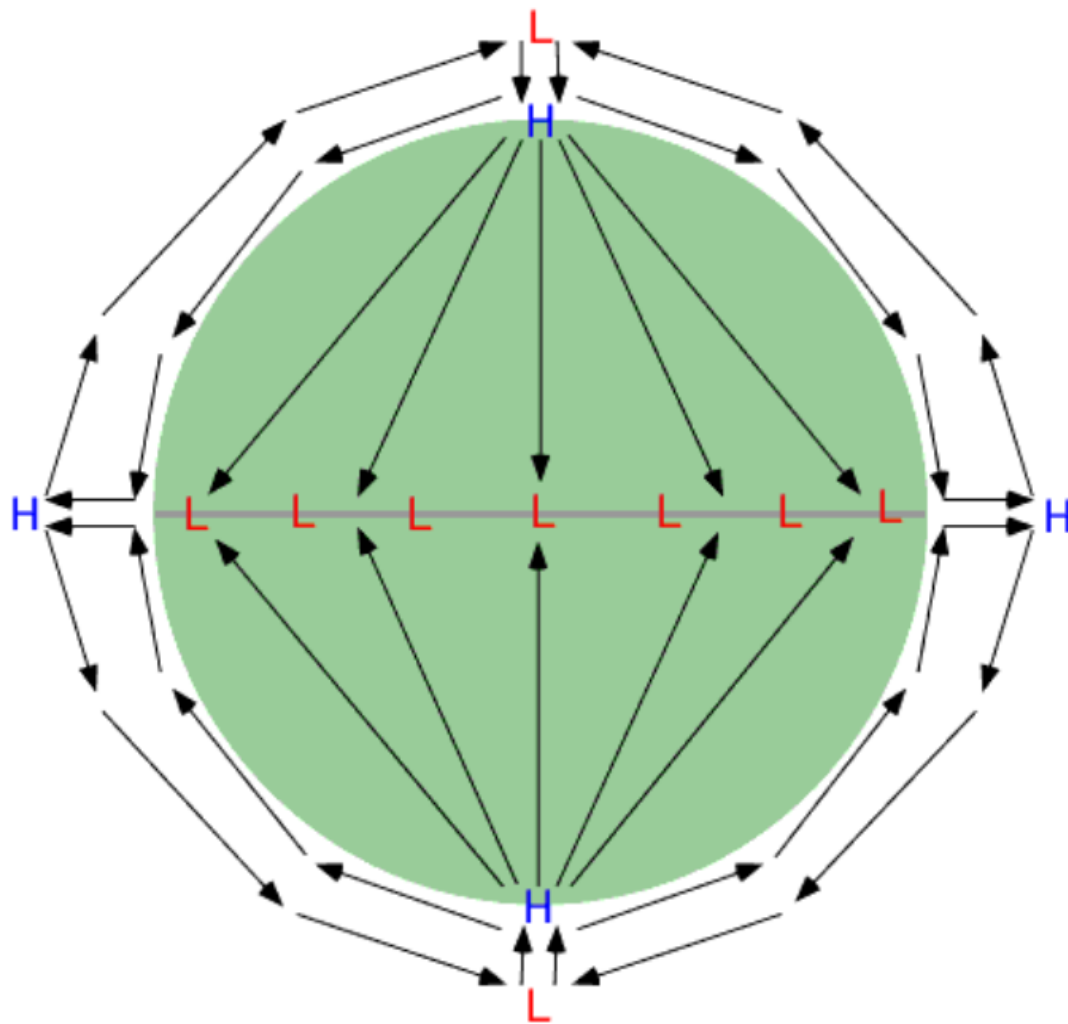
WITH HELP FROM:

- Weather Forecast Offices
- NOAA Satellite Information Service
- NOAA Ocean Service
- National Data Buoy Center
- NOAA Research
- Scripps – and many other research and data collection organizations

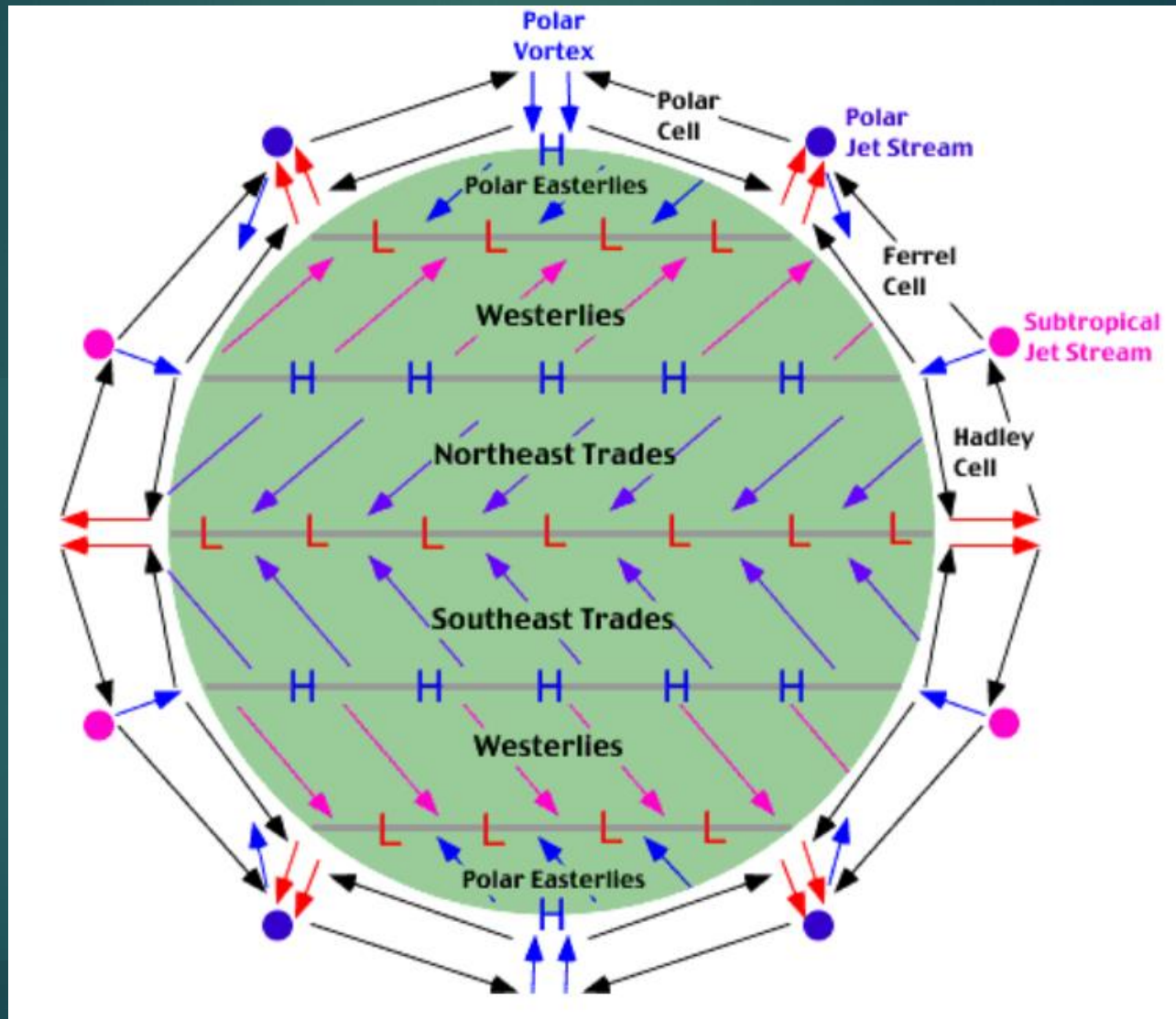
Cut Off Low Pressure Systems (Blocking Pattern)

- ▶ Omega Block
- ▶ Rex Block
- ▶ Cut off /Blocking High Pressure
- ▶ Cut Off Low Pressure

Simplified Global Winds



More Realistic Flow

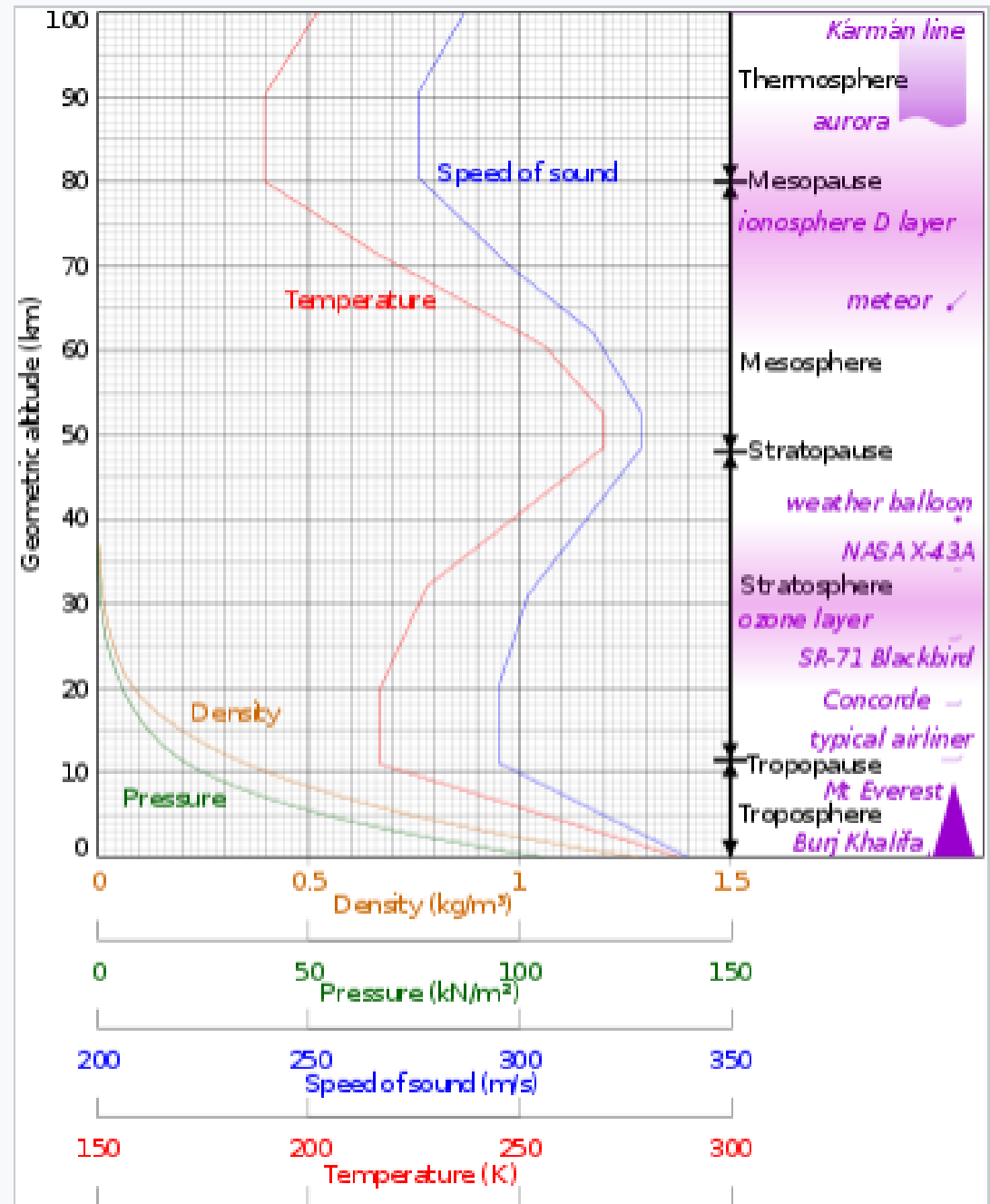


Vertical Structure of the Atmosphere

Trop– 35,000 ft

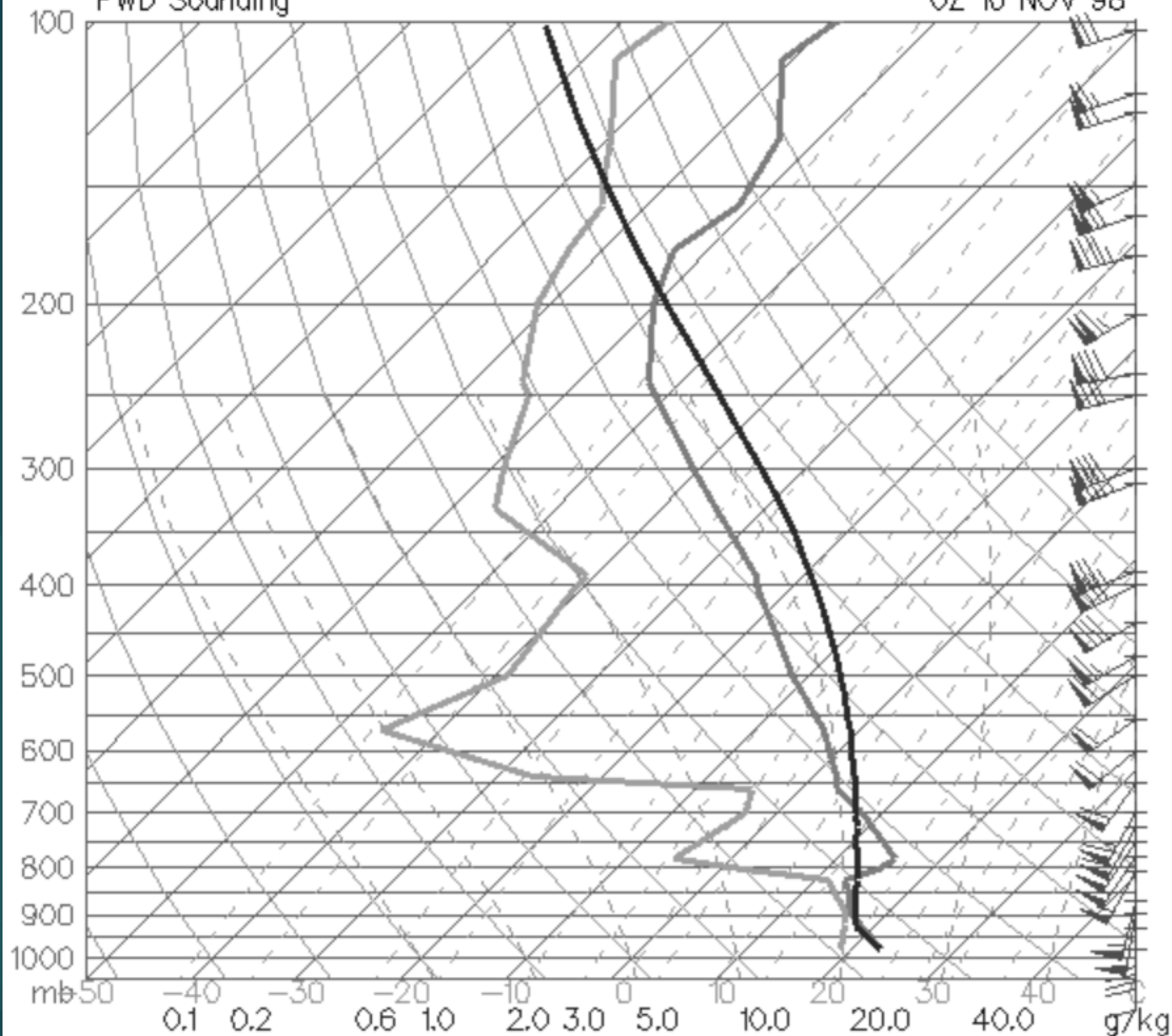
Strato– 100,000 ft

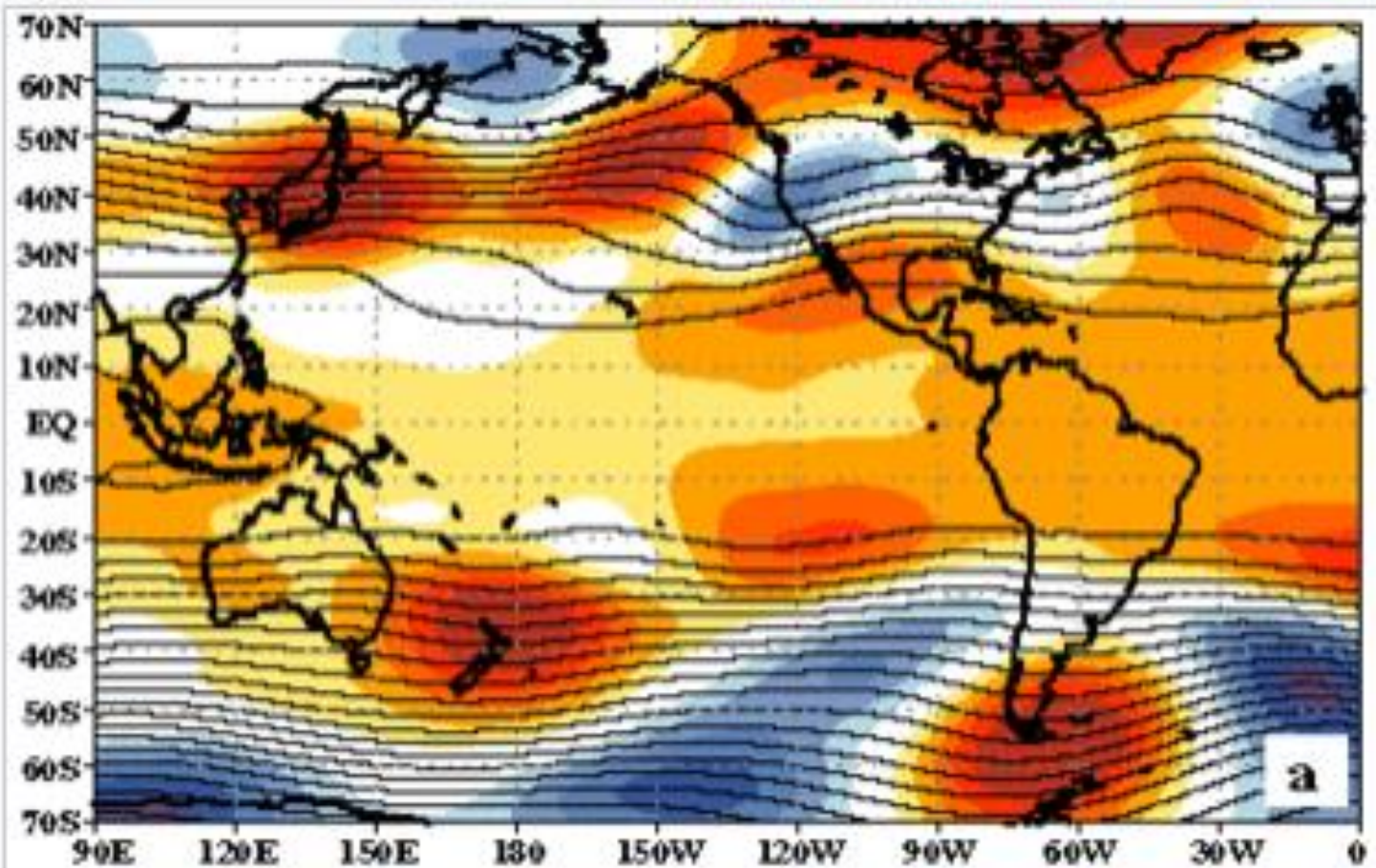
StraPause– 160,000 ft



FWD Sounding

0Z 10 NOV 98





A **zonal flow regime**. Note the dominant west-to-east flow as shown in the 500 hPa height pattern.

Westerlies - Wind Pattern Flows West to East



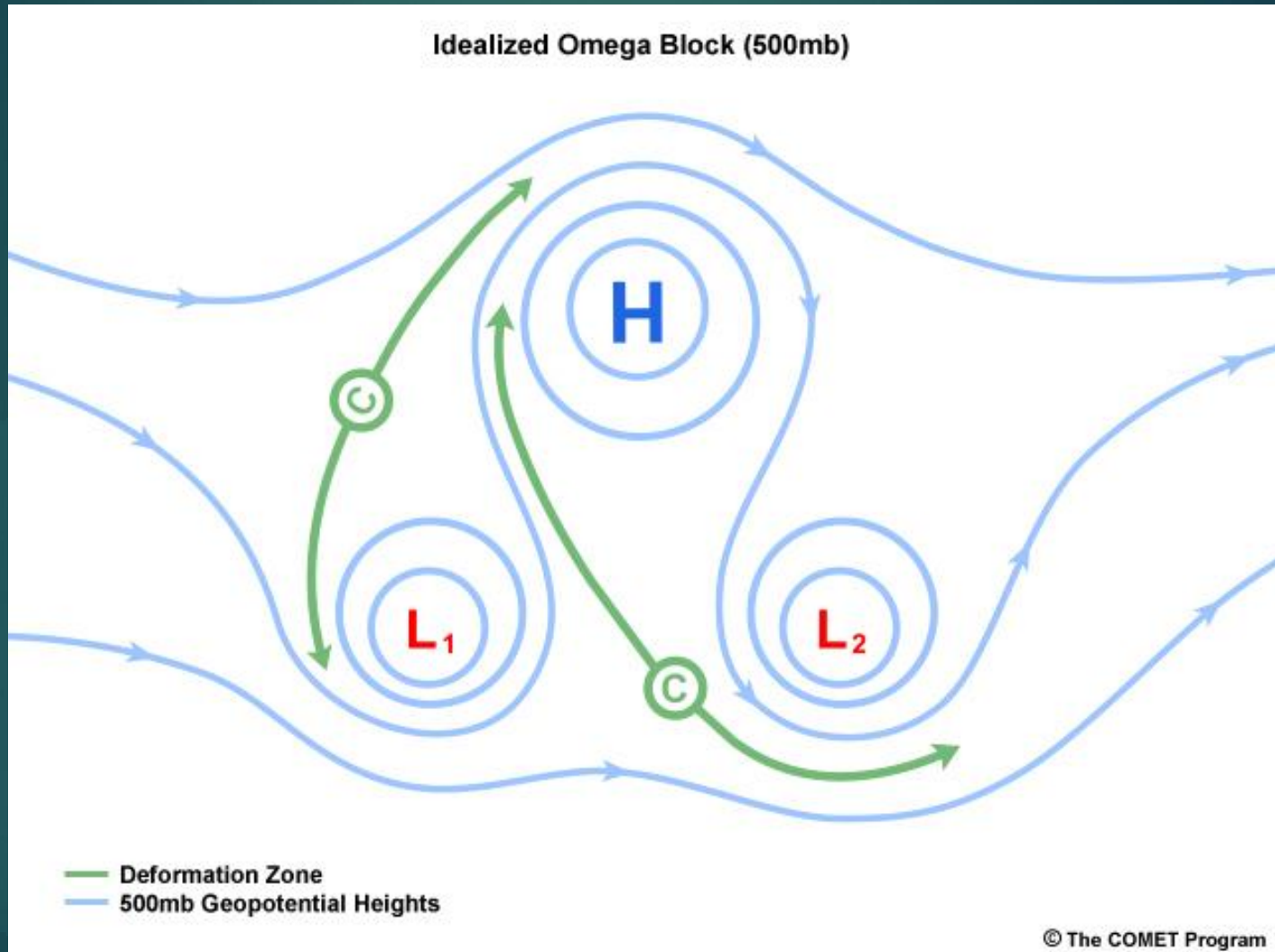
Westerlies - Wind Pattern Flows West to East

- ▶ <https://earth.nullschool.net/#current/wind/surface/level/orthographic=-133.12,9.81,263>

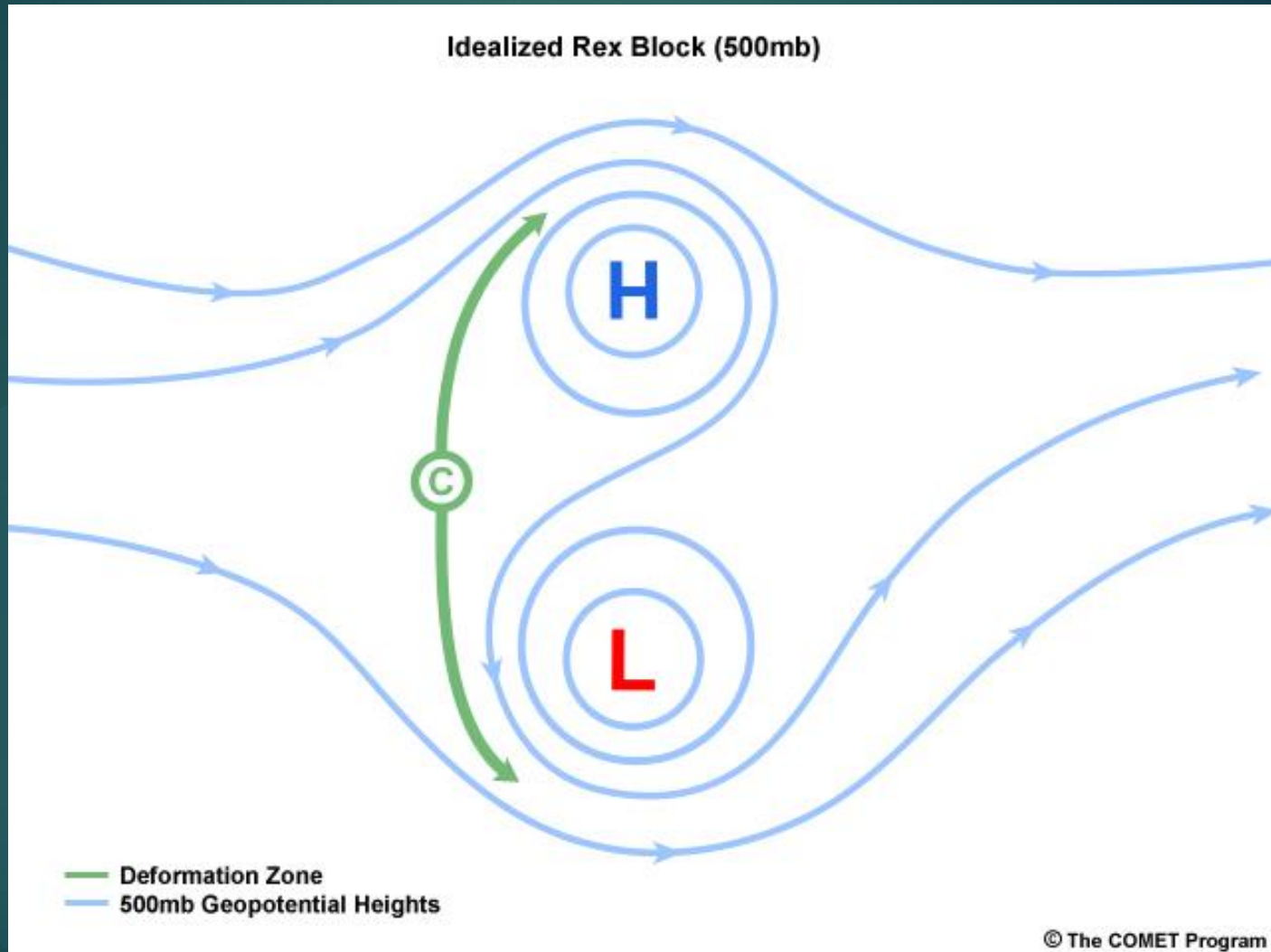
What causes it to cut off?

- ▶ Low starts off as a small wave in the westerly winds
- ▶ Winds increase on the west and south side as this “wave” decreases in pressure
- ▶ If the winds increase enough, it produces a breaking wave pattern such that as winds increase further and round the bottom of the low pressure system
- ▶ It breaks away from the westerly flow and nearby induced high pressure forces winds around the low pressure, further cutting it off from the main stream flow

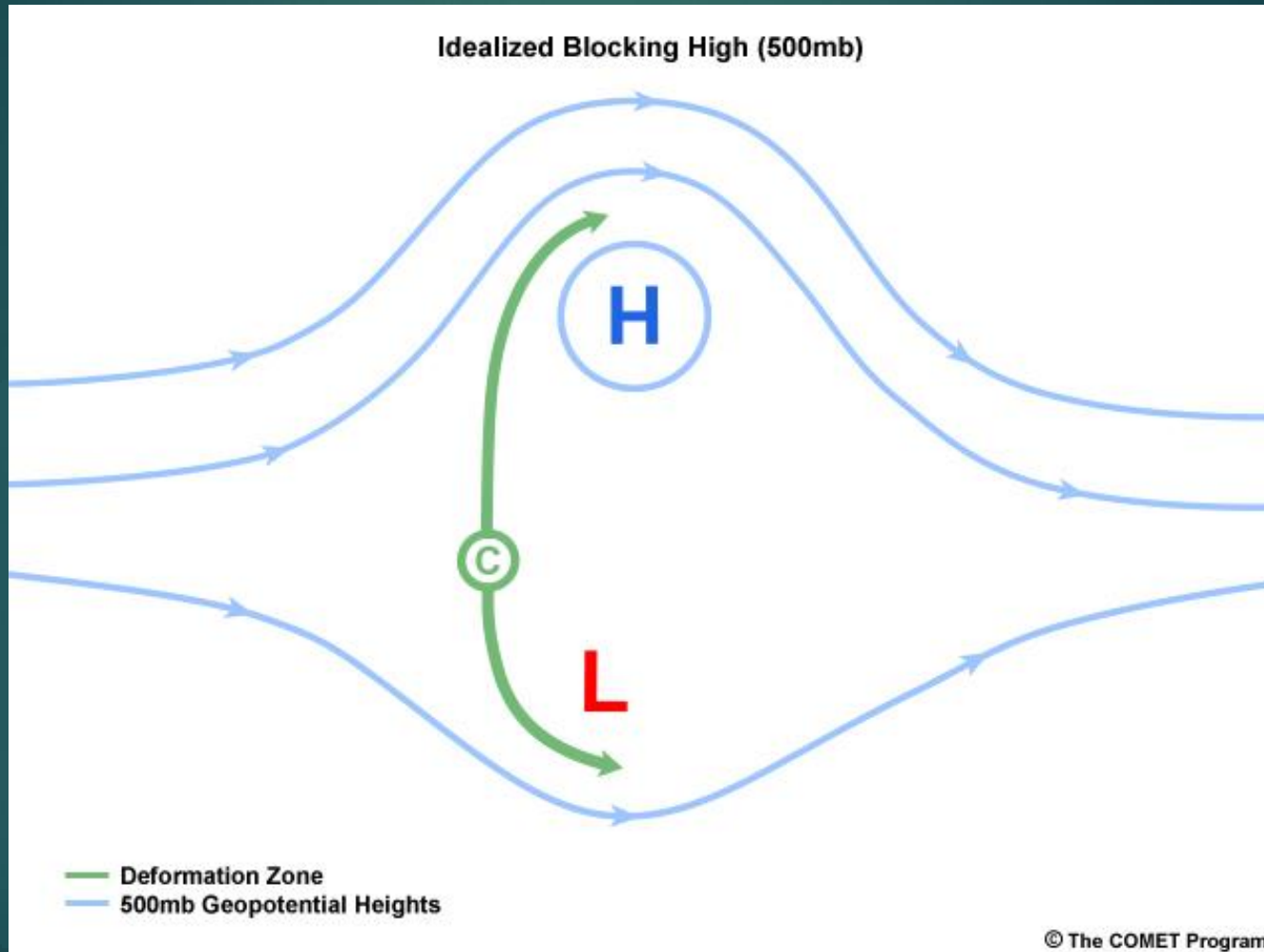
Omega Block



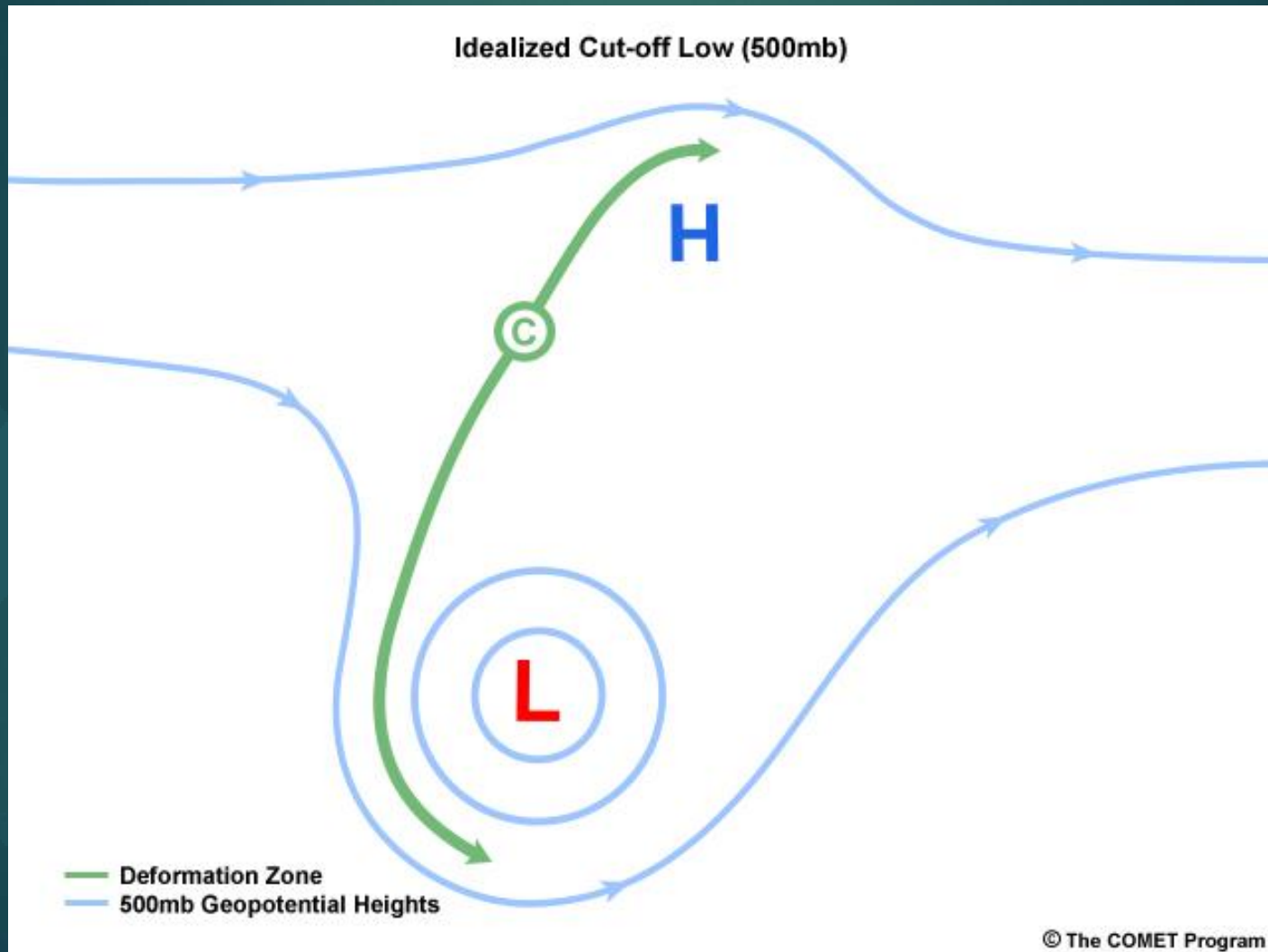
Rex Block

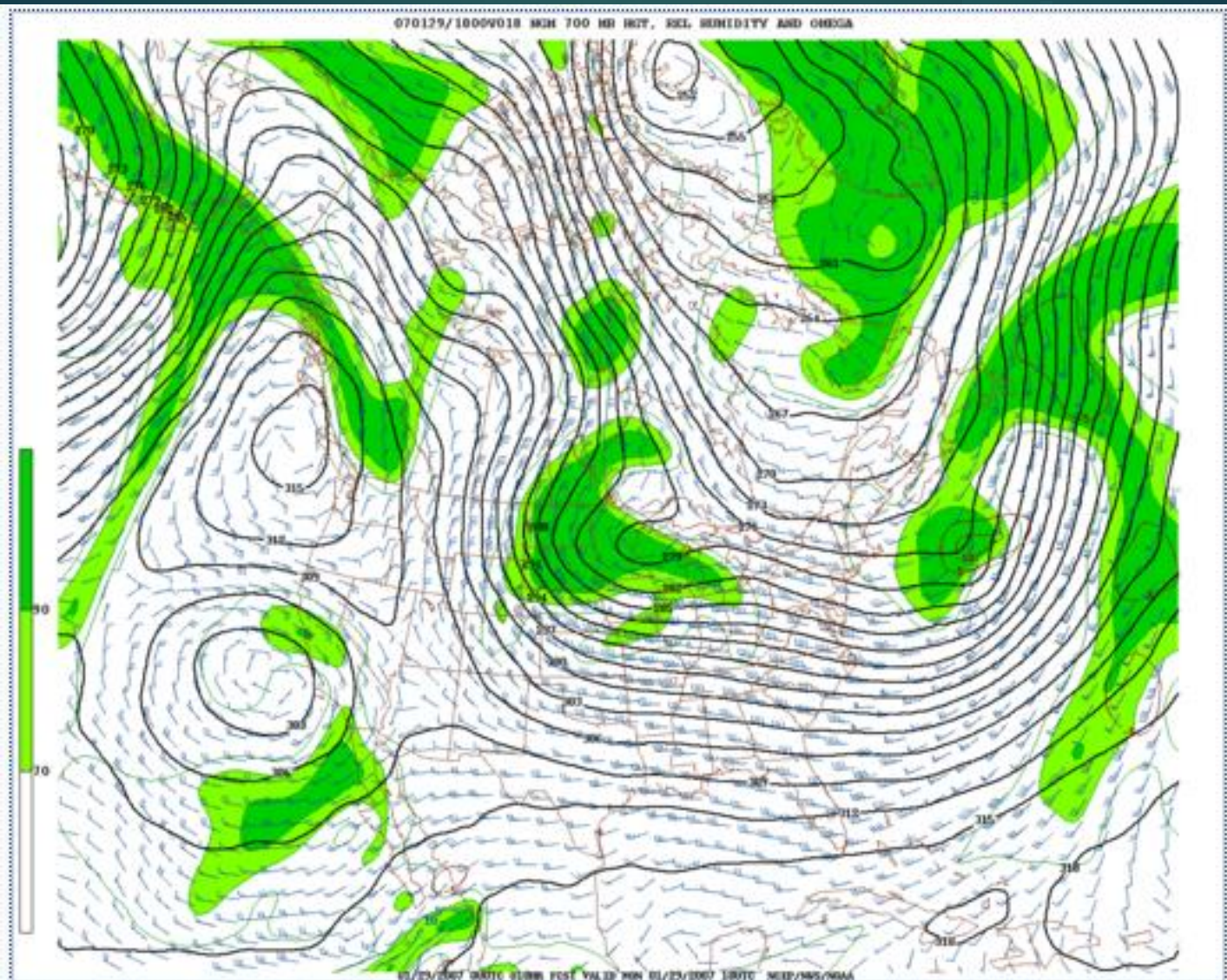


Cut Off / Blocking High



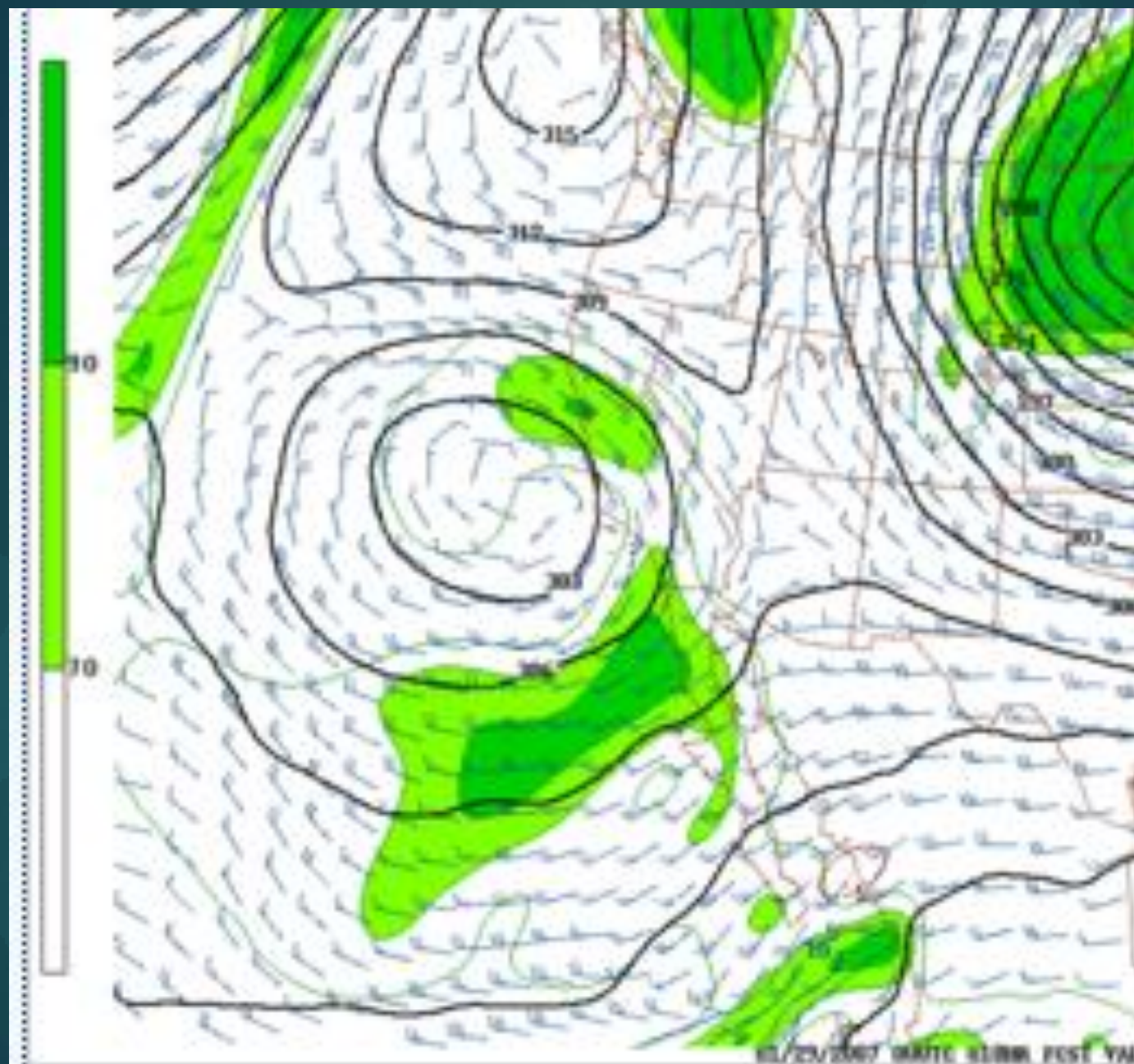
Cut Off Low

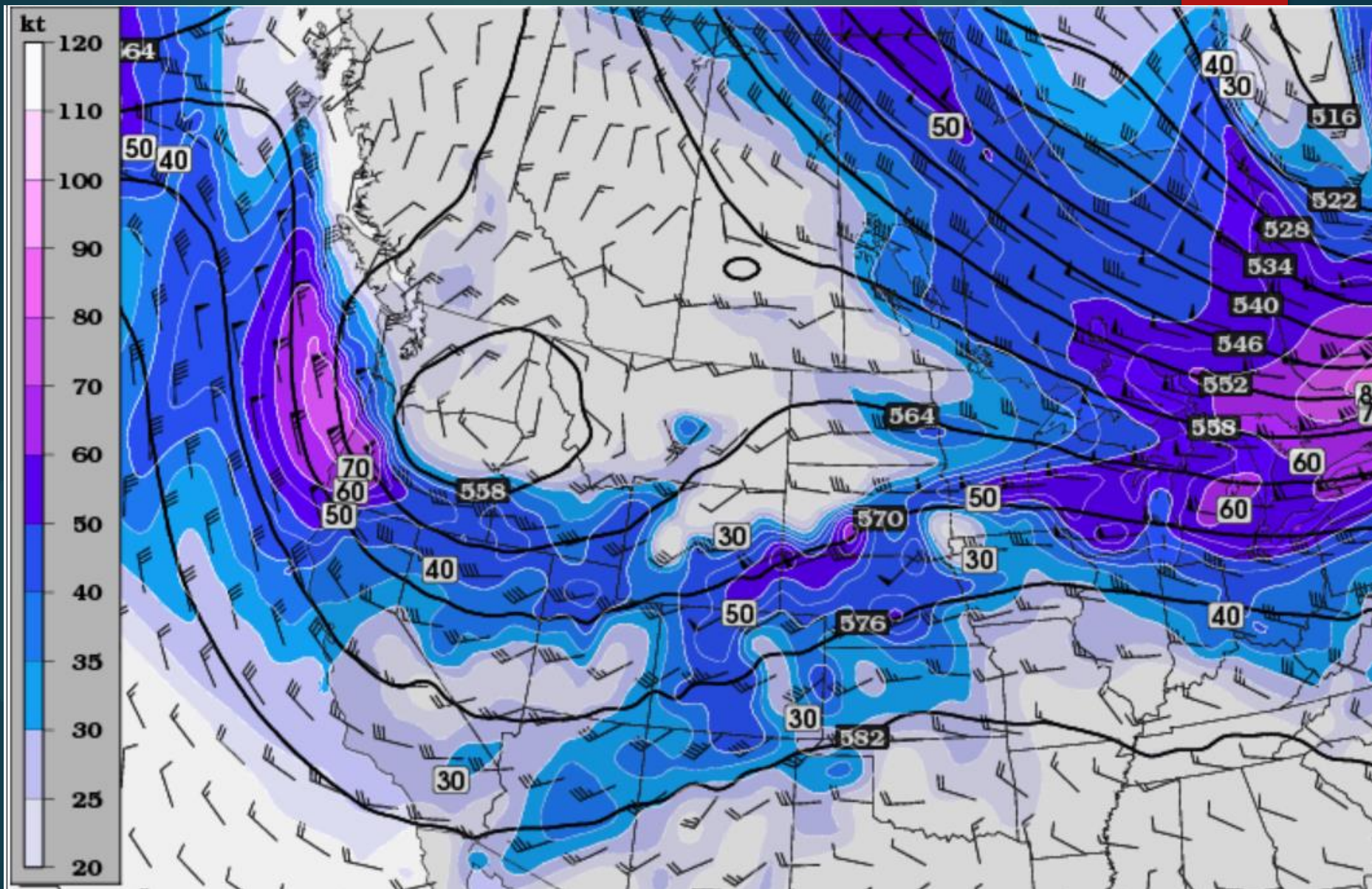




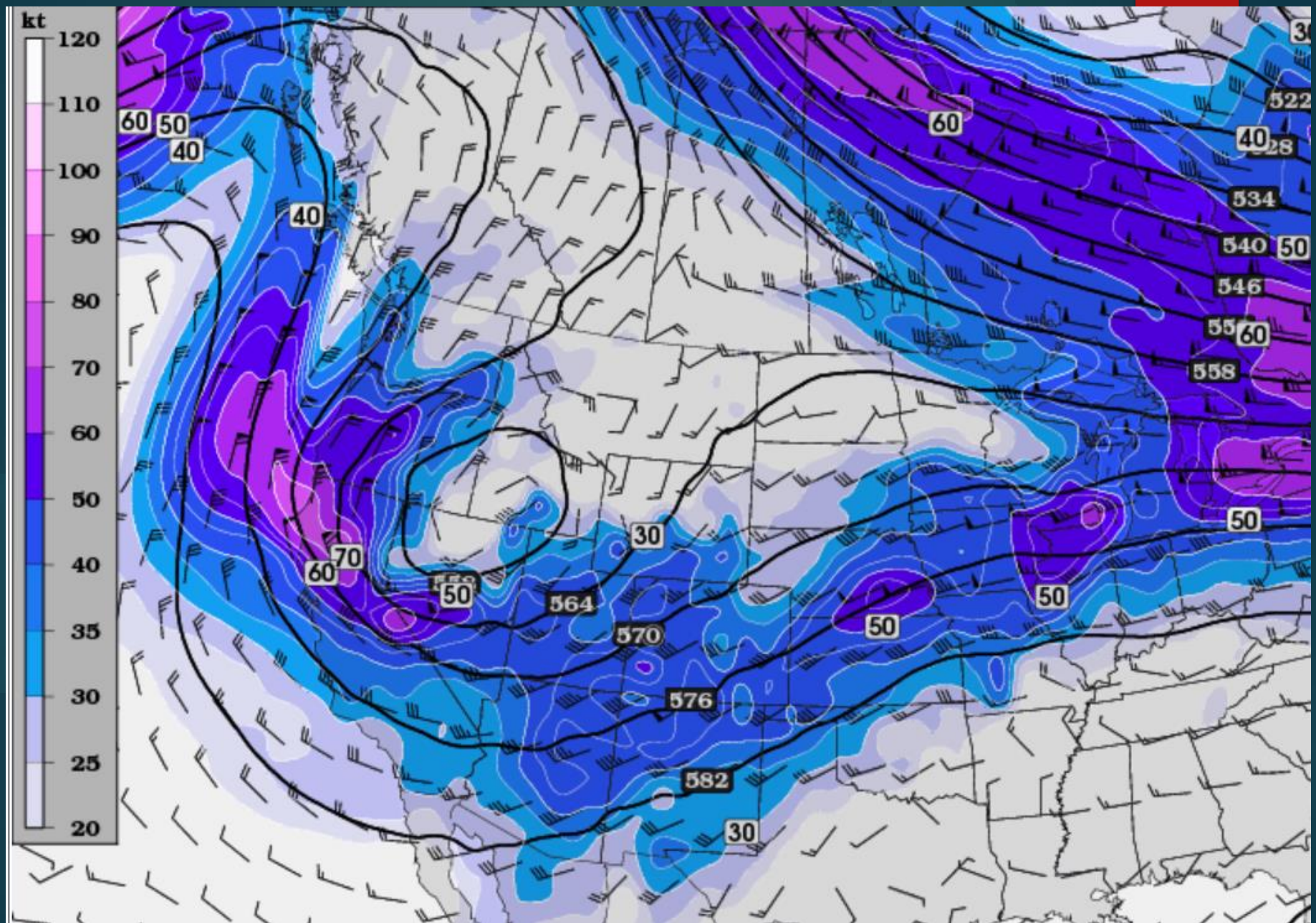
An example of a rex block off the West coast of **North America** in January 2007



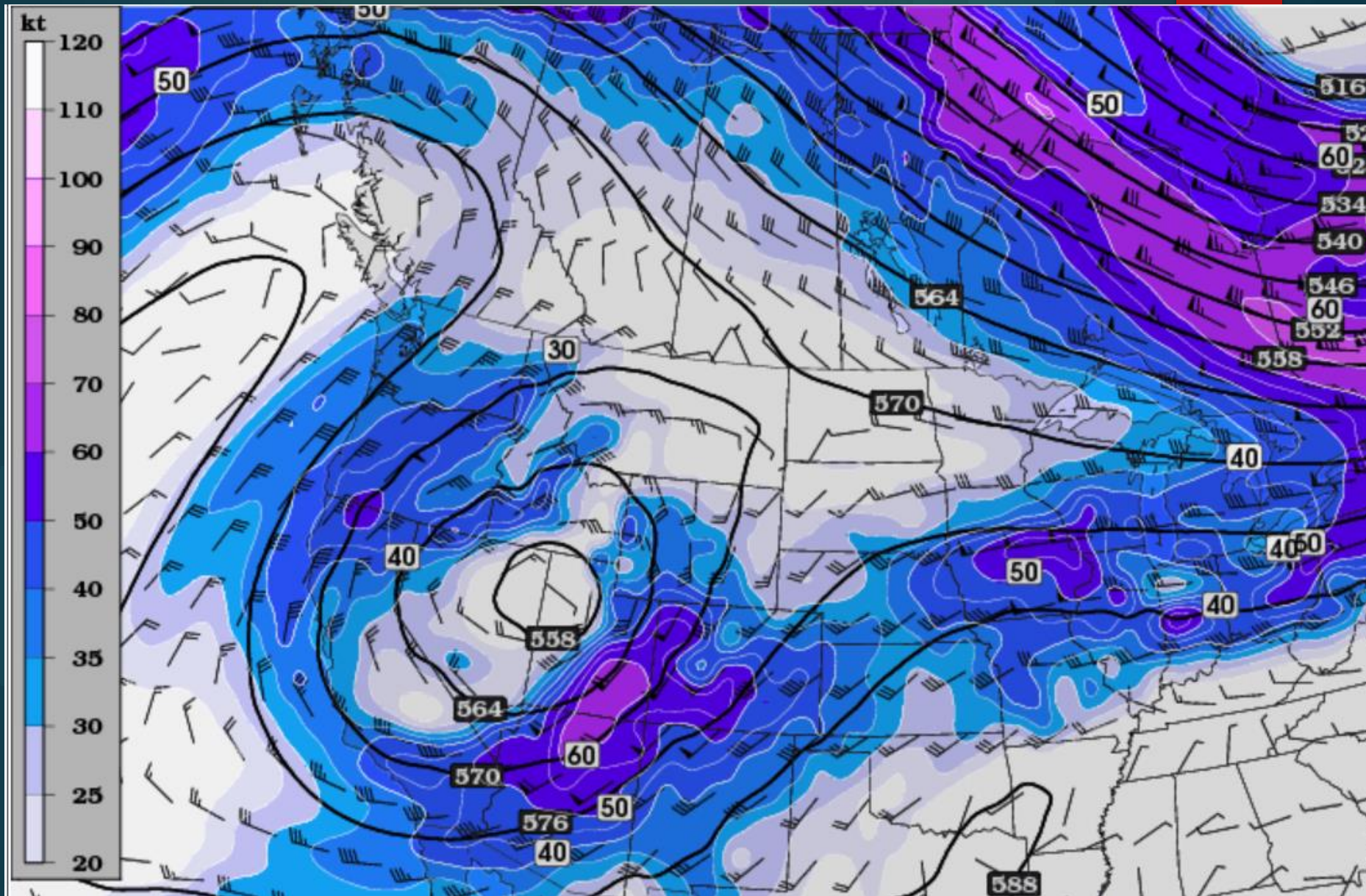




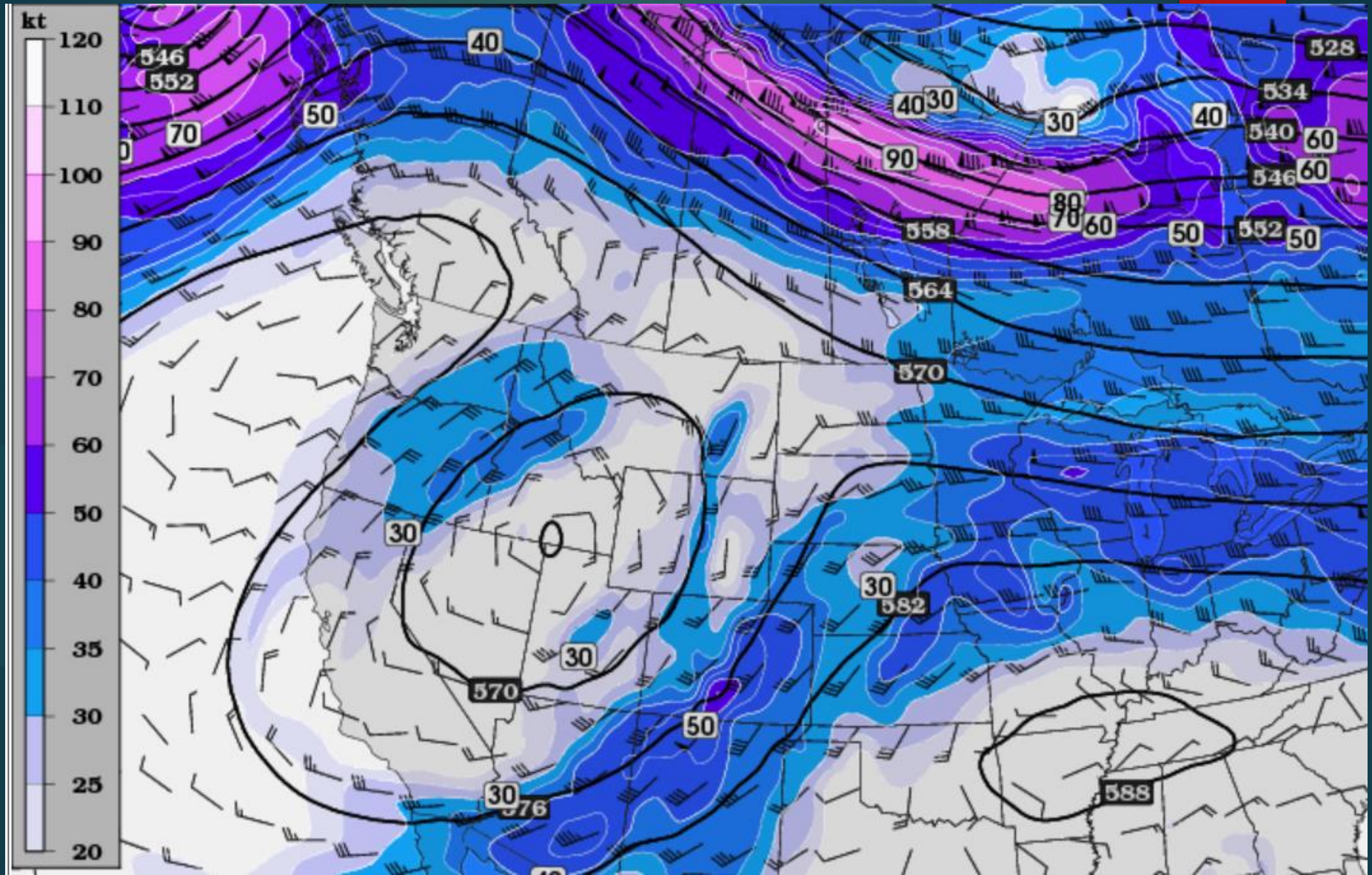
12 hours later (5/11/18)



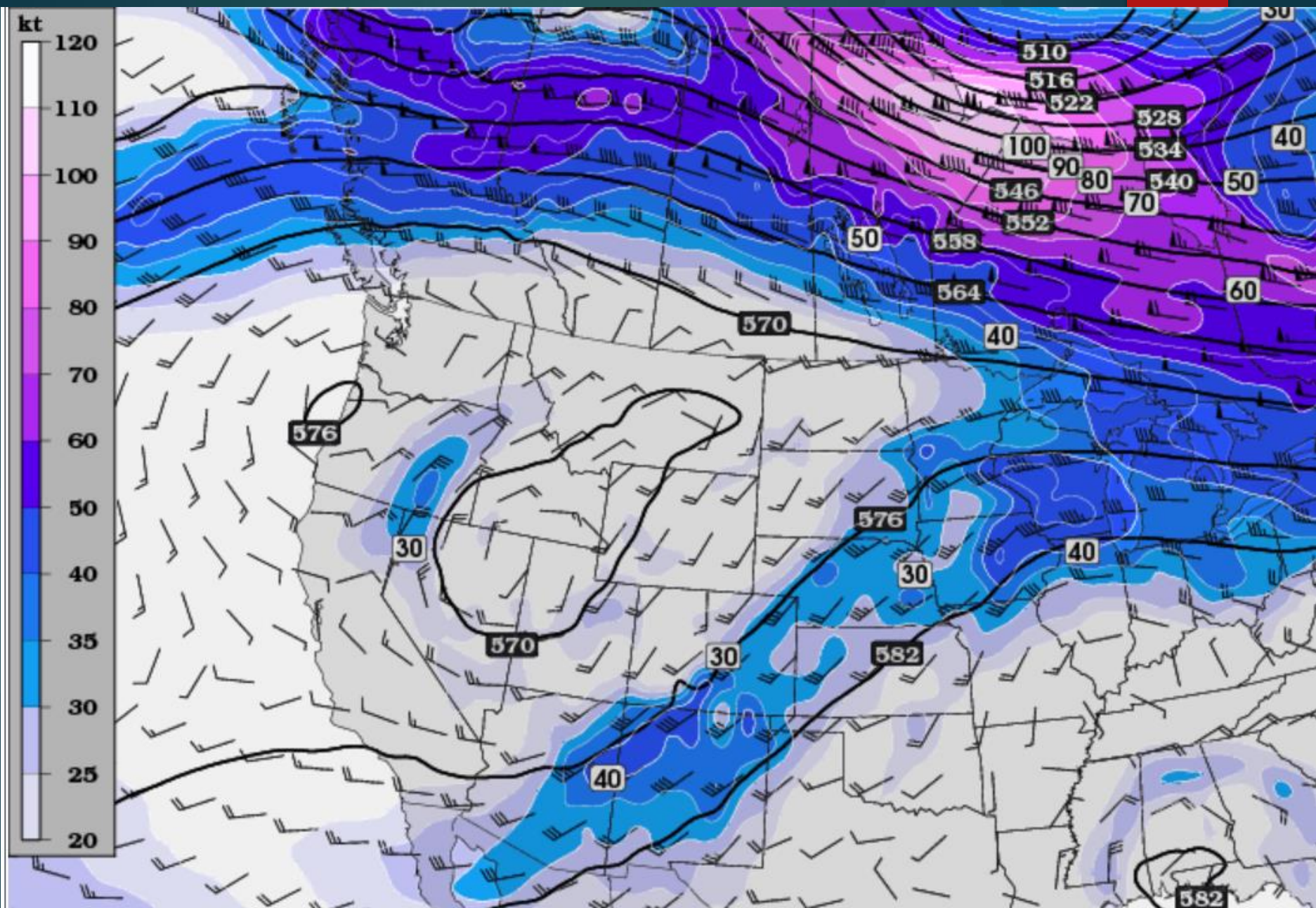
24 hours later (5/11/18)



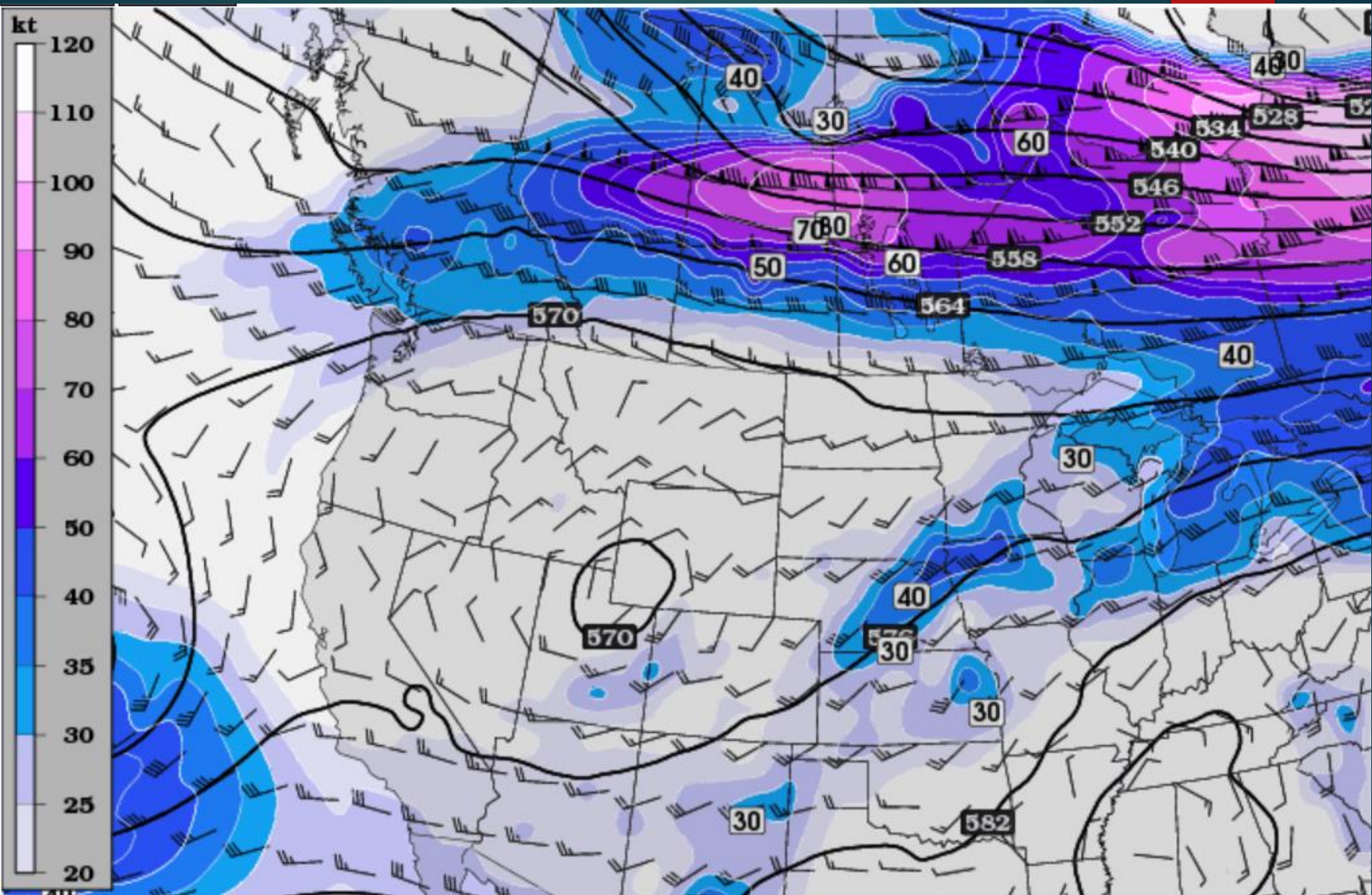
48 hours (May 12, 2018)



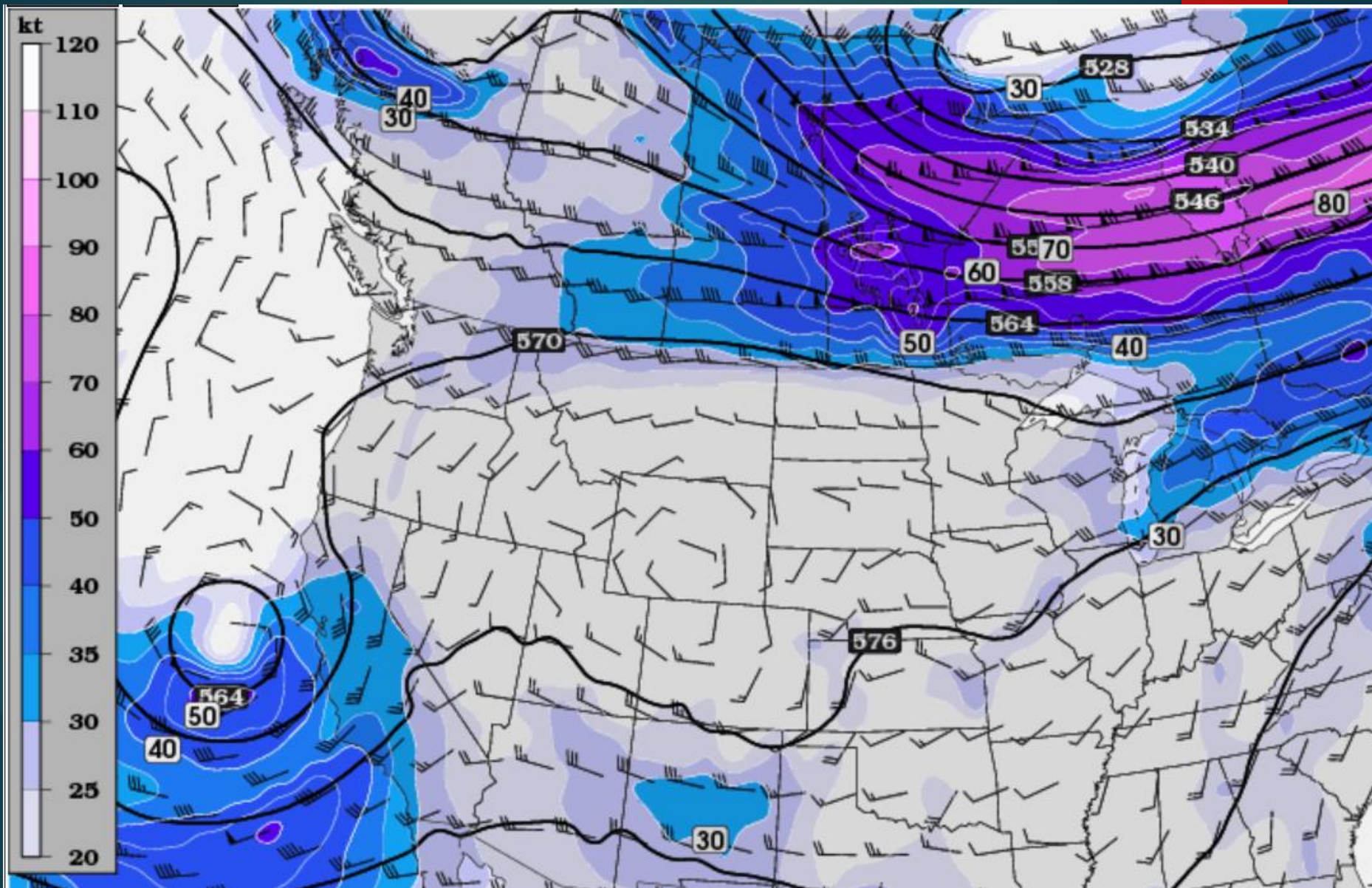
72 hours (May 13, 2018)



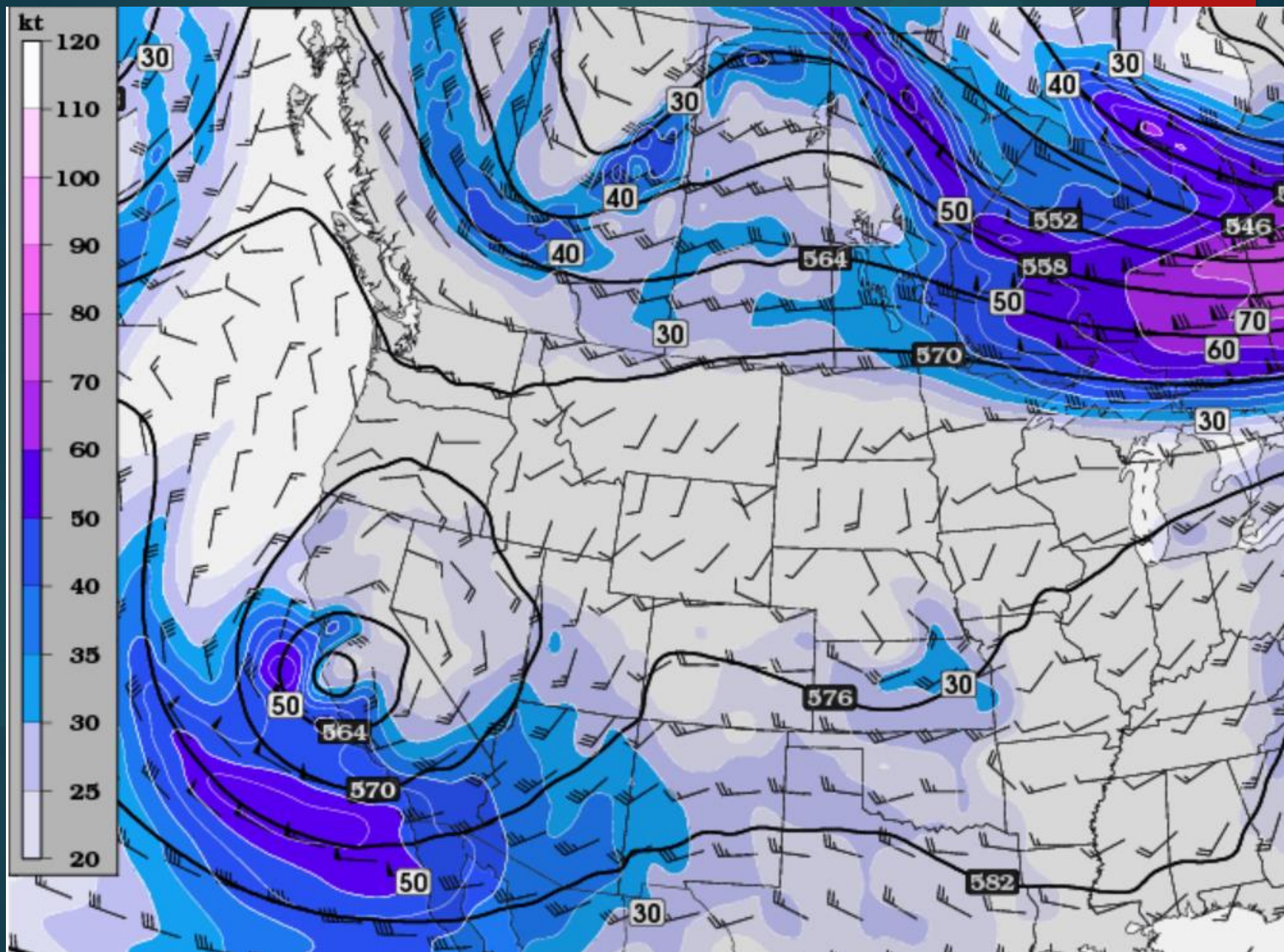
96 Hours (May 14, 2018)



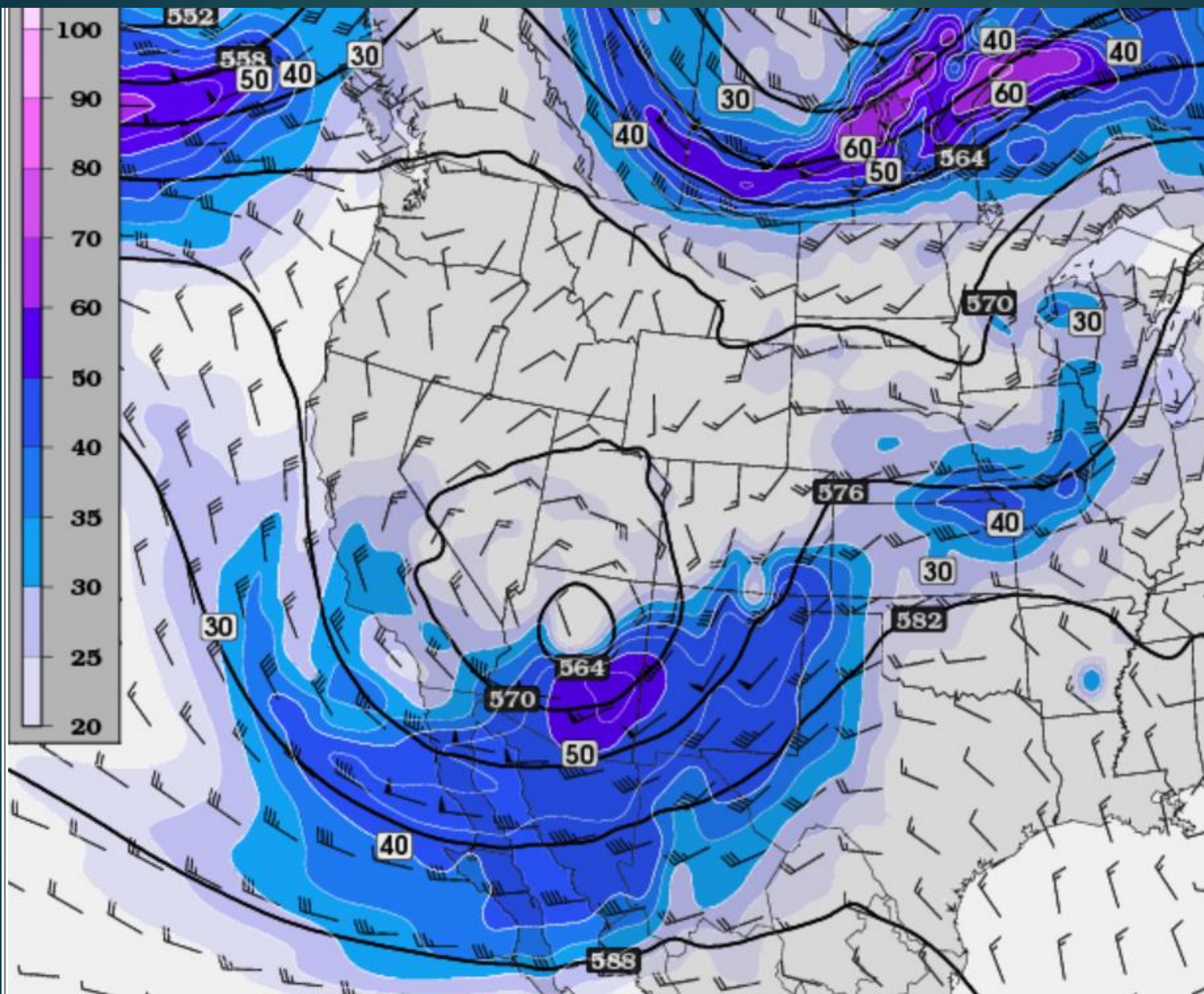
120 Hours (May 15, 2018)



144 Hours (May 16, 2018)



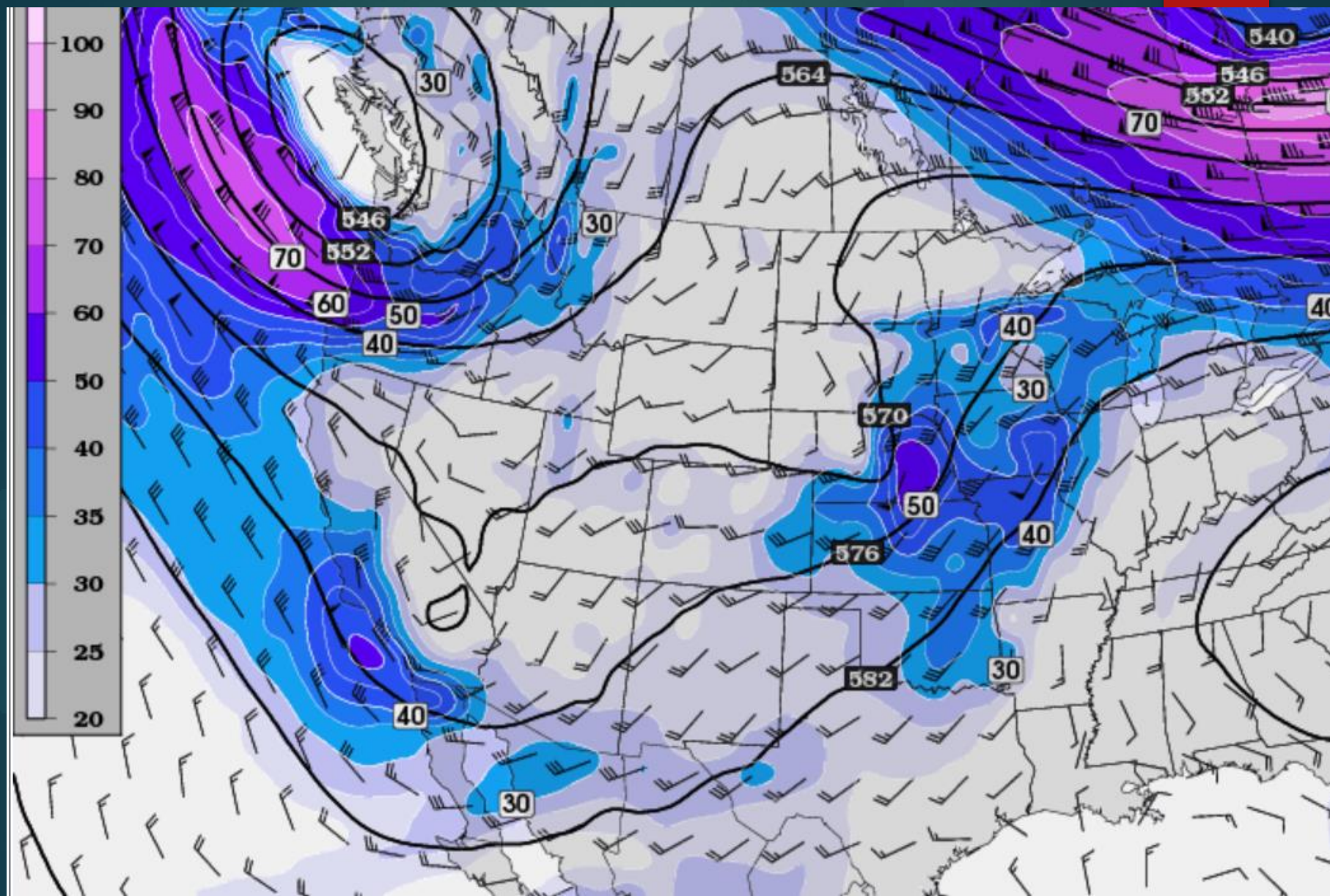
168 Hours (May 17, 2018)



192 Hours (May 18, 2018)



216 Hours (May 19, 2018)

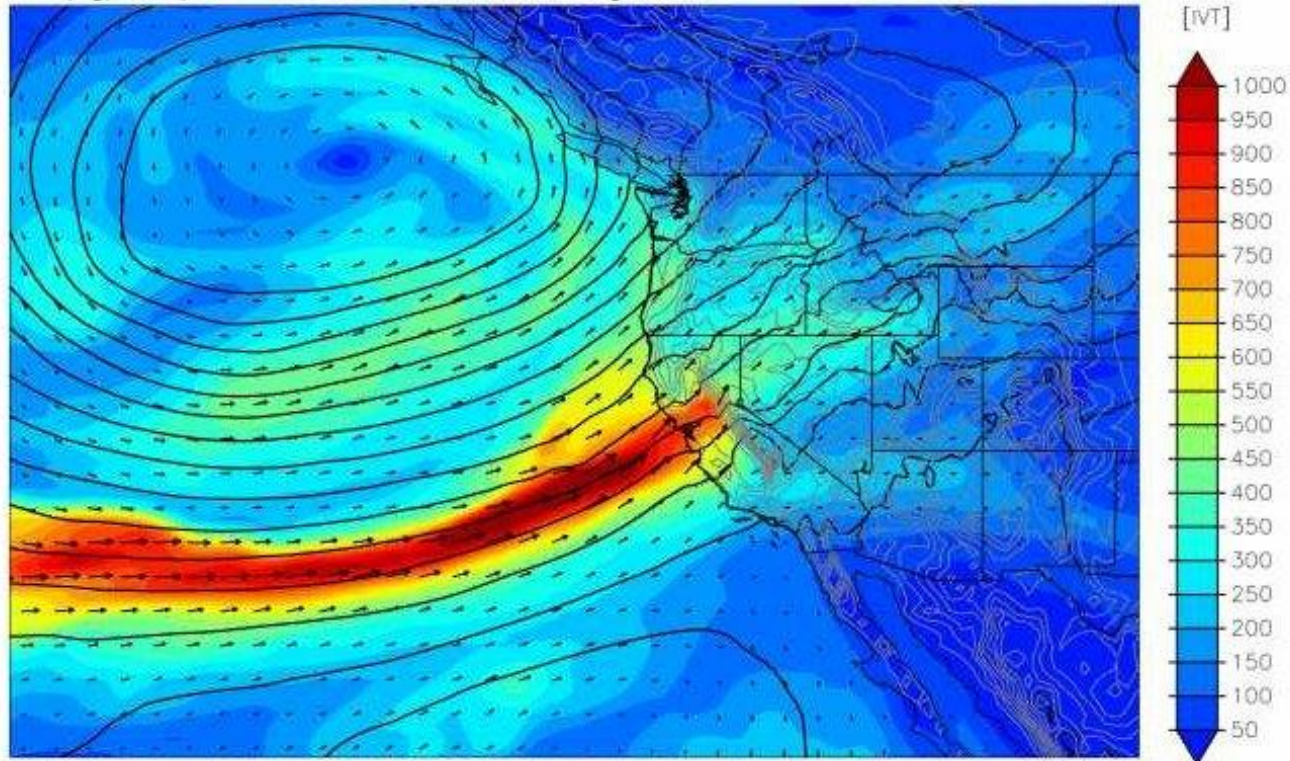


240 Hours (May 20, 2018)

Integrated Transport - Plainview

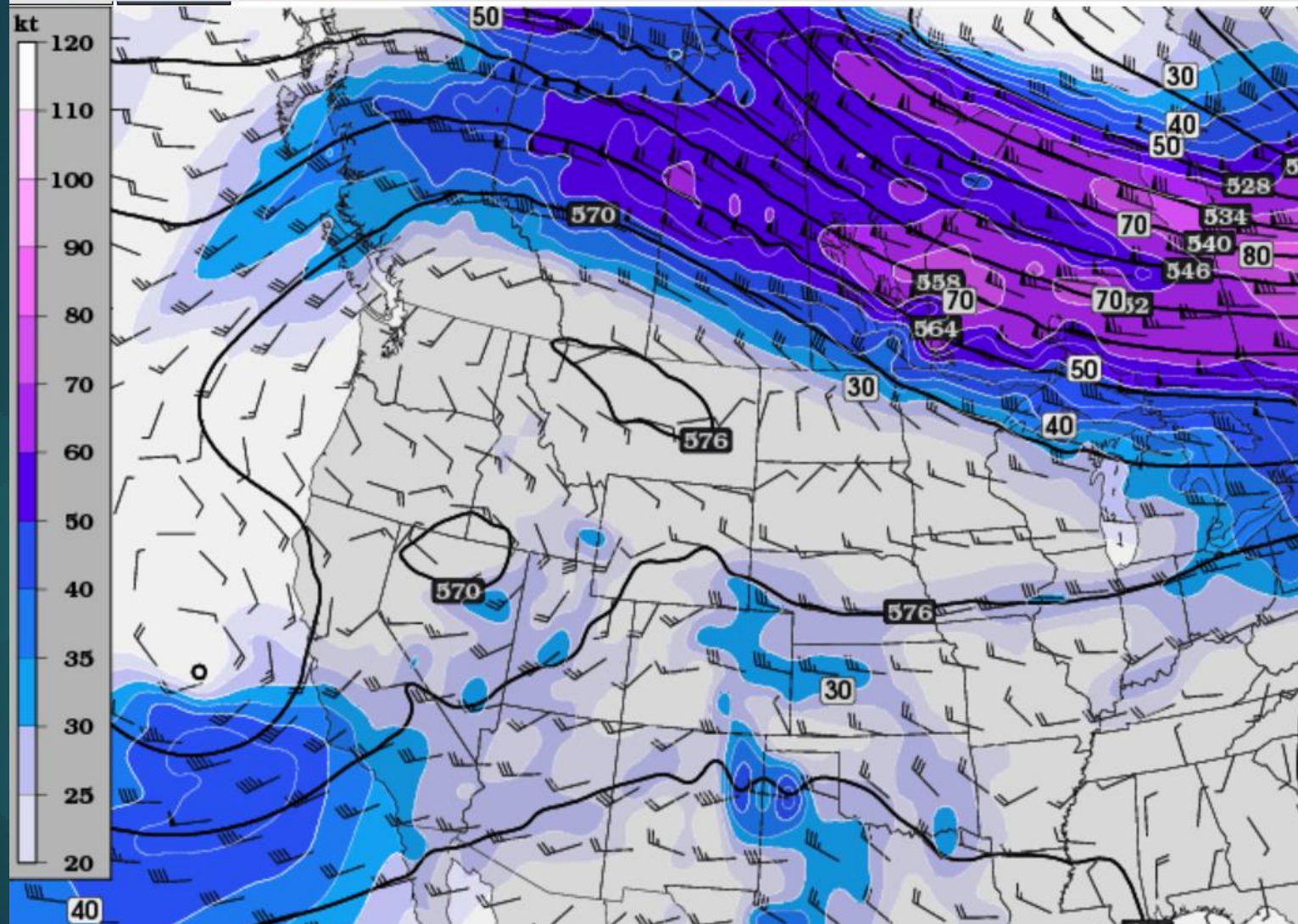
00z Nov 27, 2012 GFS F87 valid 15z Nov 30, 2012

IVT ($\text{kg/m}\cdot\text{s}$), IVT Vectors, and 850mb Heights

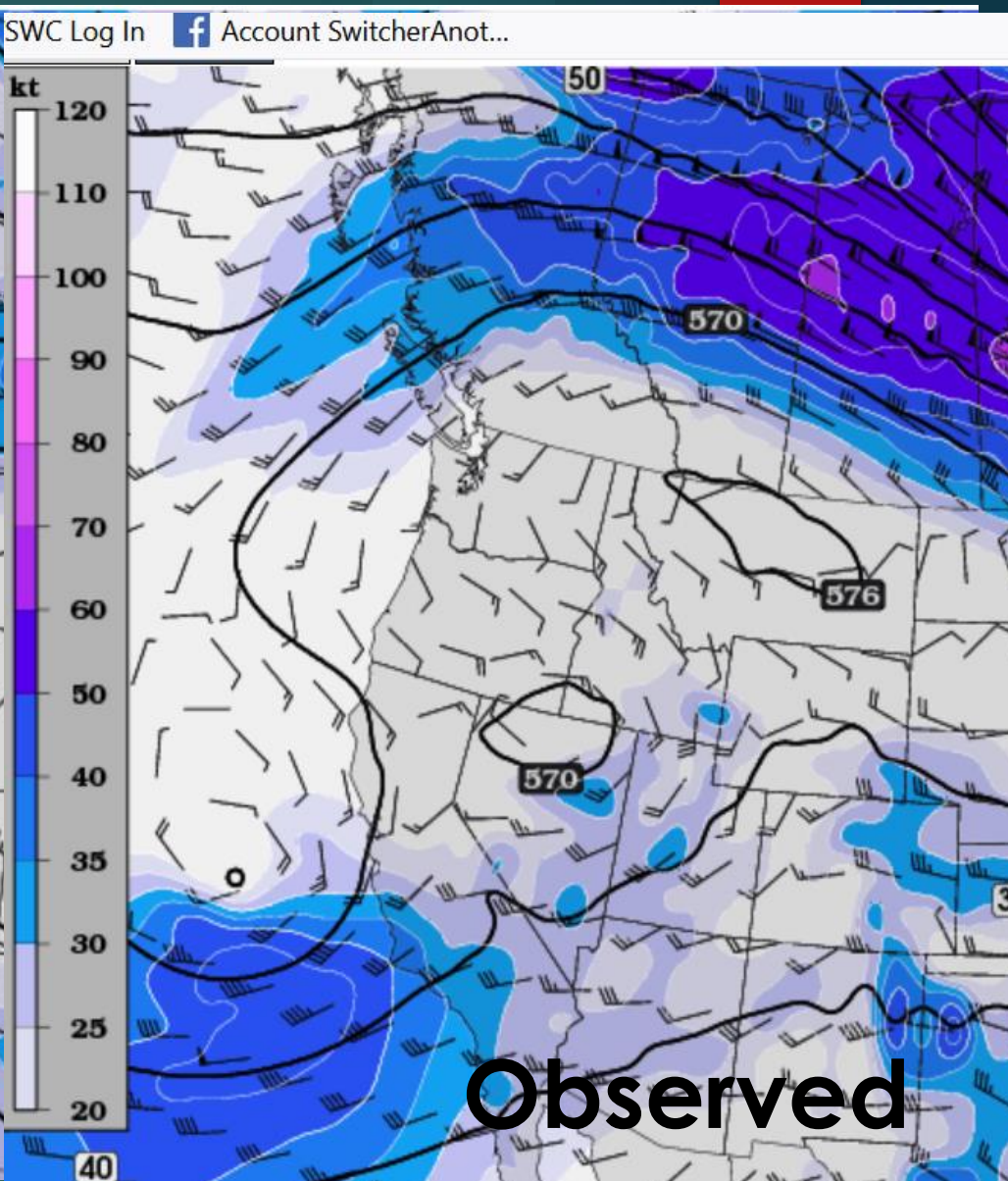
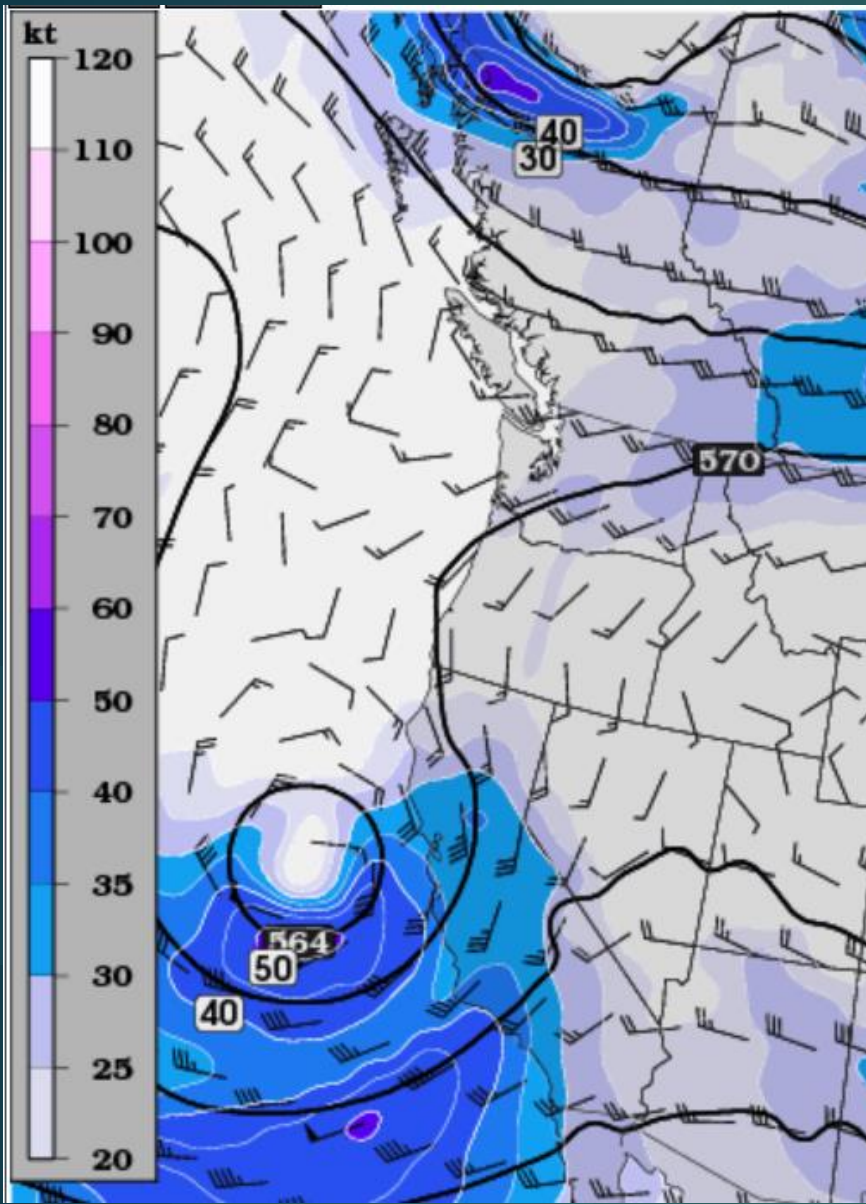


How did the model do?

SWC Log In [Account Switcher](#) [Annotate](#)



May 16, 3028



SWC Log In [f](#) Account SwitcherAnot...

144 Hours (May 16, 2018)

Credits – great graphics

- ▶ Ultimate Weather Education Website: <http://www.theweatherprediction.com>
- ▶ UCAR COMET: <https://www.meted.ucar.edu>
- ▶ Twister Data <http://www.twisterdata.com>
- ▶ NCEP GFS: <http://www.ncep.noaa.gov/>

DATA



DATA

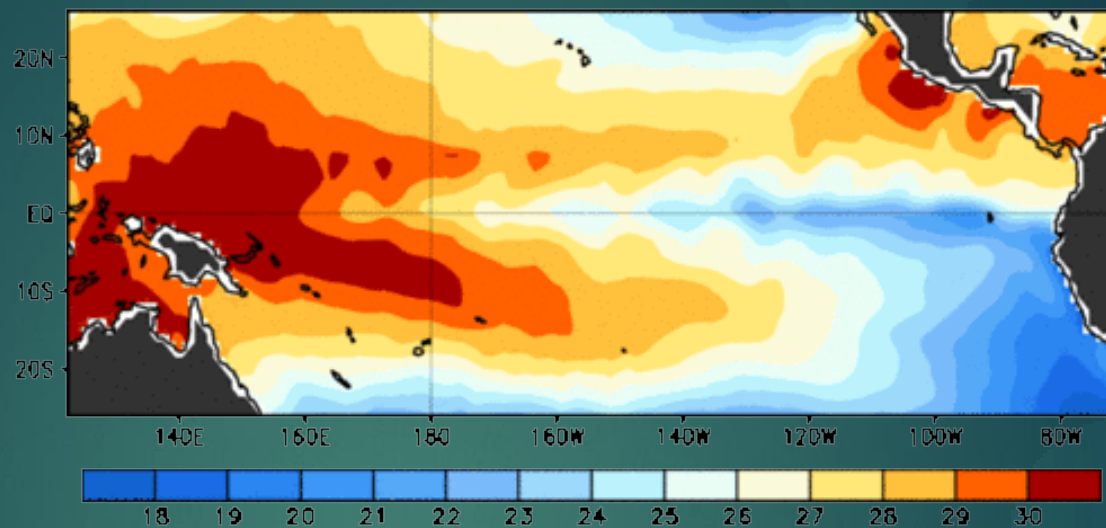


Weather Climate Linkages

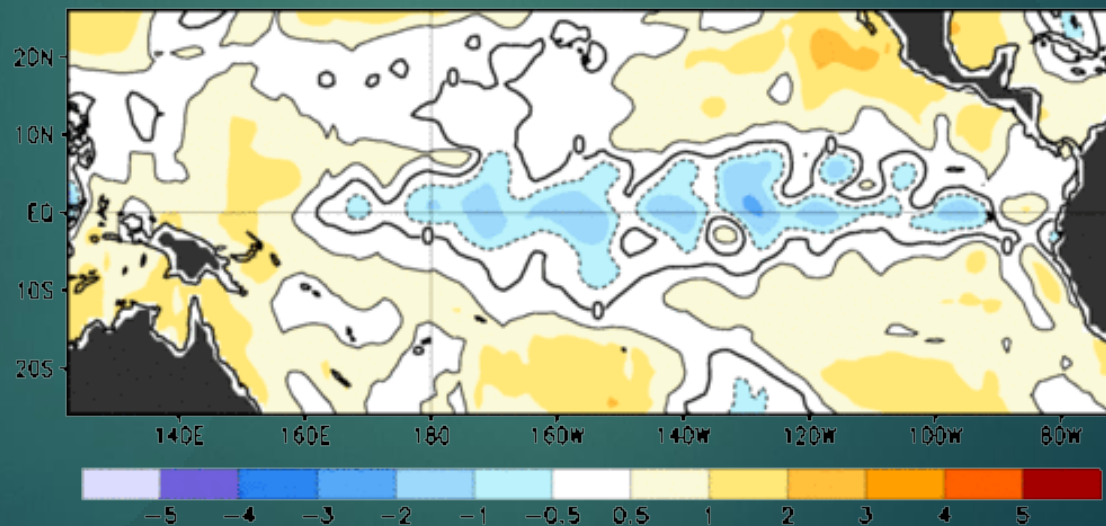
- § ENSO Cycle (El Niño/La Nina)
- § Madden/Julian Oscillation (MJO)
- § Teleconnections
- § Blocking

ENSO

Observed Sea Surface Temperature ($^{\circ}\text{C}$)

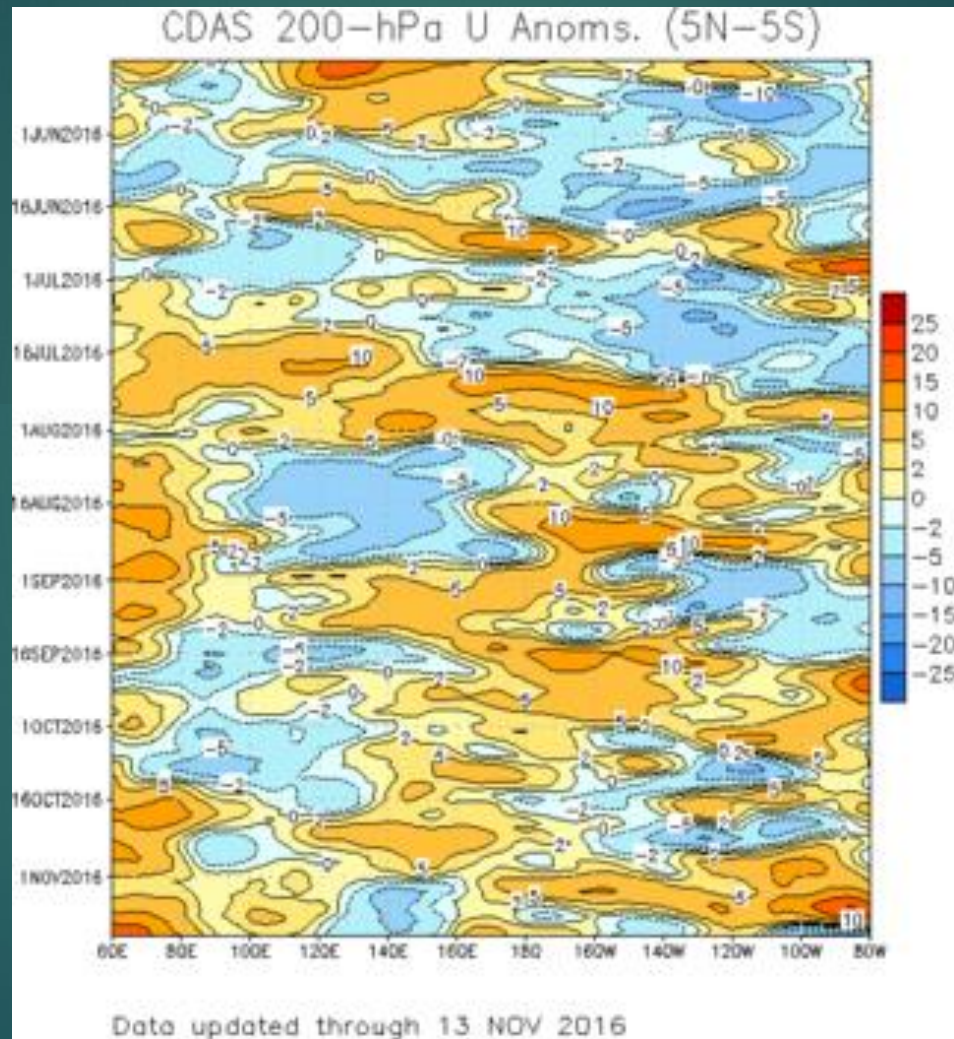


Observed Sea Surface Temperature Anomalies ($^{\circ}\text{C}$)

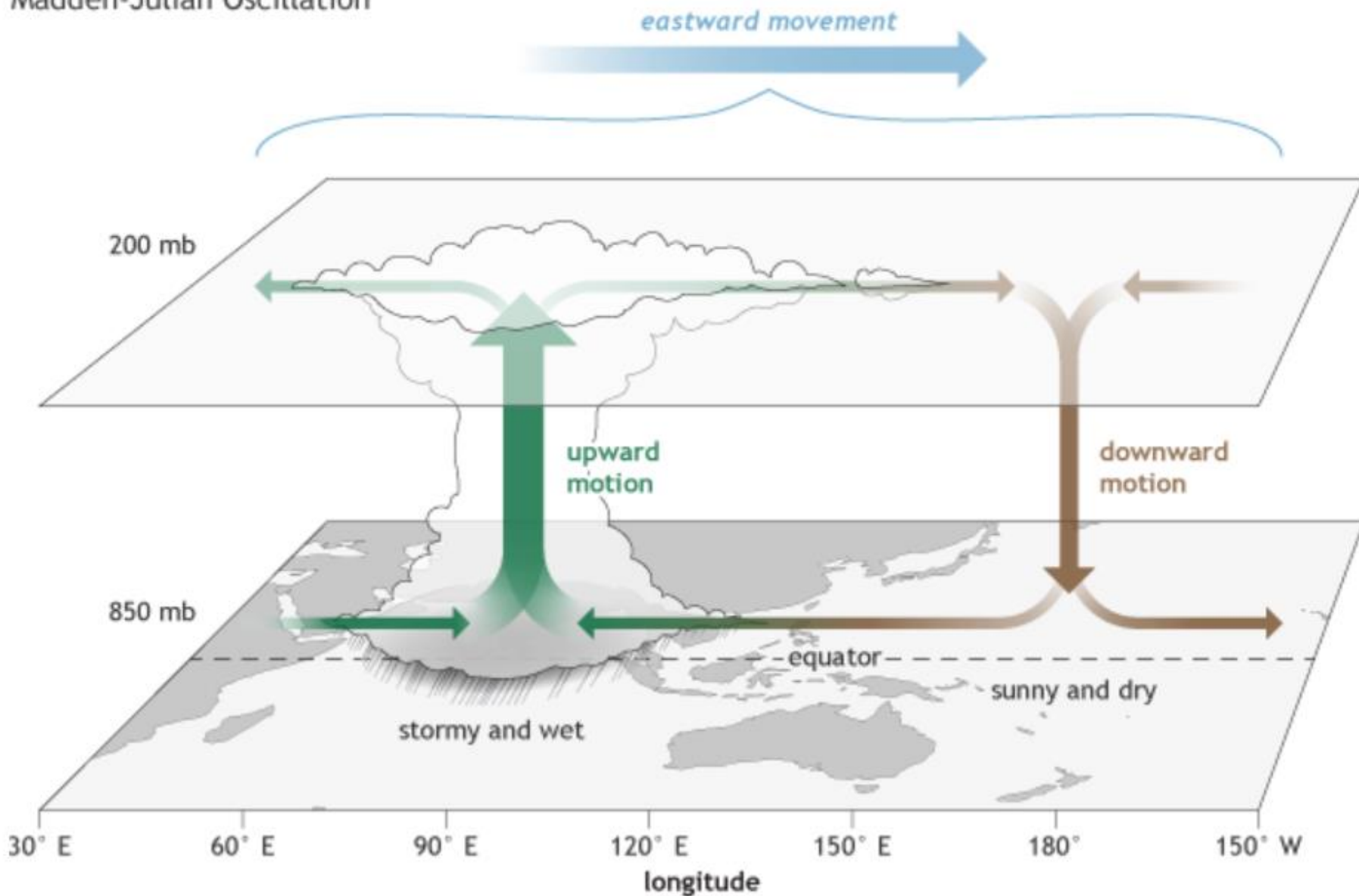


7-day Average Centered on 09 November 2016

Madden - Julian

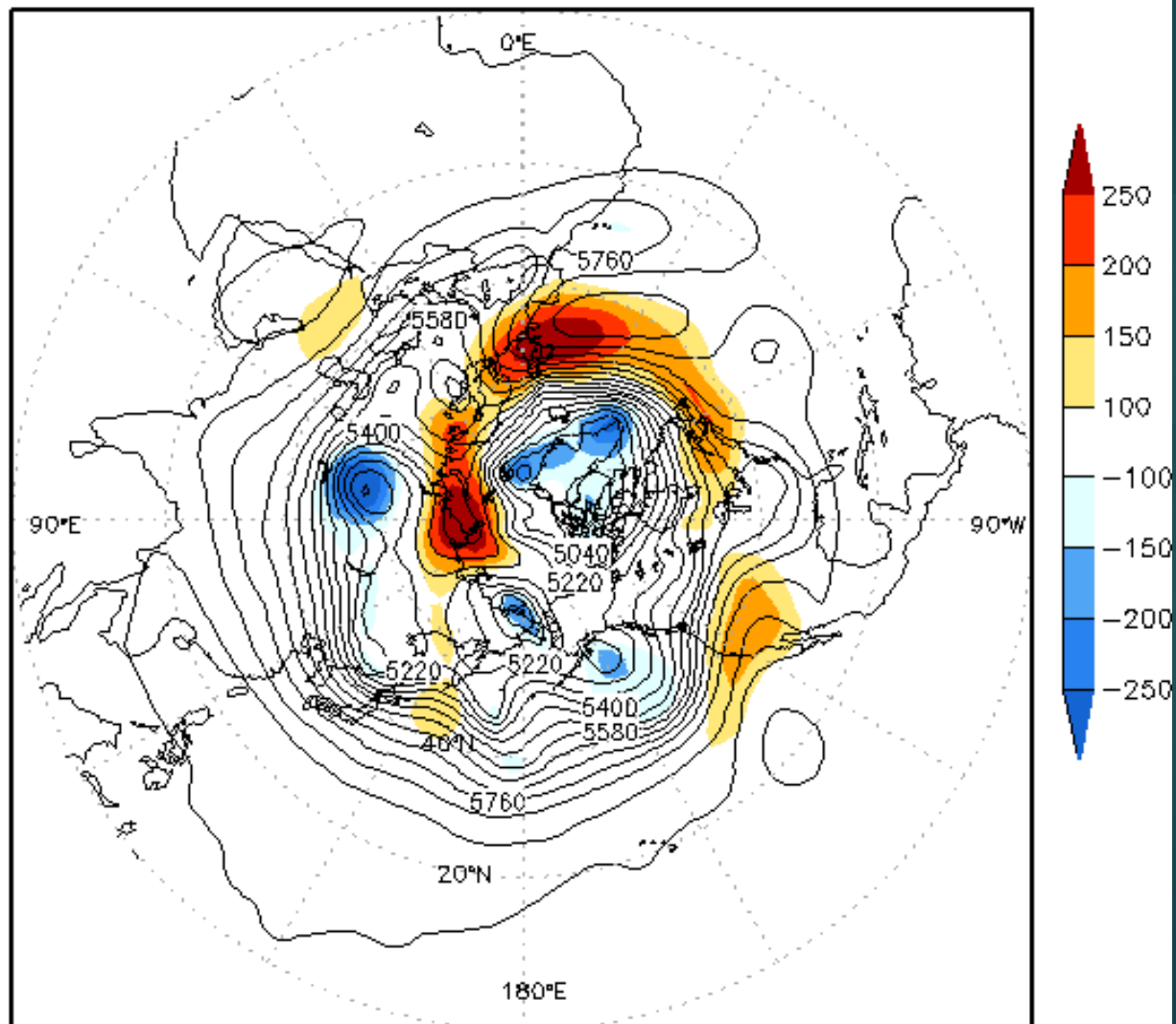


Madden-Julian Oscillation



Blocking

500 hPa Geopotential Height and Anomalies 00Z15NOV2016

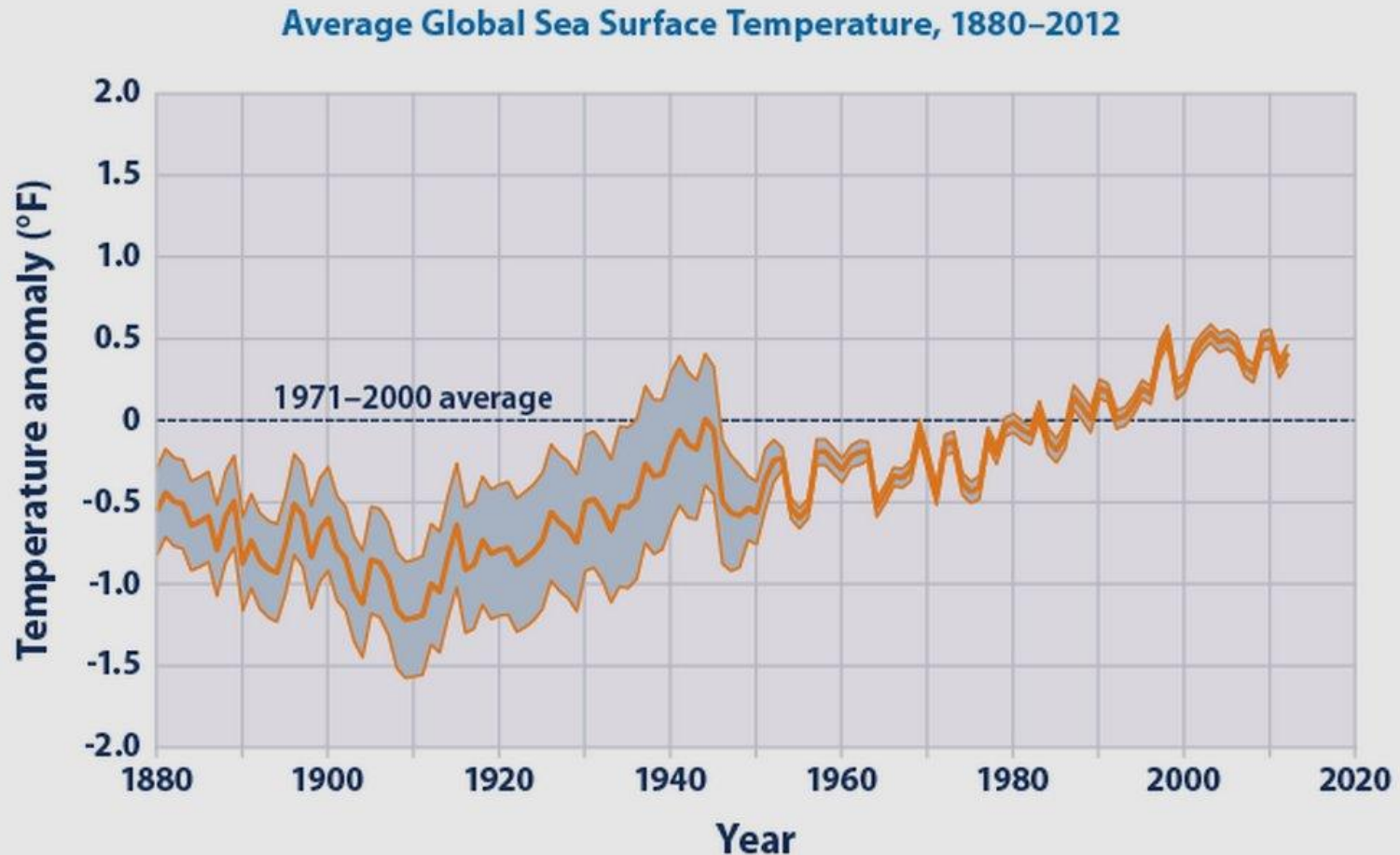


Future

- ▶ A lot of work to go

▶ **Research** - That isn't
being funded appropriately at the
Federal level - rp

Sea Surface Temperature



Data source: NOAA (National Oceanic and Atmospheric Administration). 2013. Extended reconstructed sea surface temperature (ERSST.v3b). National Climatic Data Center. Accessed February 2013. www.ncdc.noaa.gov/ersst/.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climatechange/indicators.

Products

www.cpc.noaa.gov

- ▶ 6-10 Day Outlook
 - ▶ Subset -running precipitation accumulation (CFS)
- ▶ 8-10 Day Outlook
 - ▶ Subset -running precipitation accumulation (CFS)
- ▶ 30 Day Outlook, updated every 15 days
- ▶ 90 Day Outlook
- ▶ Running 90 day Outlooks to a year

Teleconnections

§AO (Arctic Oscillation)

§NAO (North Atlantic Oscillation)

§PNA (Pacific-North American Pattern)

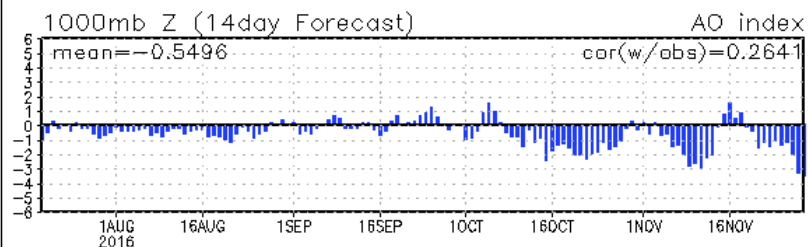
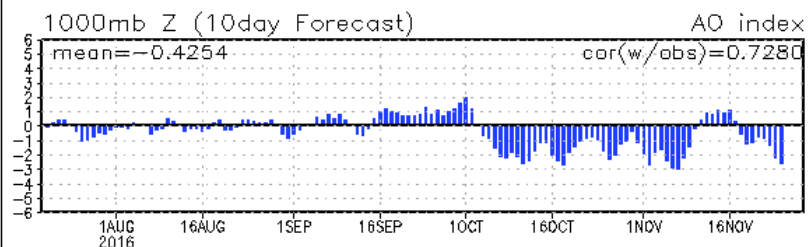
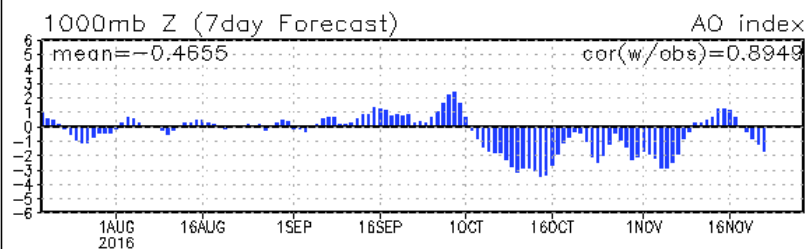
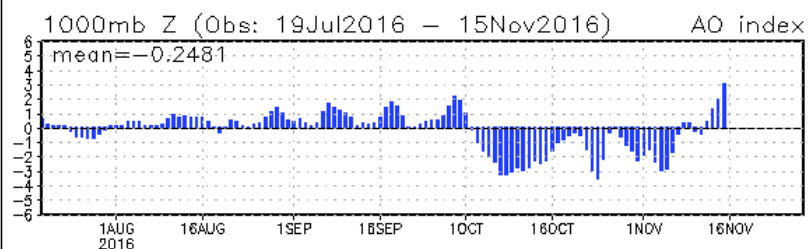
§AAO (Antarctic Oscillation)

§Archive of Daily Indices

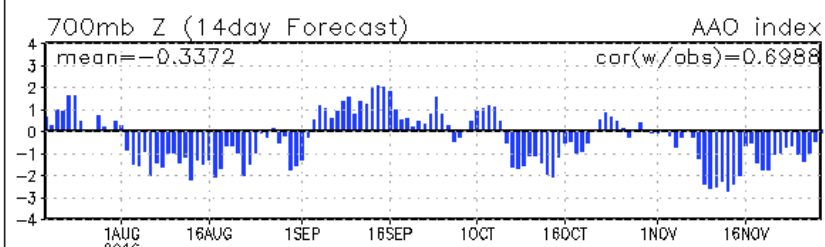
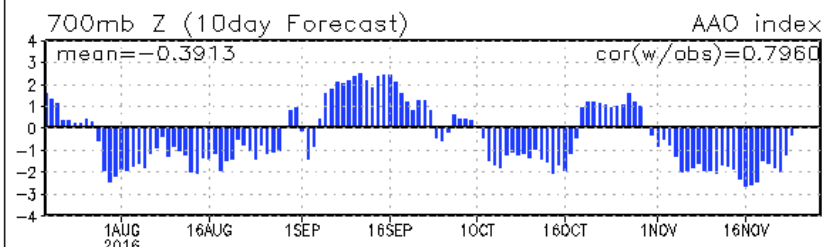
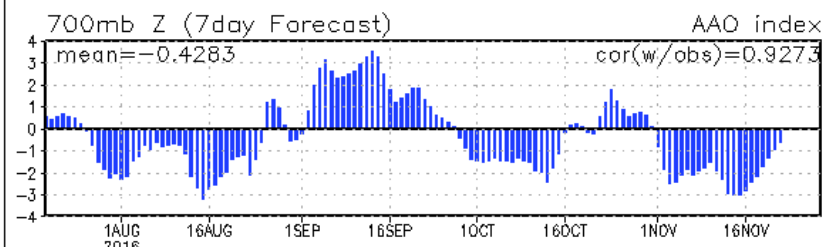
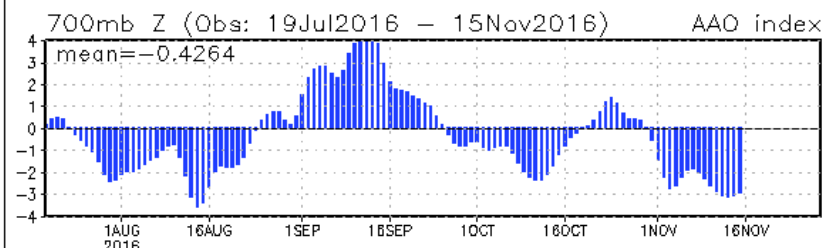
§Monthly Teleconnection Indices

AO and AAO

AO: Observed & GFS forecasts

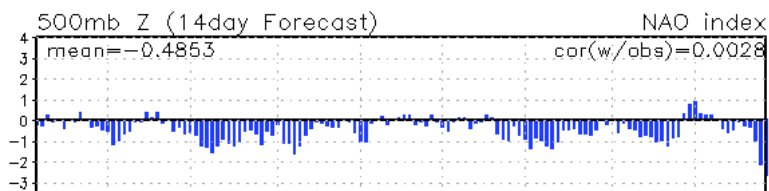
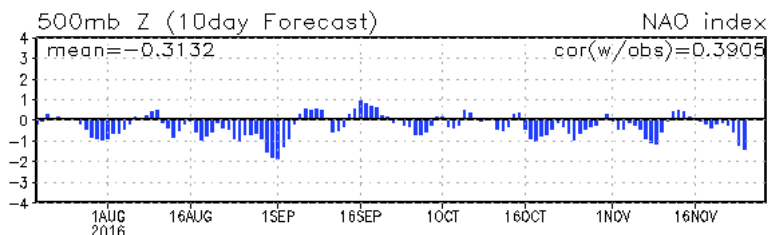
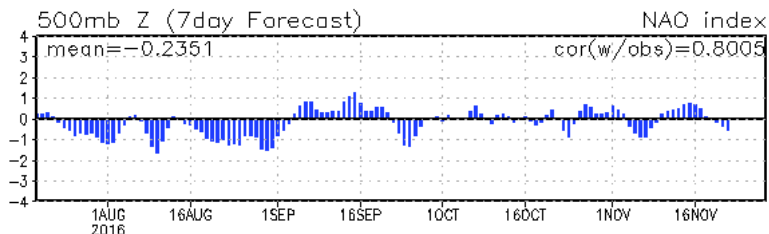
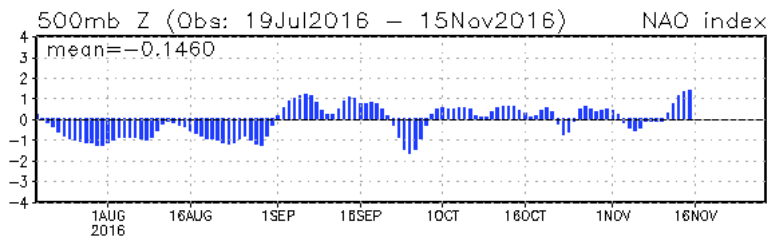


AAO: Observed & GFS forecasts

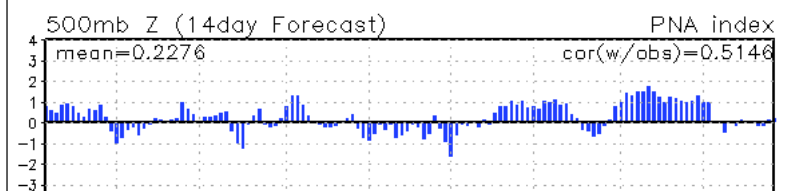
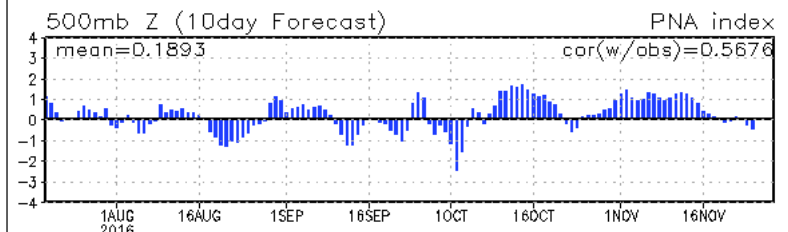
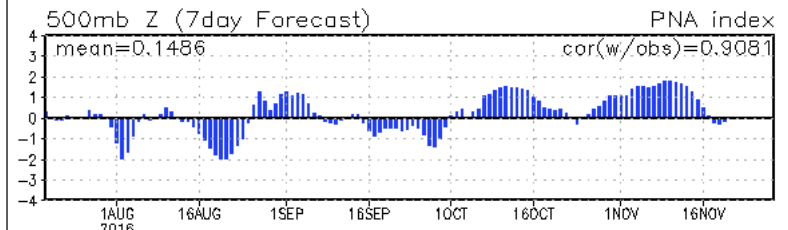
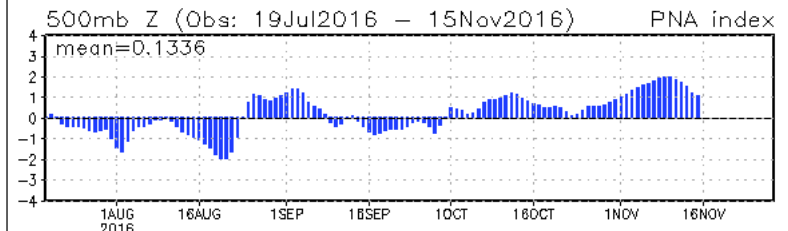


North Atlantic Oscillation / Pacific - North American pattern (NAO/PNA)

NAO: Observed & GFS forecasts



PNA: Observed & GFS forecasts



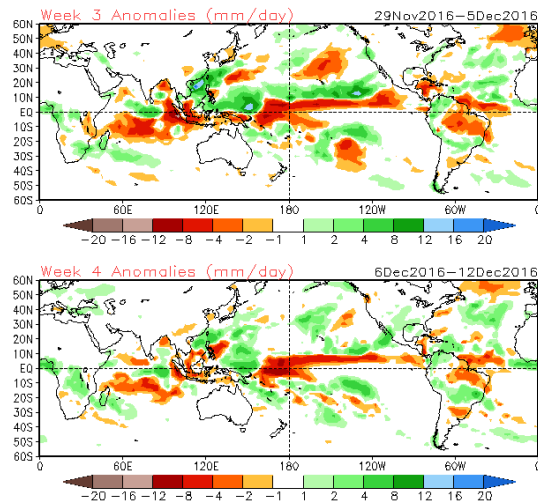
Products

www.cpc.noaa.gov

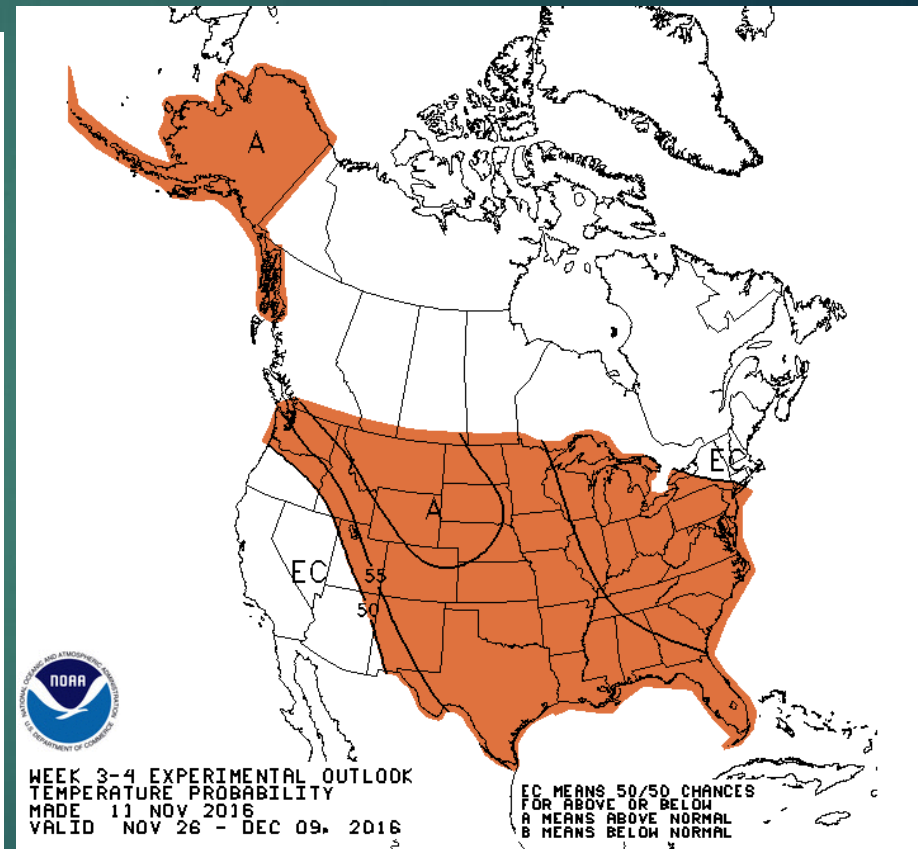
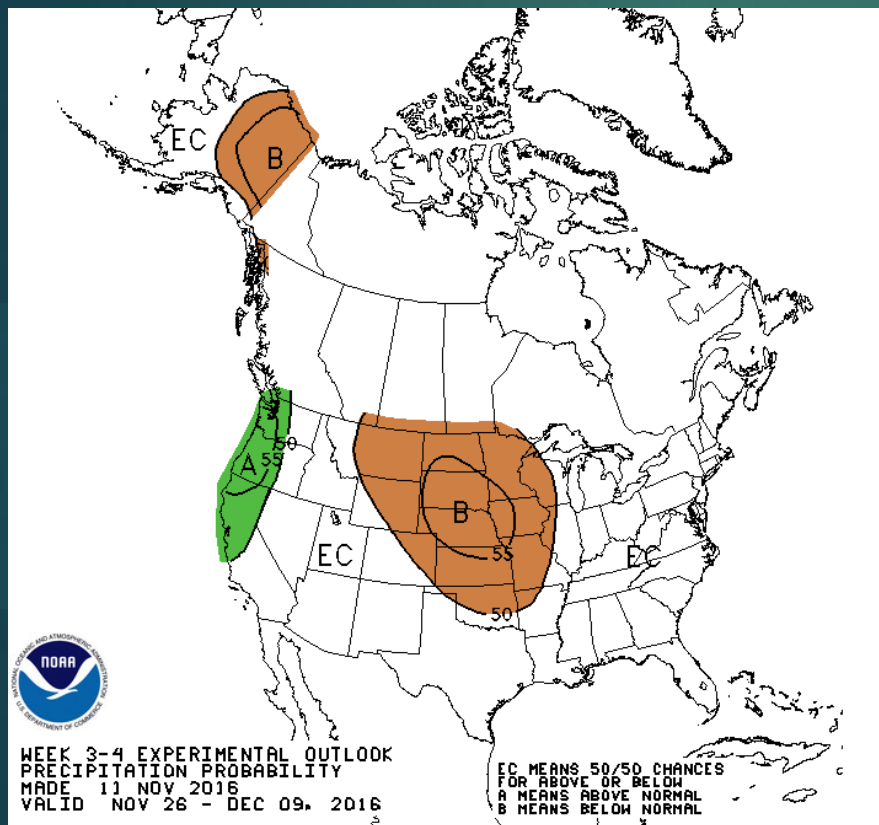
- ▶ 6-10 Day Outlook
 - ▶ Subset -running precipitation accumulation (CFS)
- ▶ 8-10 Day Outlook
 - ▶ Subset -running precipitation accumulation (CFS)
- ▶ 30 Day Outlook, updated every 15 days
- ▶ 90 Day Outlook
- ▶ Running 90 day Outlooks to a year

CFS Week 3 and 4

CFSv2 Weeks 3 & 4 Precipitation
16 Member Ensemble Mean Forecast from 14Nov2016



CPC week 3 and 4 forecasts beyond Day 6-14 outlooks





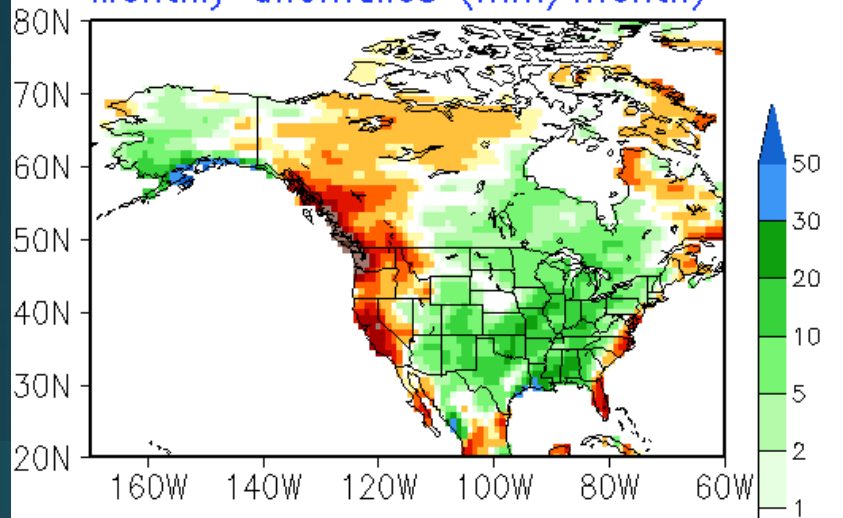
NWS/NCEP/CPC

Last update: Tue Nov 15 2016

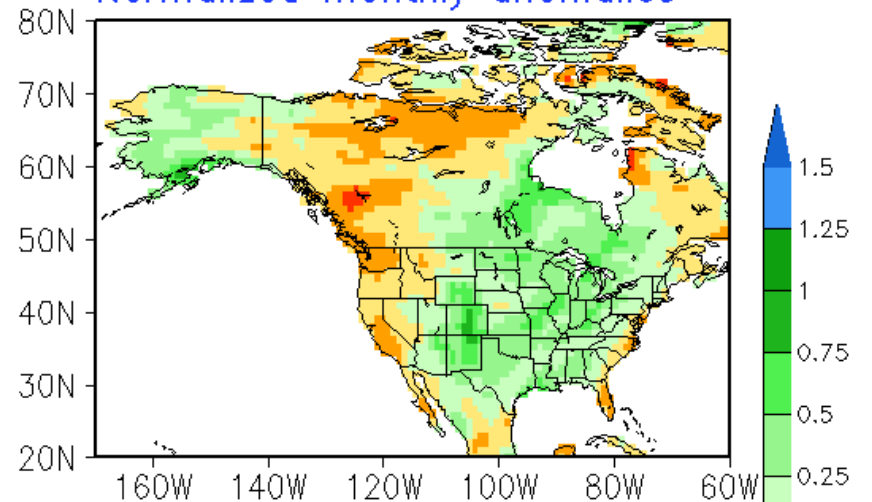
Initial conditions: 06Z12Nov2016-00Z15Nov2016(21 members)

CFSv2 monthly Prec forecast for Dec2016

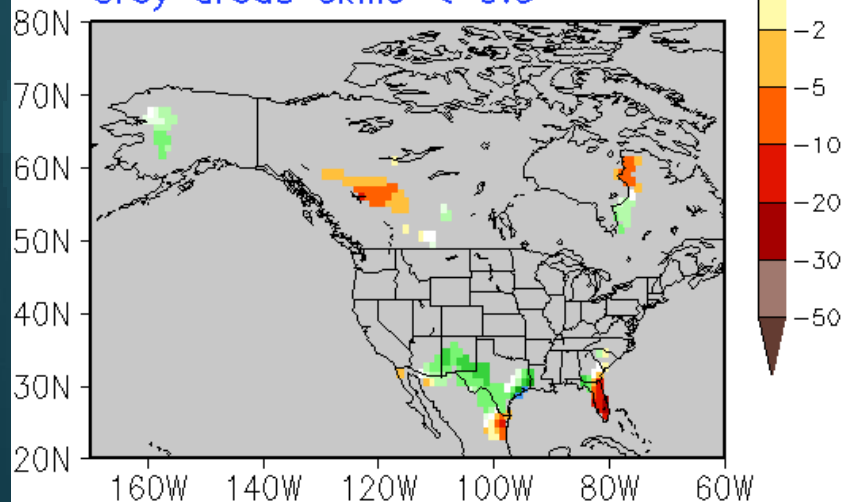
Monthly anomalies (mm/month)



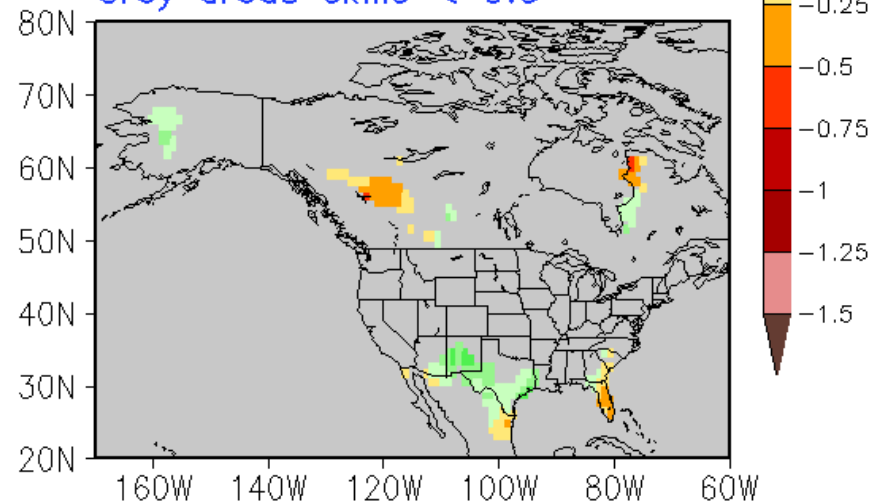
Normalized monthly anomalies



Grey areas skills < 0.3



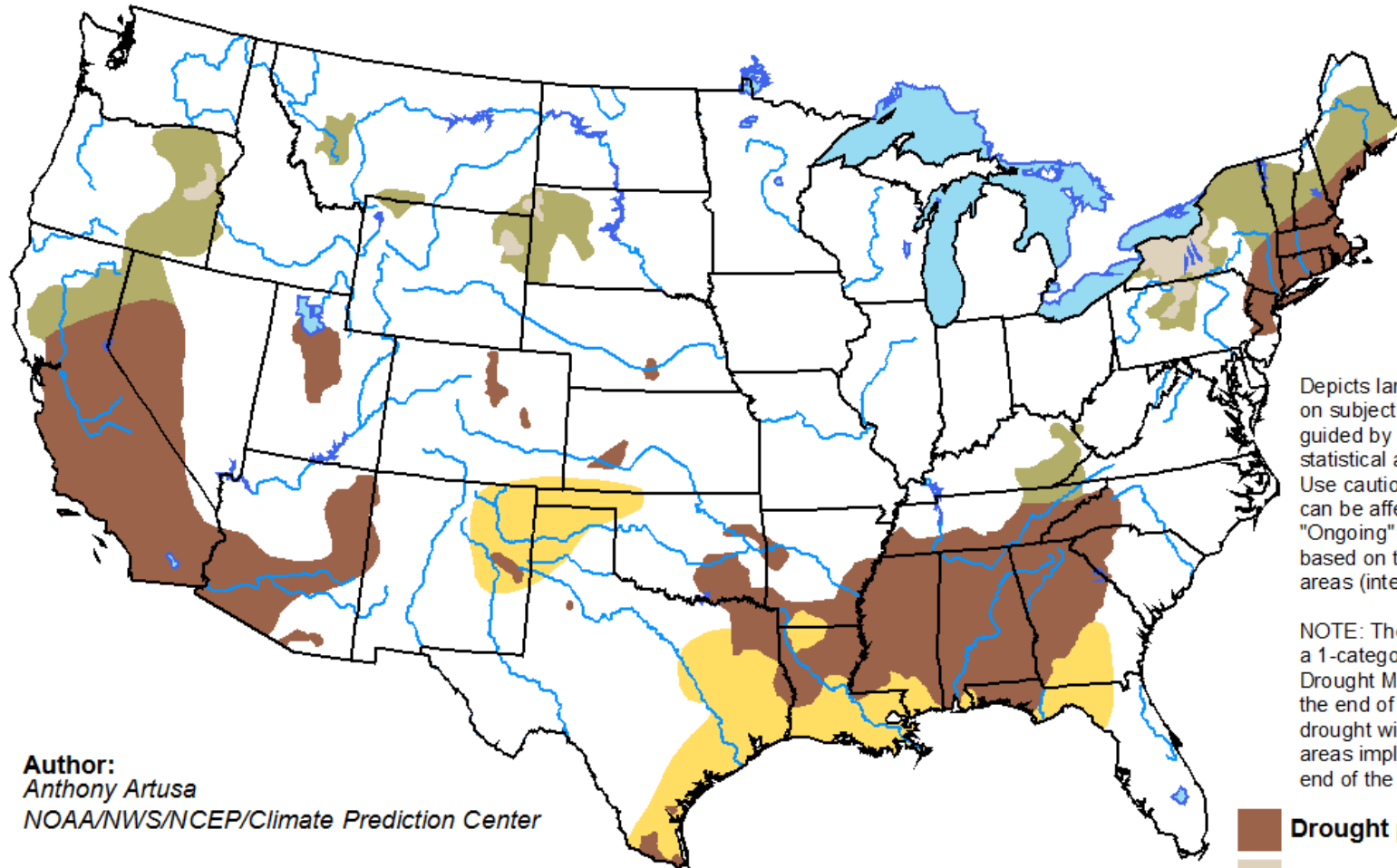
Grey areas skills < 0.3



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for October 20 - January 31, 2017
Released October 20, 2016

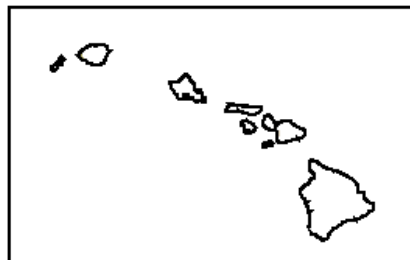
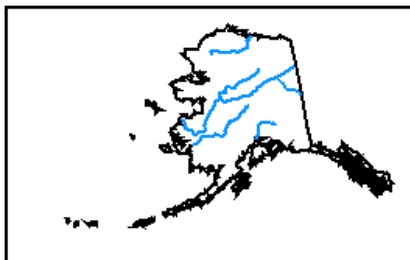


Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

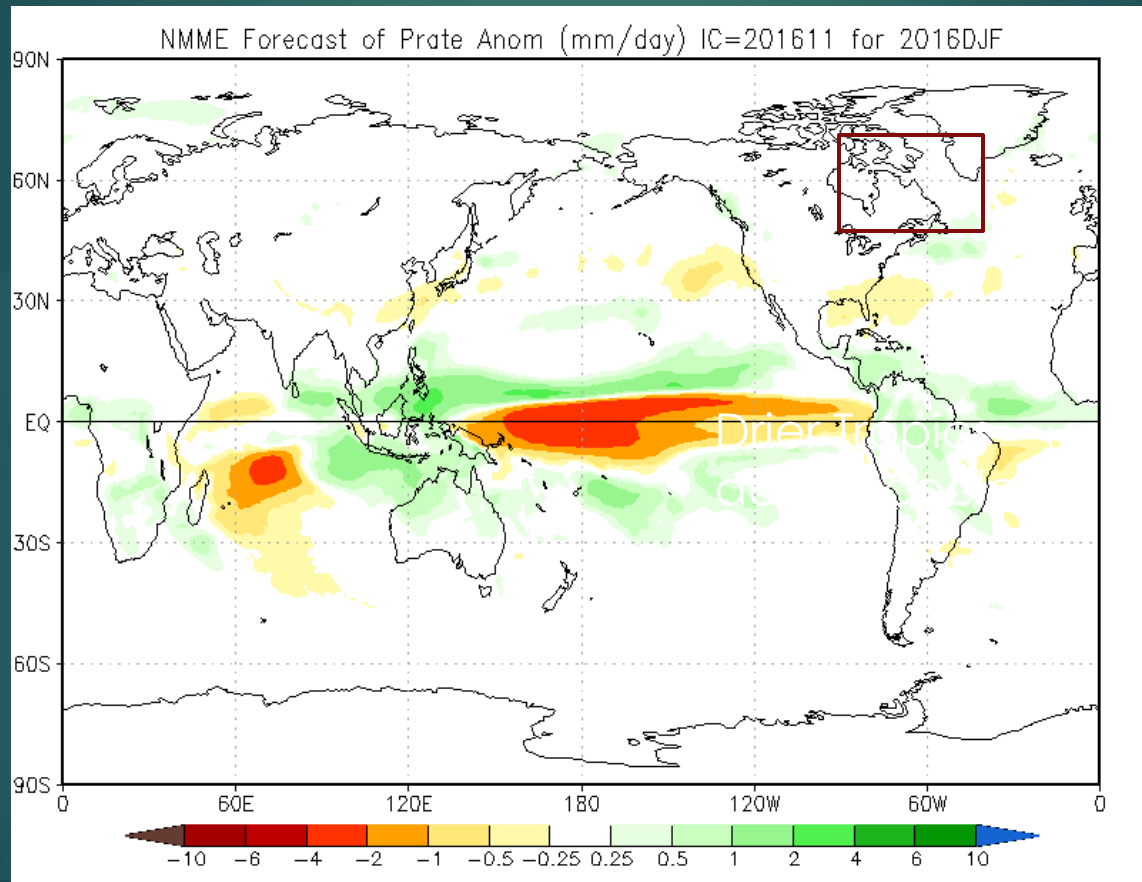
Author:
Anthony Artusa
NOAA/NWS/NCEP/Climate Prediction Center

-  Drought persists
-  Drought remains but improves
-  Drought removal likely
-  Drought development likely

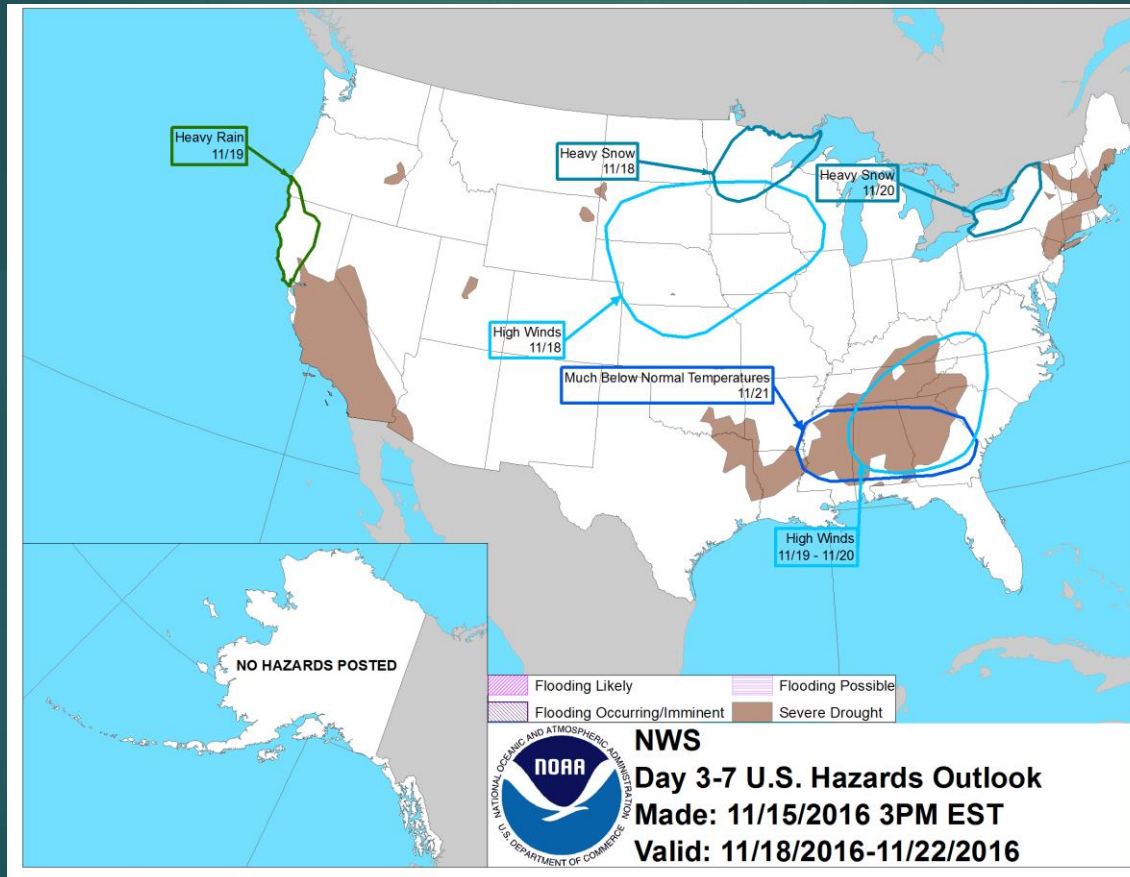


<http://go.usa.gov/3eZ73>

North America Multi-Model prediction



Day 3-7 Hazards Outlook



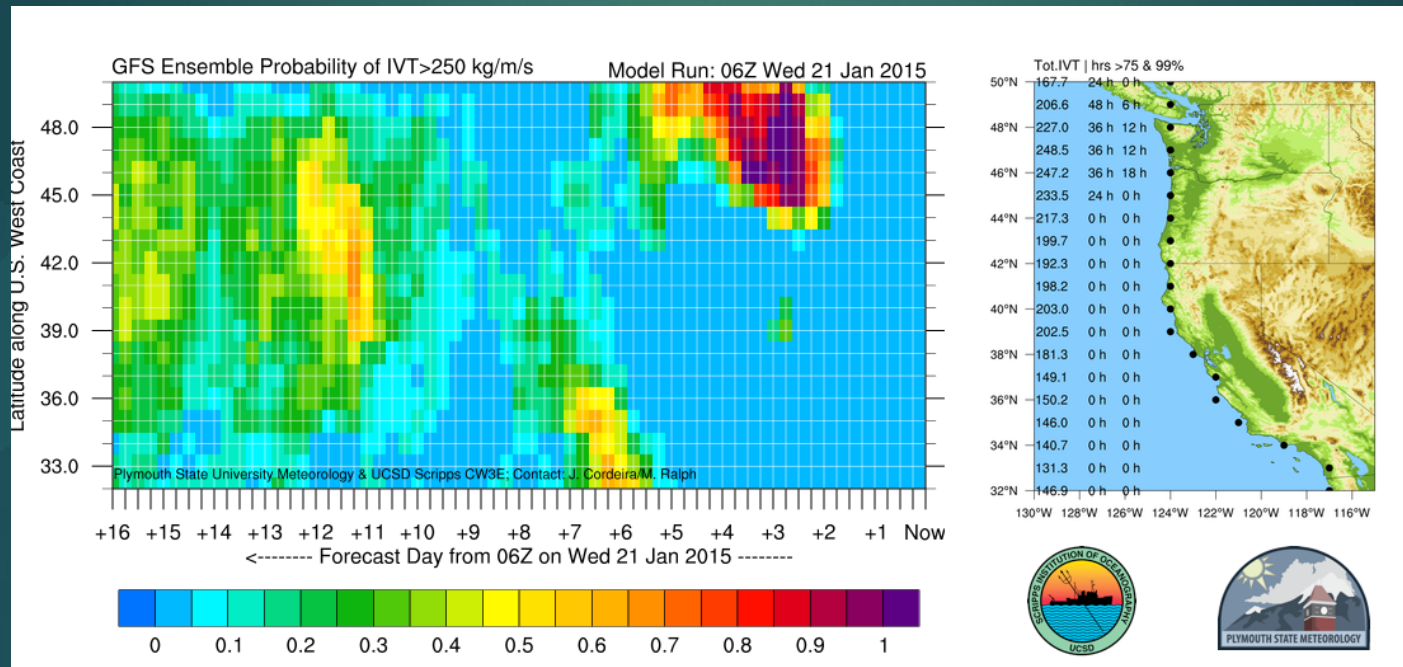
Product Changes

- ▶ Experimental Week 3 and 4
Temperature – Operational in 2017
- ▶ Experimental Week 3 and 4
Precipitation – little skill and
continues in development
- ▶ Hazard Products – Probabilistic
- ▶ Sea Ice Extent Product in
Development

People and Money

- ▶ CPC staff 39 – lowest in it's existence (48)
- ▶ Directly tied to S2S 4 to 8 people (\$500k)
- ▶ Collaborative forecast process (\$500k)
- ▶ Product development (\$200k)
- ▶ Total CPC 9 Million
- ▶ CFS – Environmental Modeling Center leveraging –
Not a clean cut value.
- ▶ Computing – huge – separate funding
- ▶ NOAA Research – Climate Program Office, PSD,
ARL, CSD, GSD, and NESDIS.

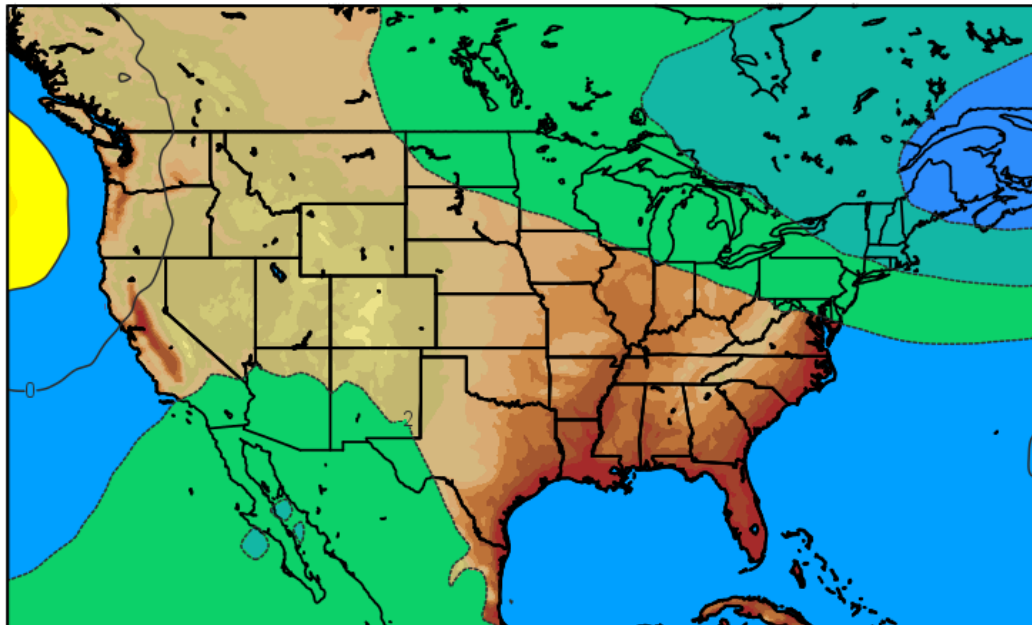
Integrated Water Vapor Transport



CFS 20 Member Ensemble 500 mb

Latest Model Cycle Used: 00 UTC 12 Feb 2014

CFS 20-member Ensemble (00/06/12/18 UTC Control Runs - Last 5 Days)
Mean 500 hPa Mean Height Anomalies (dam) for Week 3 - All Members (CFSR 1982-2010 Climatology)
12 AM CST Wed, Feb 26, 2014 - 12 AM CST Wed, Mar 05, 2014



Am I Out of Time?



Future

- ▶ A lot of work to go

▶ **Research** - That isn't
being funded appropriately -rp