

# Hercules Dome: Meteorology & Climate for the Next Deep Ice Core Site

David B. Reusch & Eric Steig

New Mexico Institute of Mining & Technology

& University of Washington

david.reusch@nmt.edu



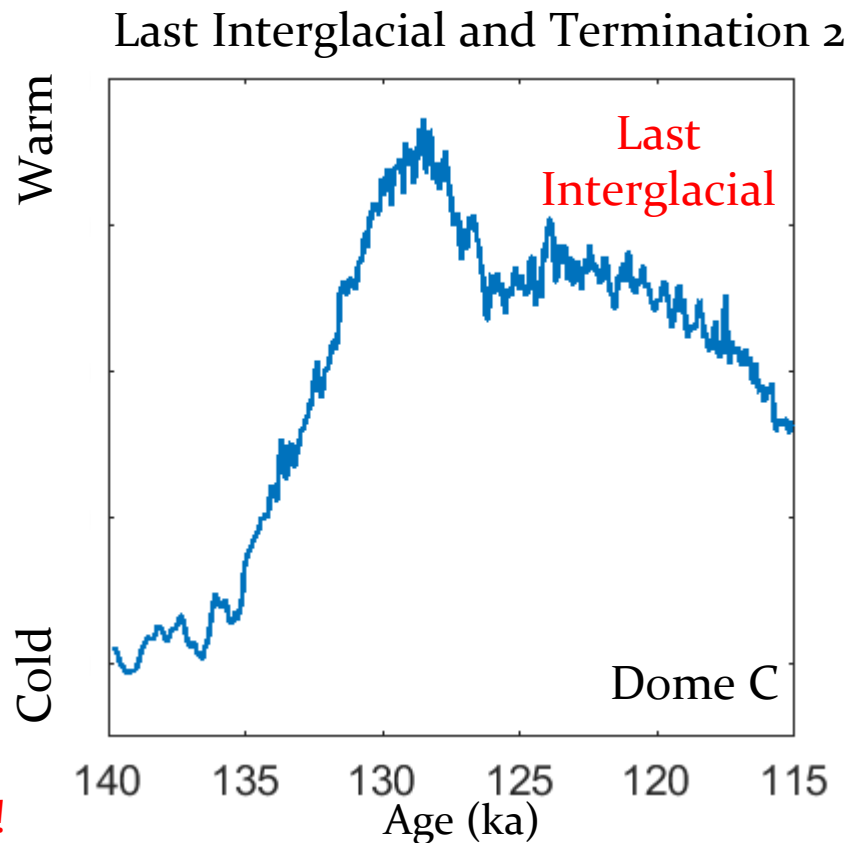
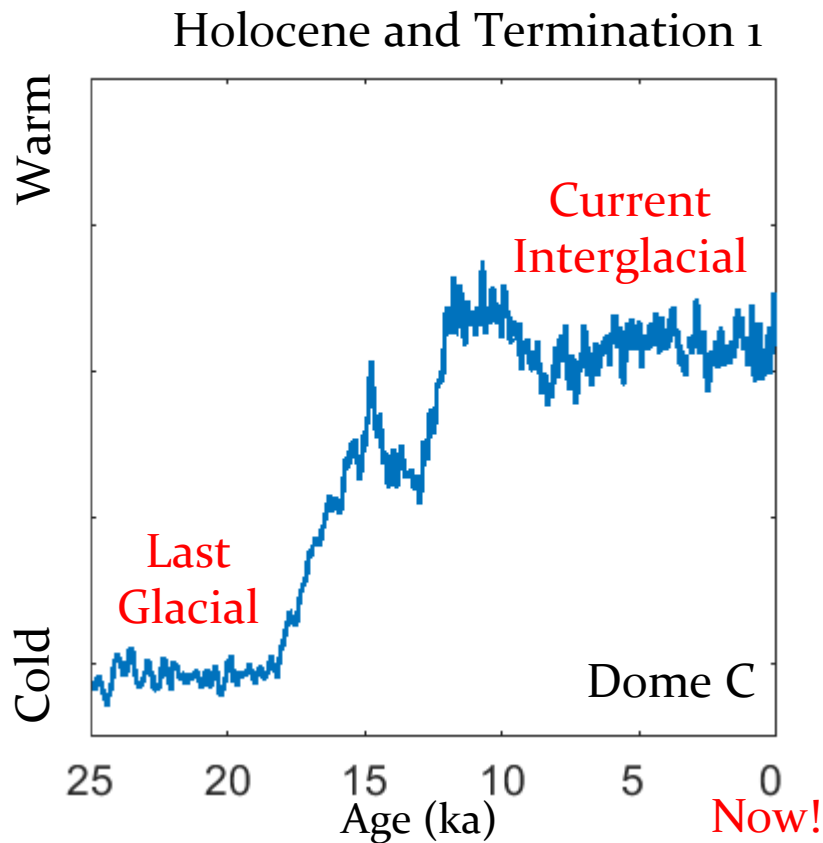
**W** UNIVERSITY *of* WASHINGTON

WAMC 26 Jun 2019

# Last Interglacial (LIG)

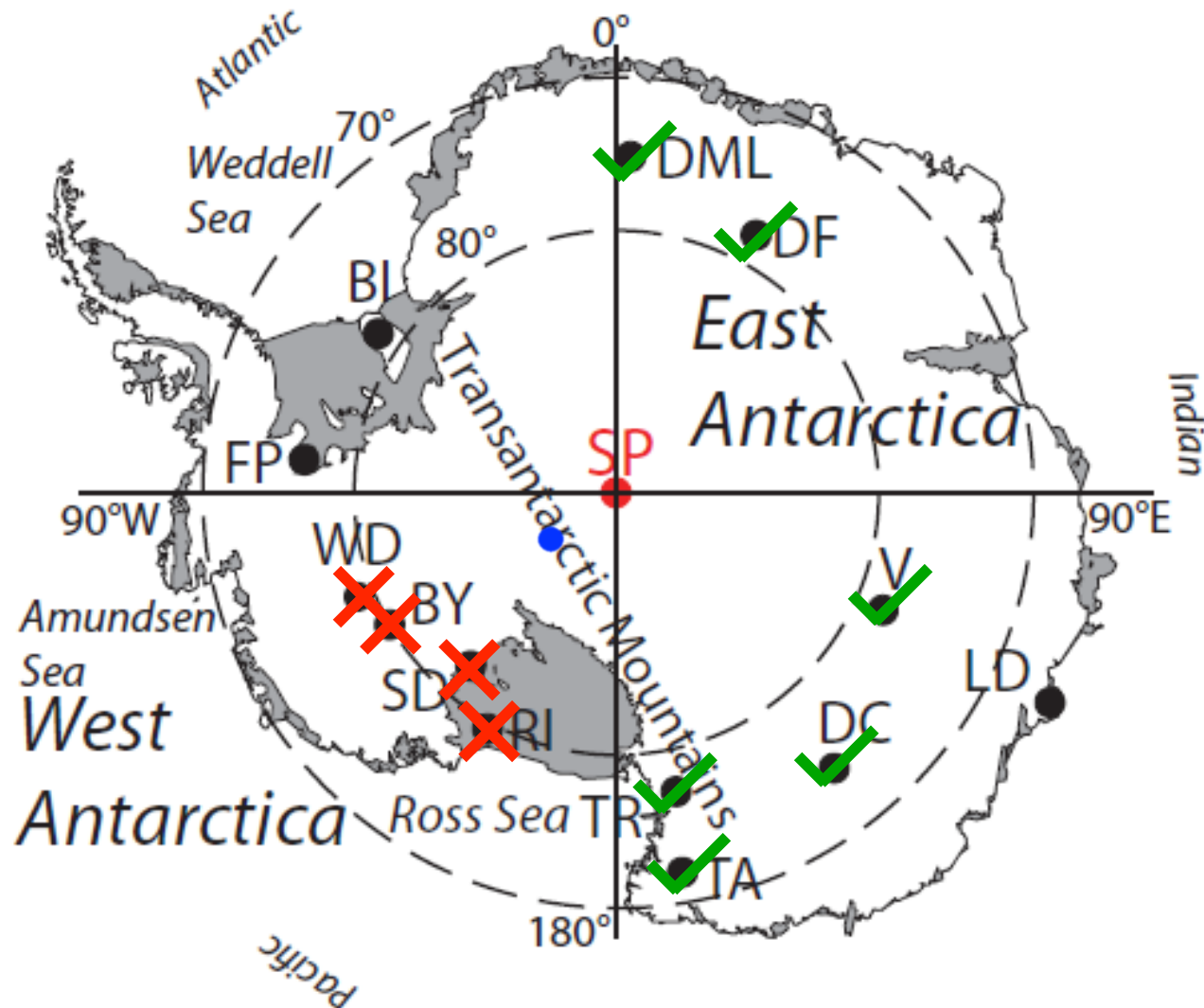
Conditions similar to what is expected by 2100

- 0-2 °C warmer globally, 3-5 °C warmer in polar regions





# Where Last Interglacial Ice has been drilled

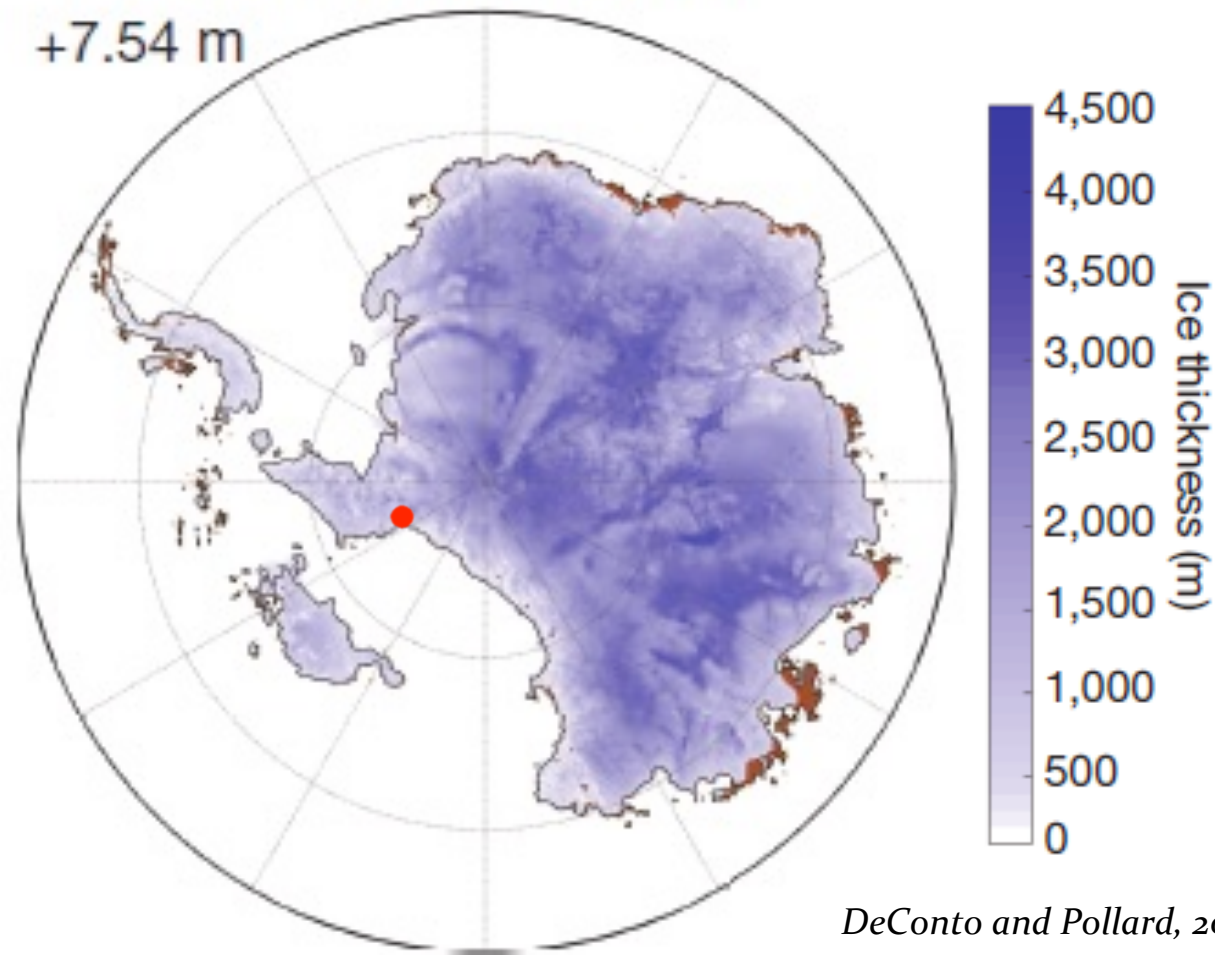


# Hercules Dome retains deep ice during a WAIS collapse

**c** Maximum retreat  
(glacial initial conditions)

+7.54 m

86° S, 105° W

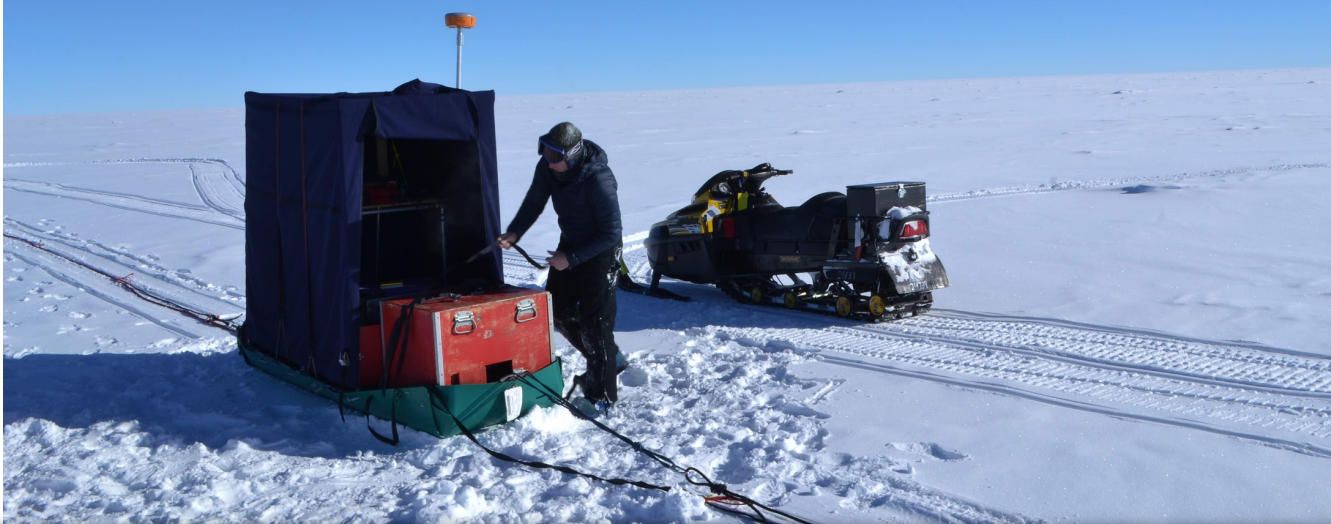


*DeConto and Pollard, 2016, Nature*

# 2018-2019 Field Season

	Goal	Actual
Radar tracks	500 km	36 km
GPS/radar sites	50	8
Science days	20	2.5

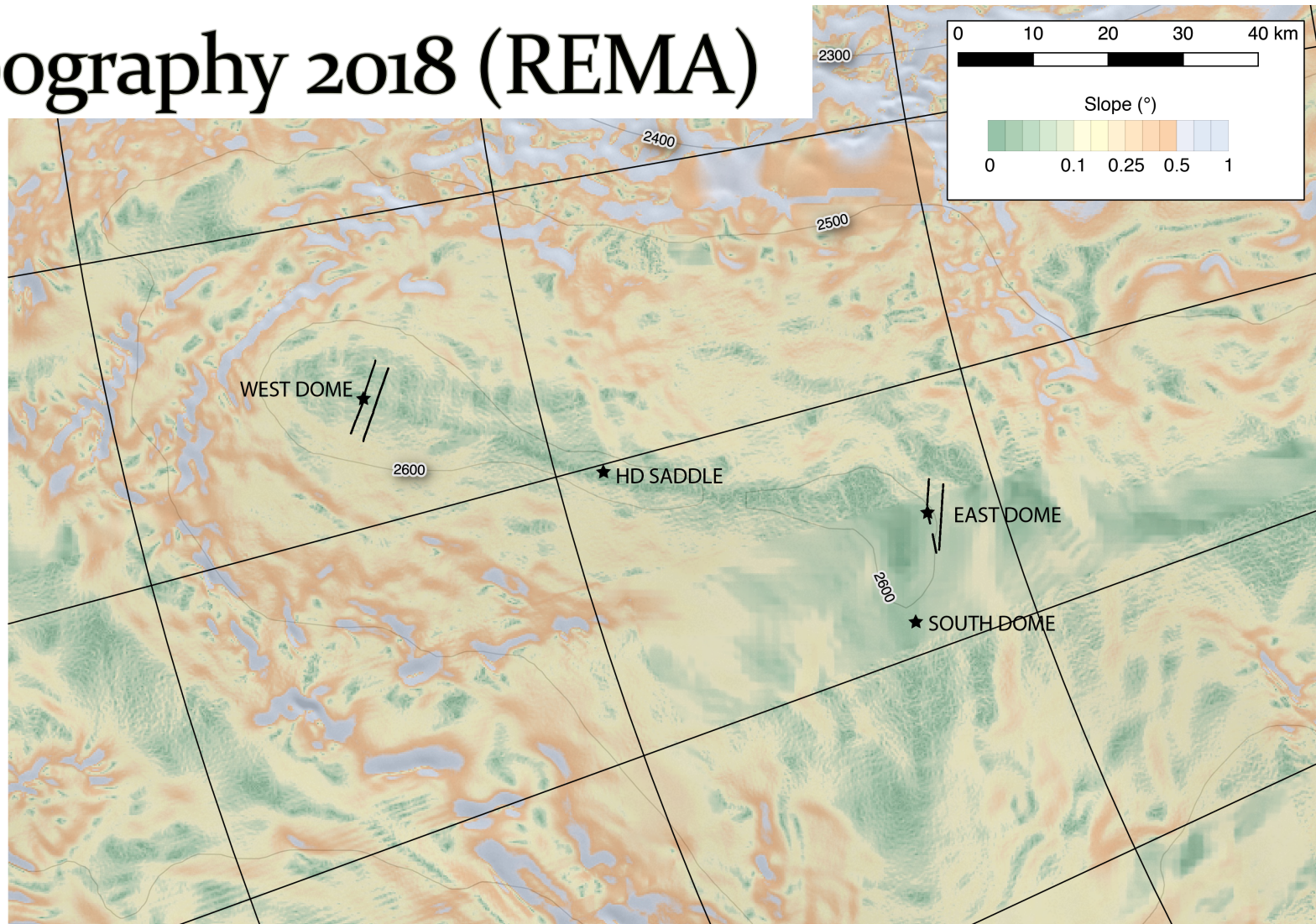
Conditions at both Hercules Dome sites visited were beautiful.  
No sastrugi, moderate temperatures.  
Smoother terrain than at South Pole.



Ice Cores • Meteo Intro • Variability • SOMs • Summary



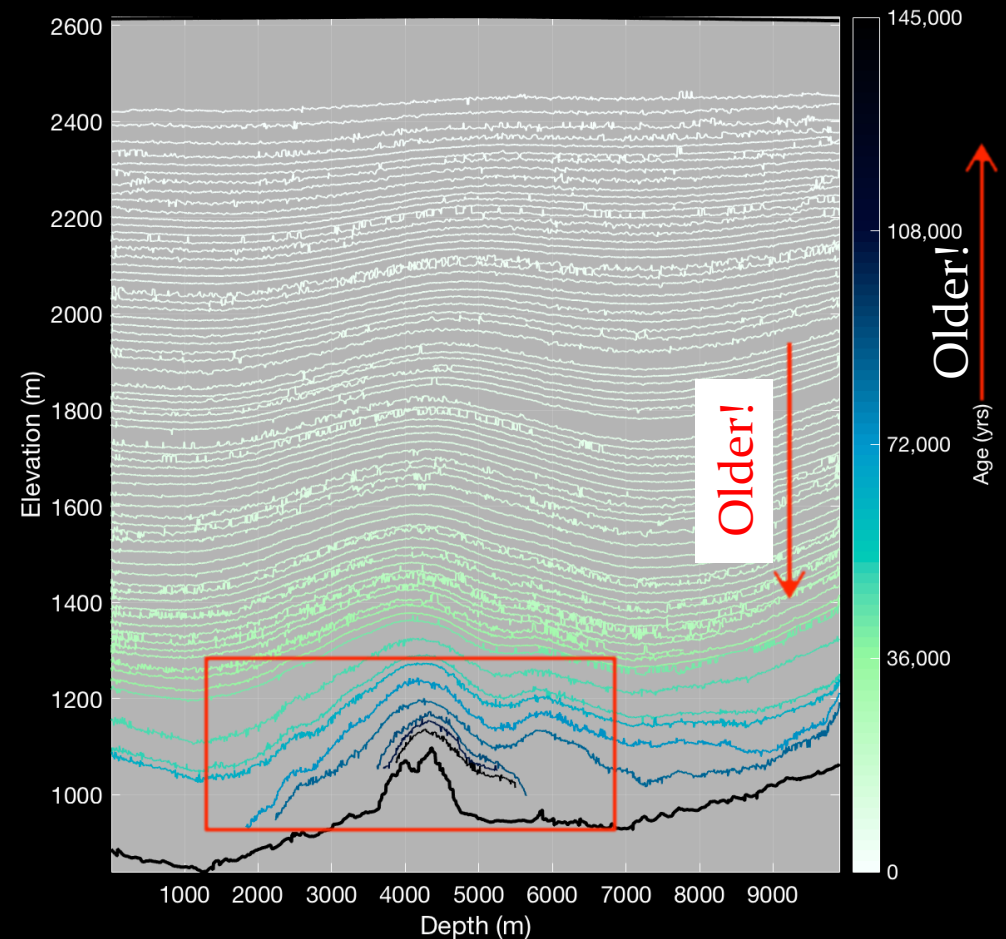
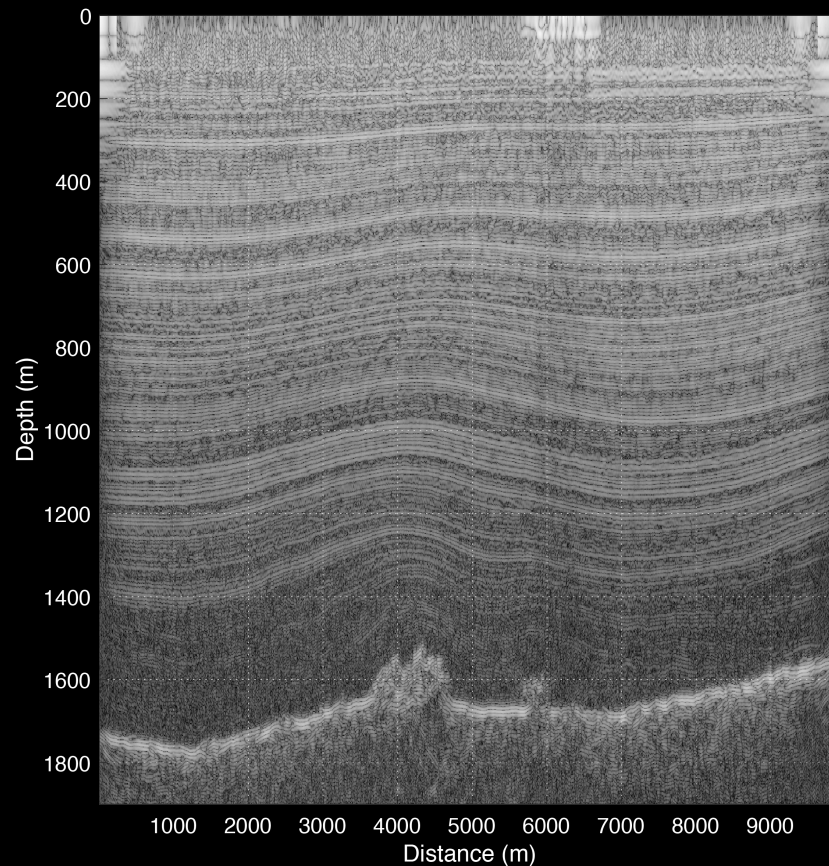
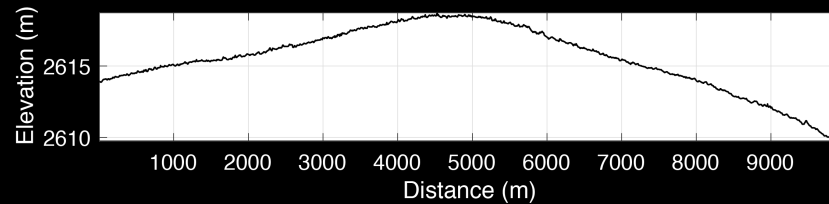
# Topography 2018 (REMA)



A map of surface slope with the latest data shows that Hercules Dome is more complex than old topographic maps would suggest. There are actually three distinct ridges. We visited two, which we call West and East for the grid directions from South Pole. The old ITASE traverse crossed the East dome.

# West Dome topography and stratigraphy.

West Dome is a well-defined ice ridge fixed by a simple topographic ridge with simple ice flow. Last interglacial ice is >50 to >100 m above the bed.





# This Project: Meteorology

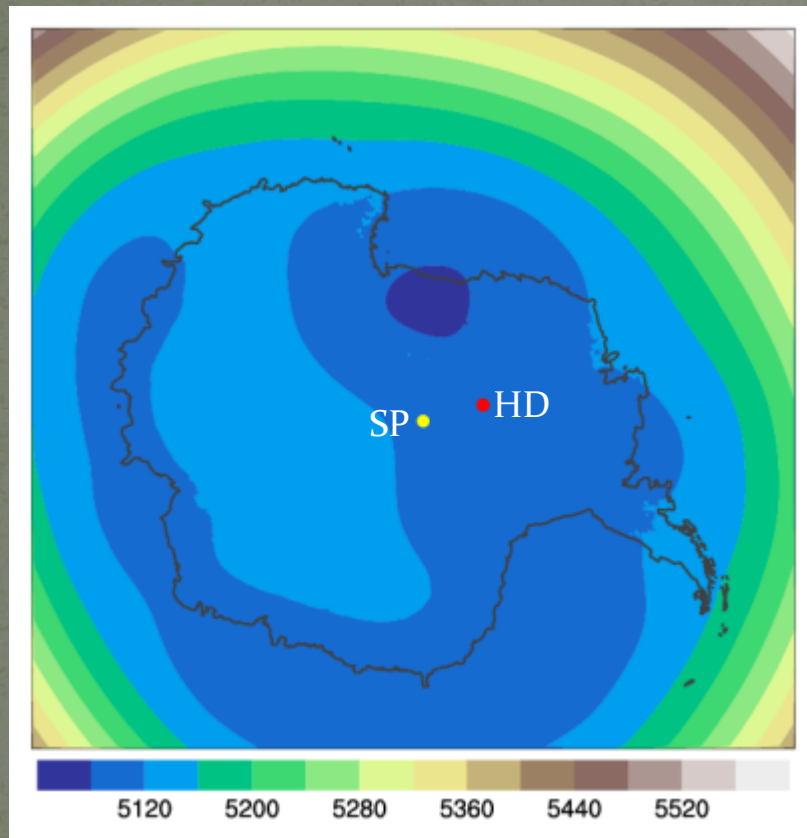
- Recent variability in the Hercules Dome region
  - Was that nice weather normal or unusual?
  - Compare to other regions
- Strategies
  - Standard deviation(Z500) == “variability”
  - Self-organizing maps
    - Patterns
    - Transitions



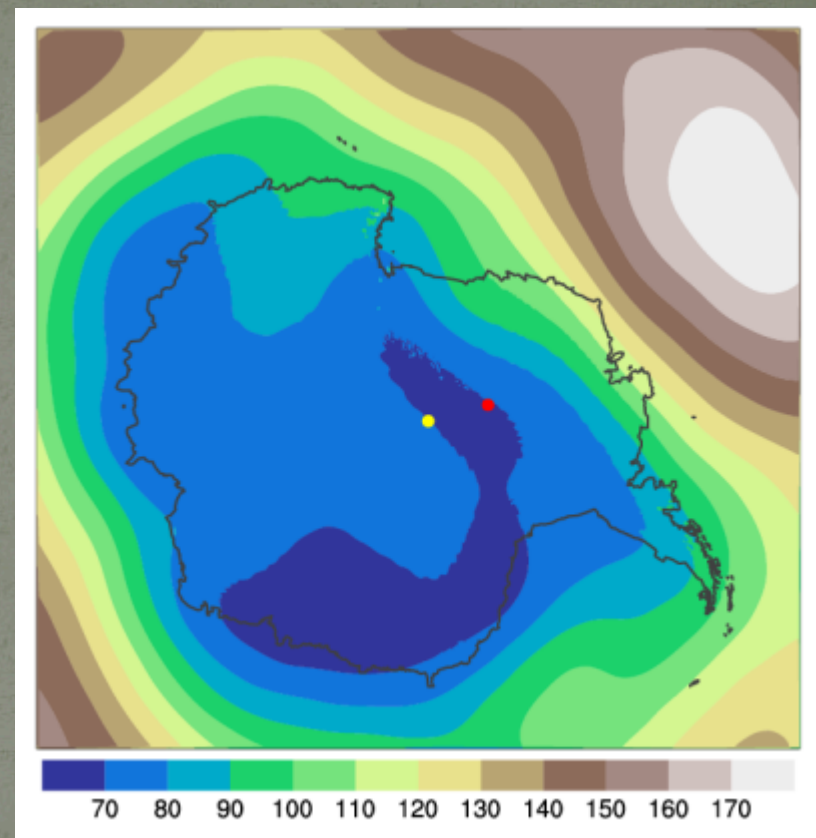
# The AMPS (non-climate) archive

- Domains 2 (continental) & 3 (Ross Sea)
- December-January, 2013/14 to 2018/19 (6 years)
  - 2,976 3-hourly timesteps
  - 372 daily timesteps
- Resolutions & versions
  - 2013/14 – 2016/17: 10 km/3.33 km, WRF 3.3.1 & 3.7.1
  - 2017/18 – 2018/19: 8 km/2.67 km, WRF 3.9.1.1
  - RegridDED to higher resolution

# Mean and Variability: Z500



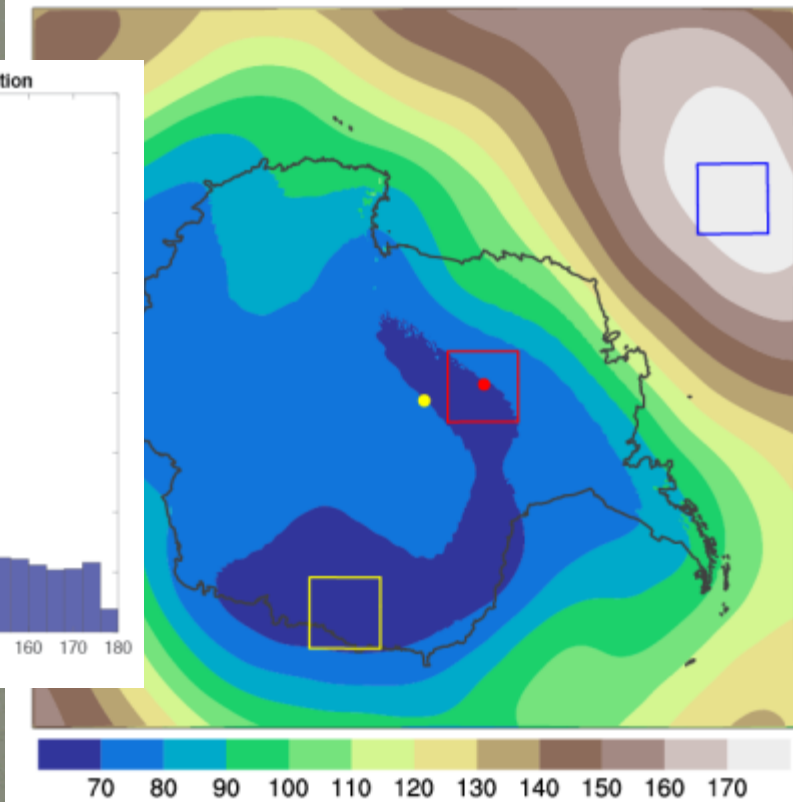
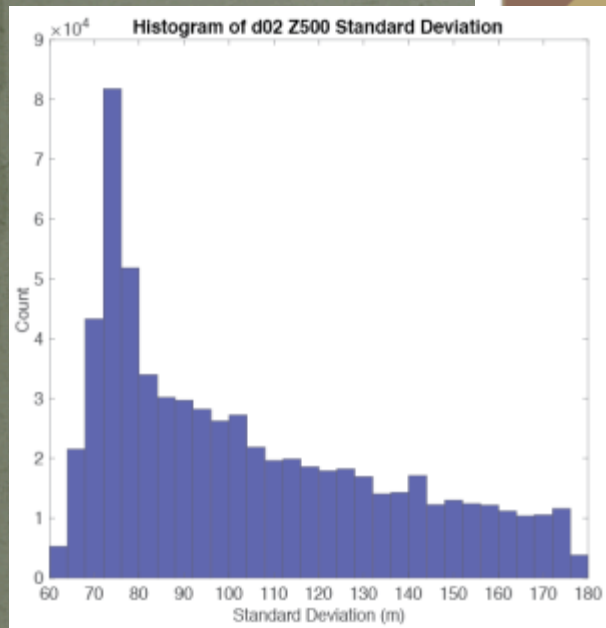
Mean (m)



Standard deviation (m)



# Comparative Variability: Z<sub>500</sub>

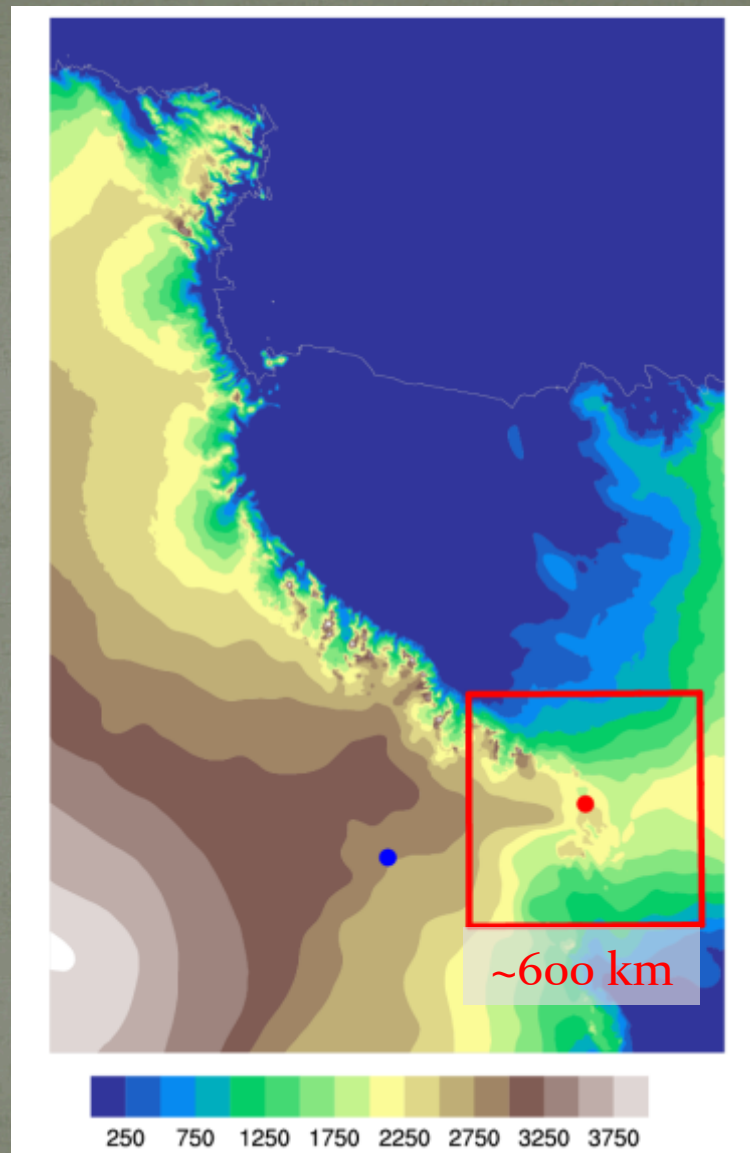


Max: 175.7

HD: 70

Min: 64.2





Herc Dome 3-hourly

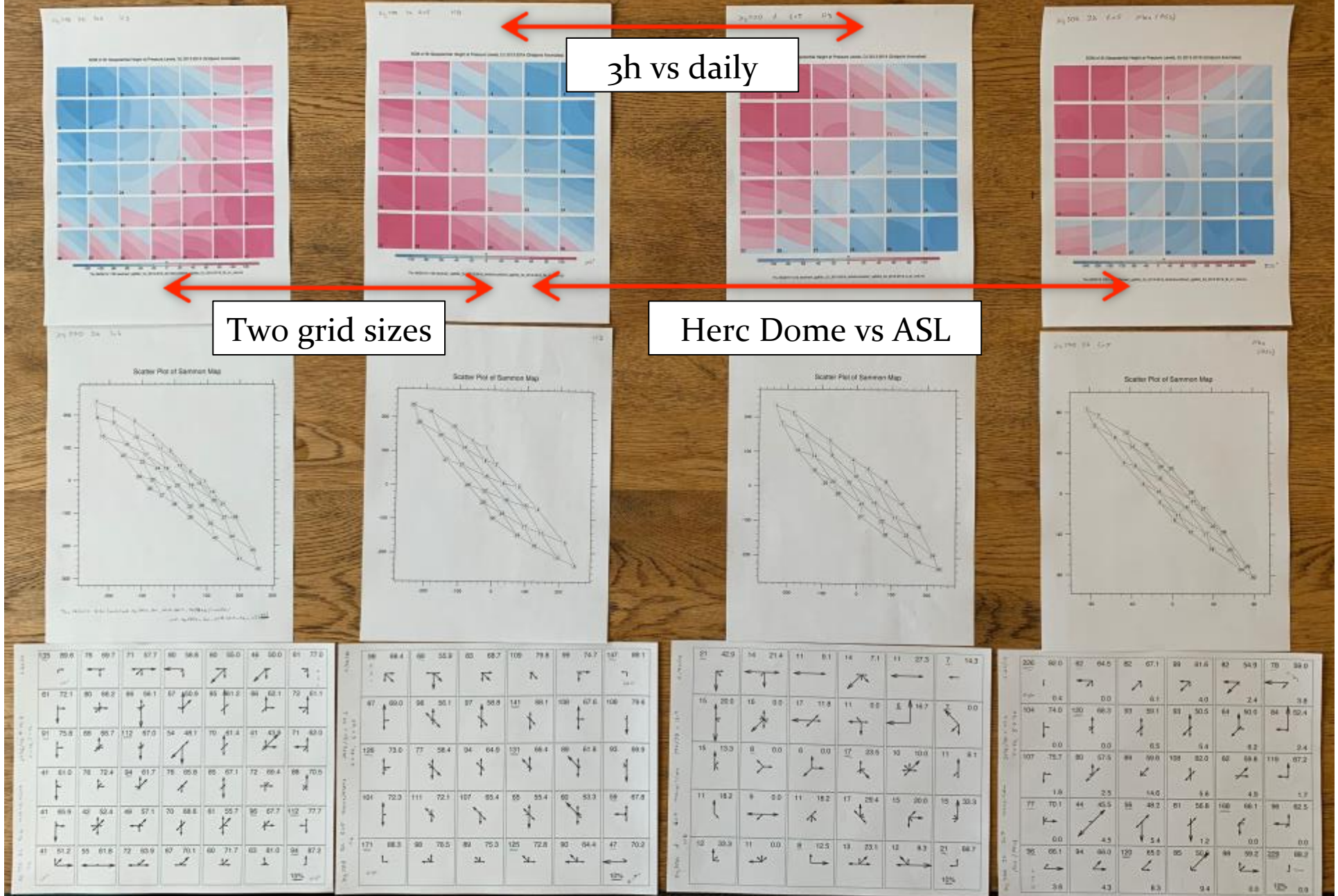
HD Daily

ASL 3-hourly

3h vs daily

Two grid sizes

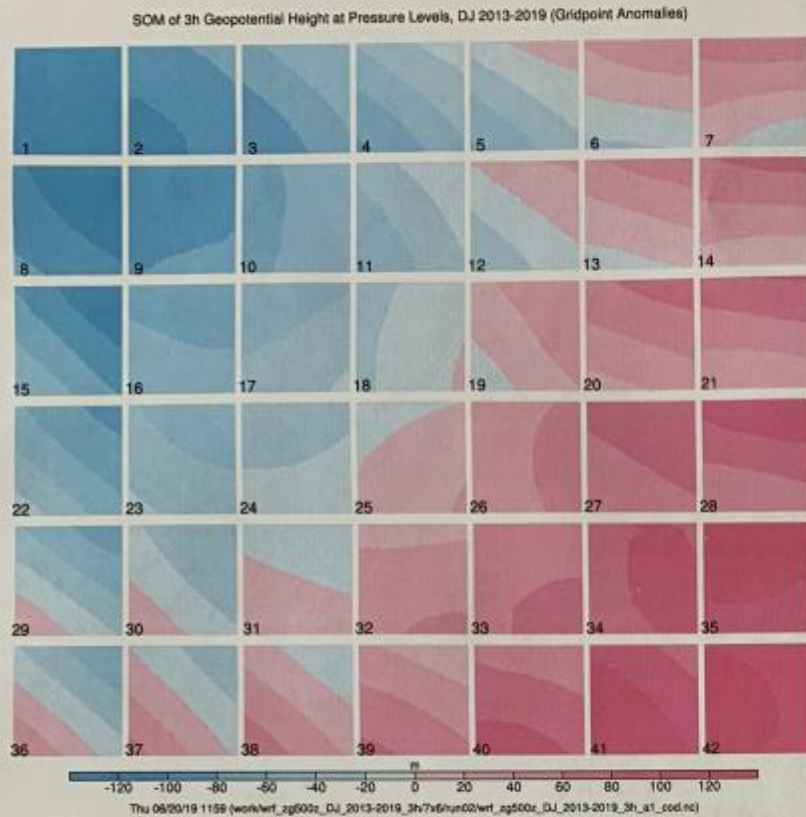
Herc Dome vs ASL





## Herc Dome Z500 3-hourly

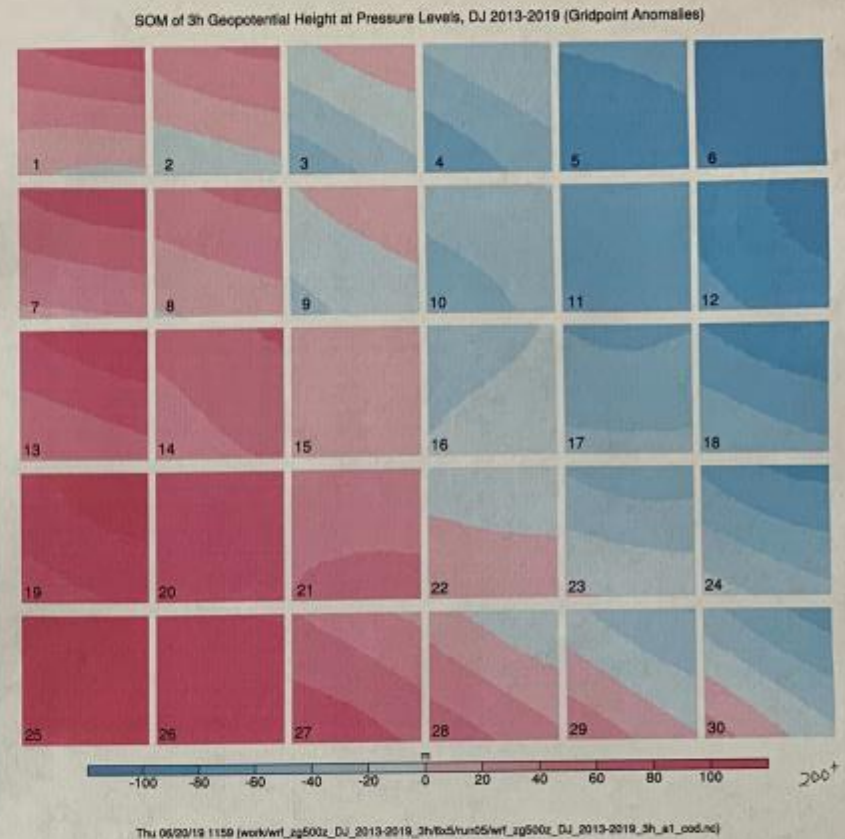
7x6 SOM



-120 m

120 m

6x5 SOM

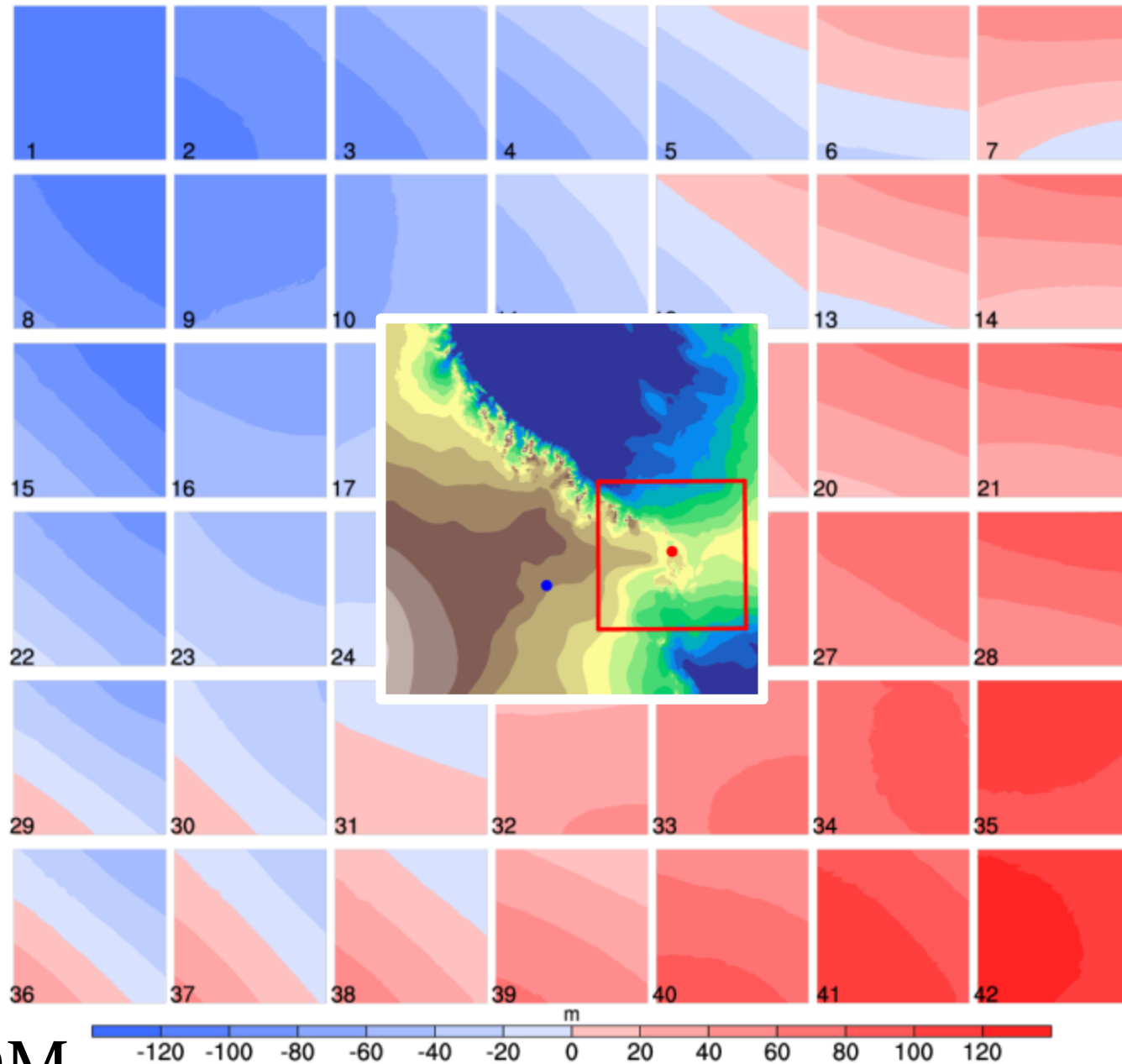


-100 m

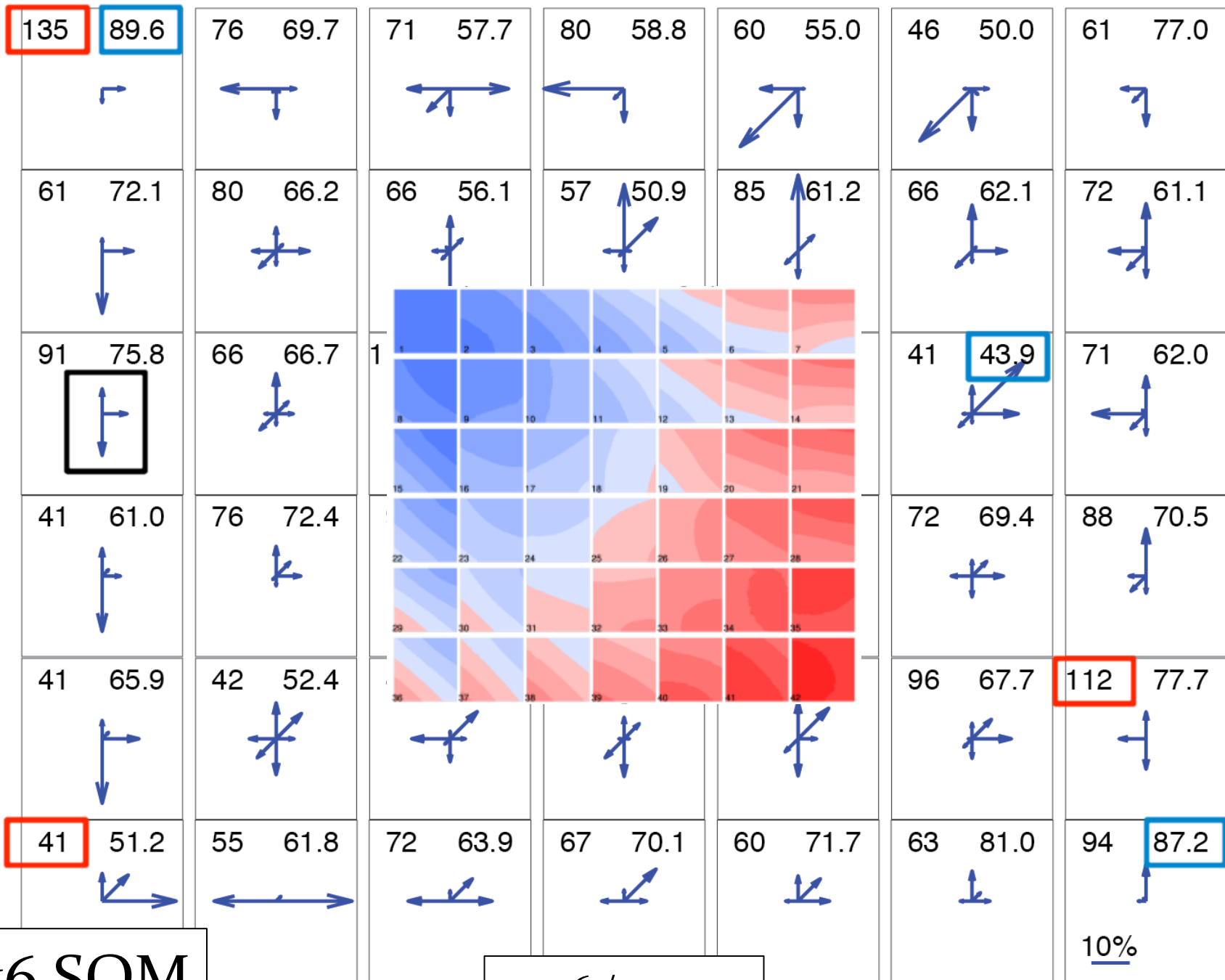
100 m



3-hourly Z500, Dec-Jan 2013-2019 (gridpoint anomalies)



7x6 SOM



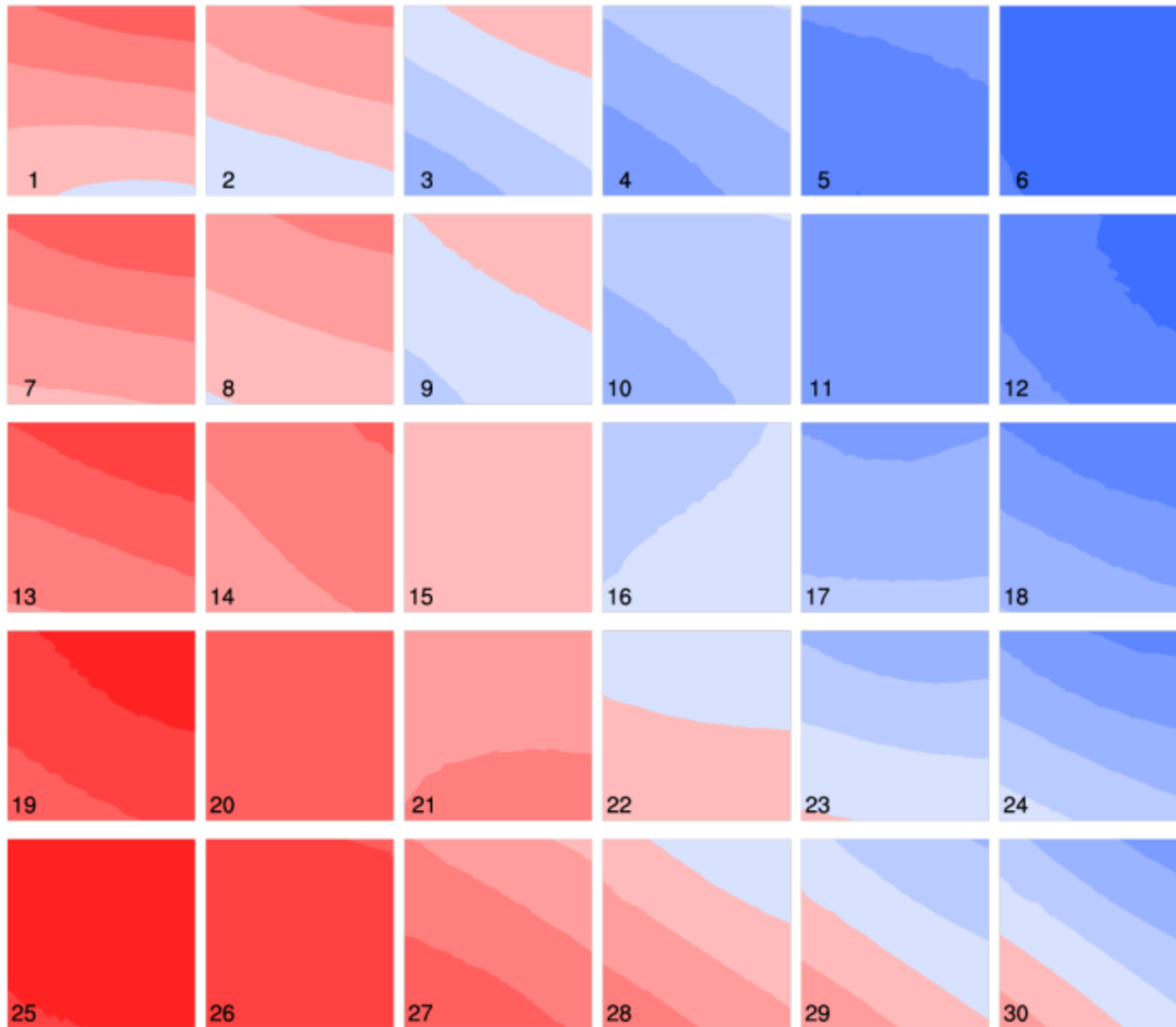
7x6 SOM

$$2976 / 42 = 71$$

10%

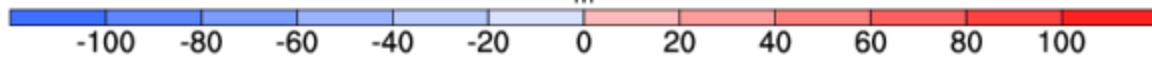


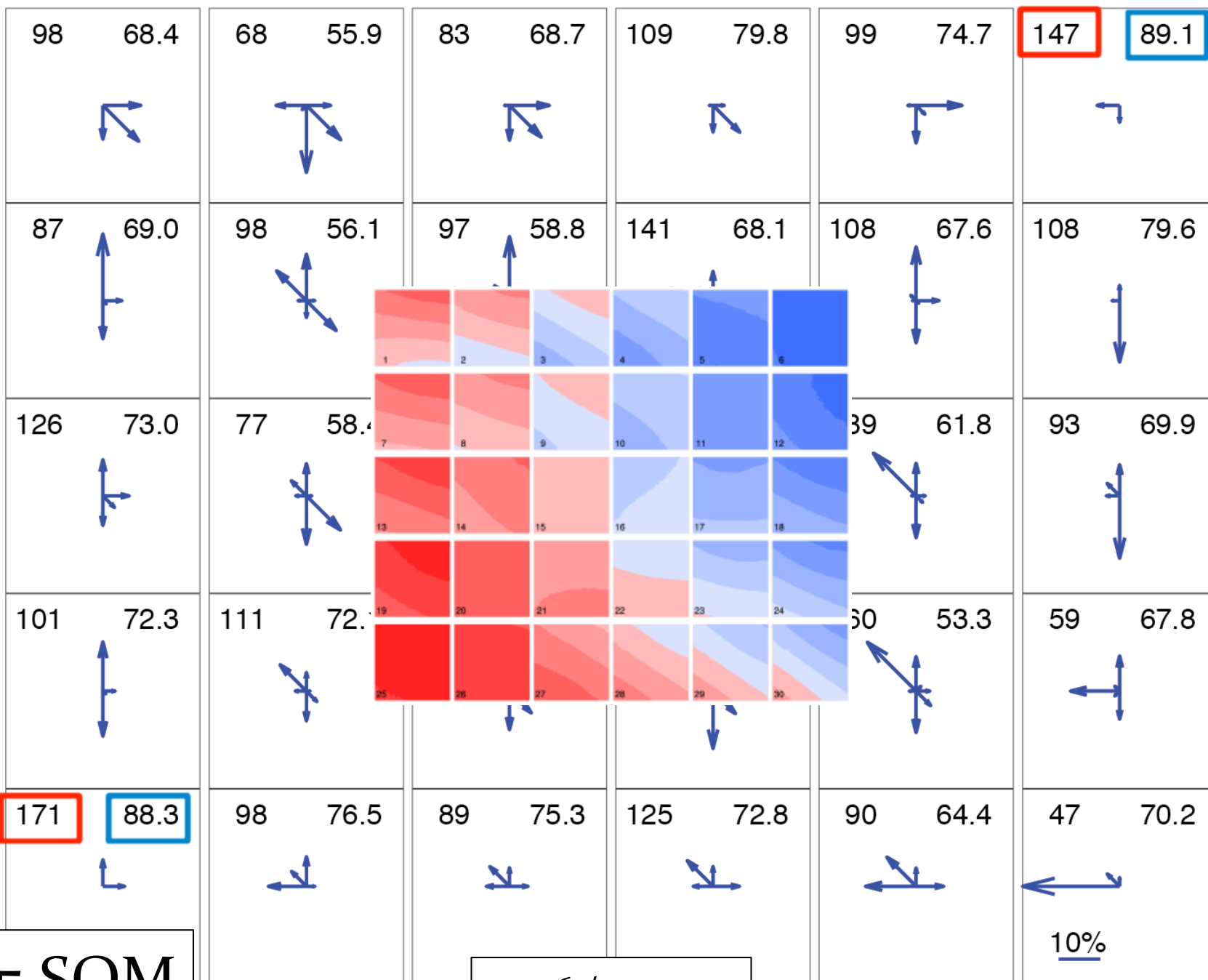
3-hourly Z500, Dec-Jan 2013-2019 (gridpoint anomalies)



m

6x5 SOM



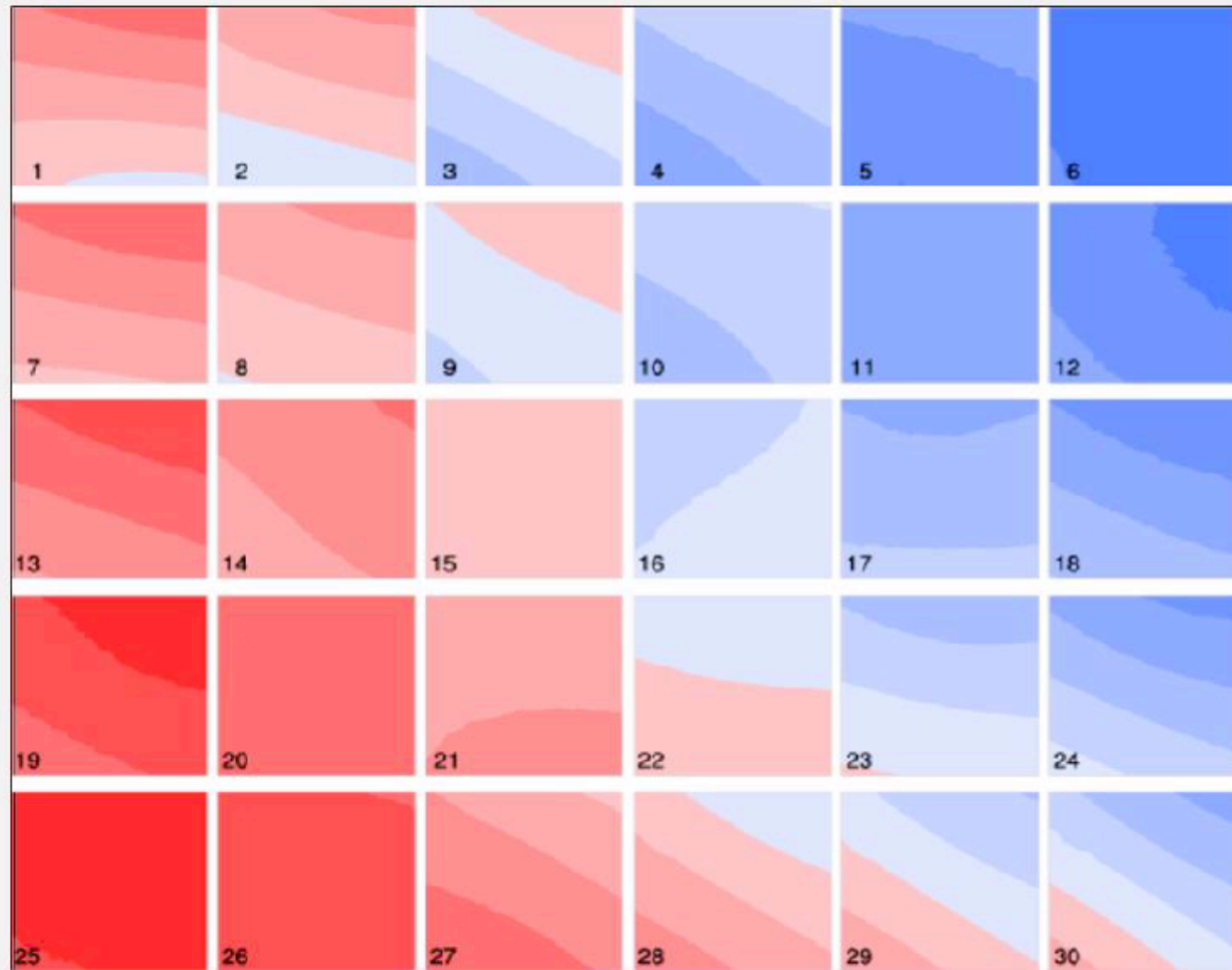


$$2976 / 30 = 99$$

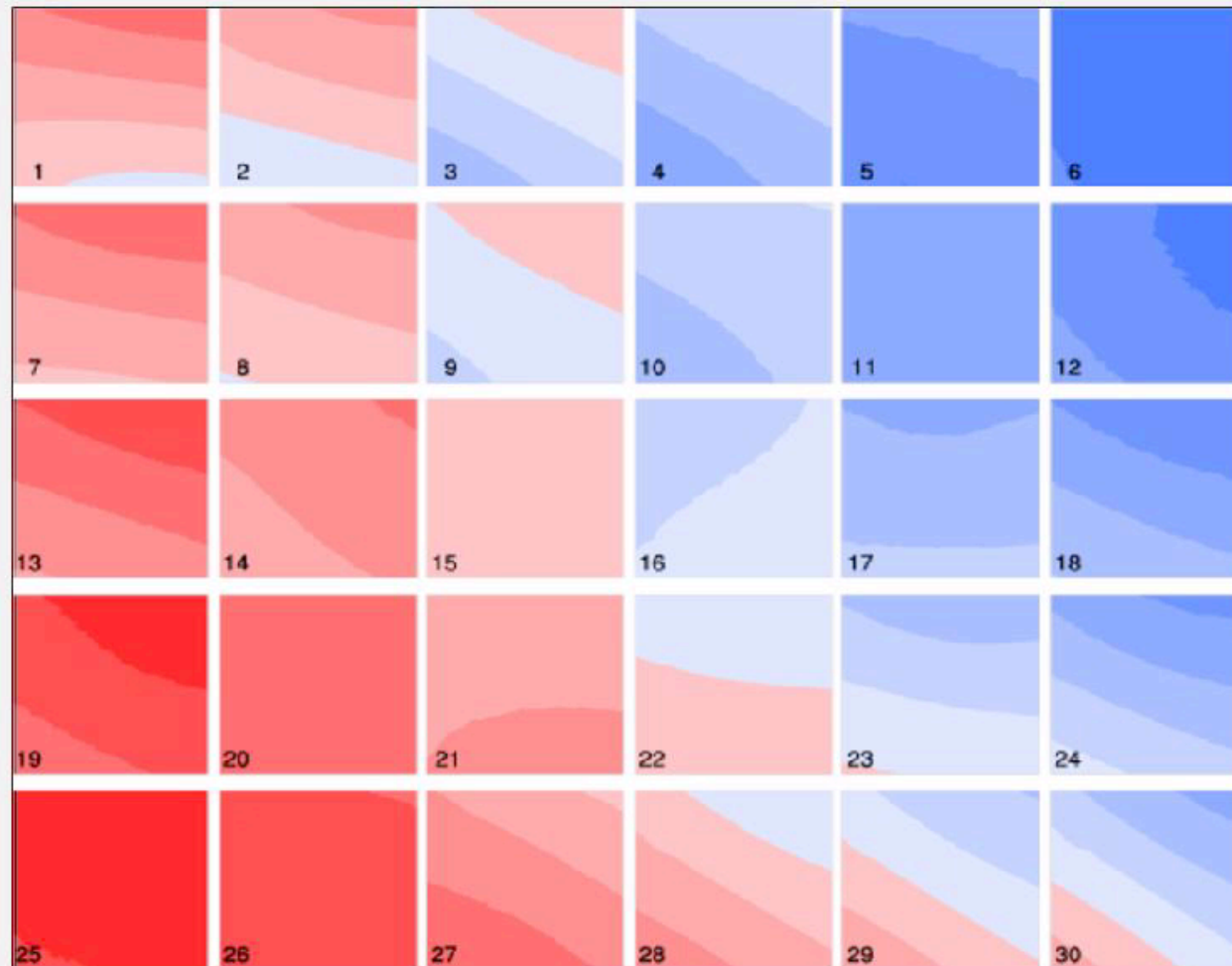
6x5 SOM



### 3-hourly Pattern Transitions January 2019



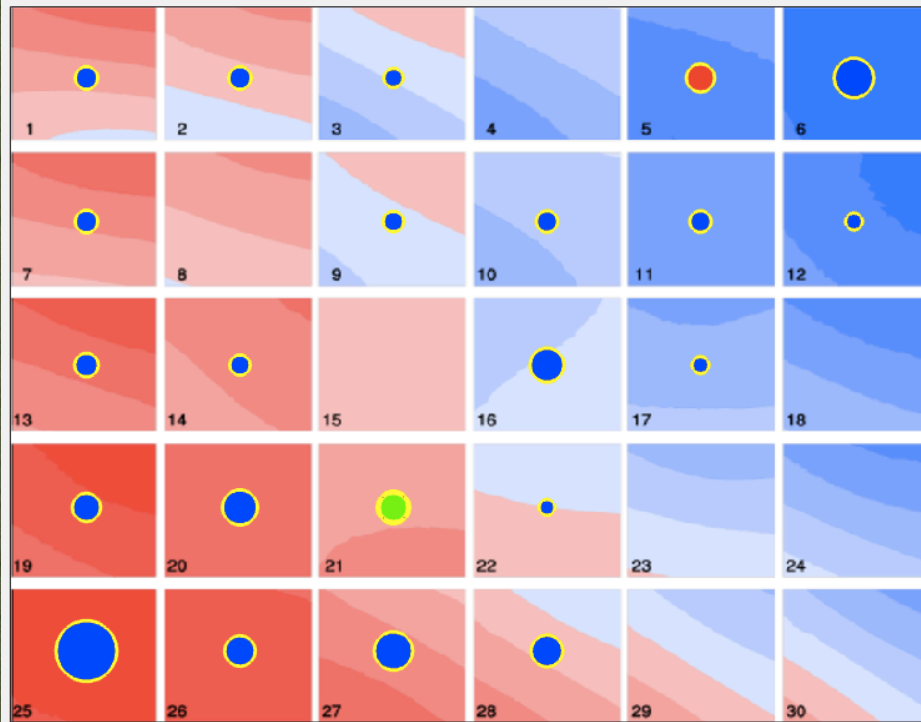
### 3-hourly Pattern Transitions January 2014



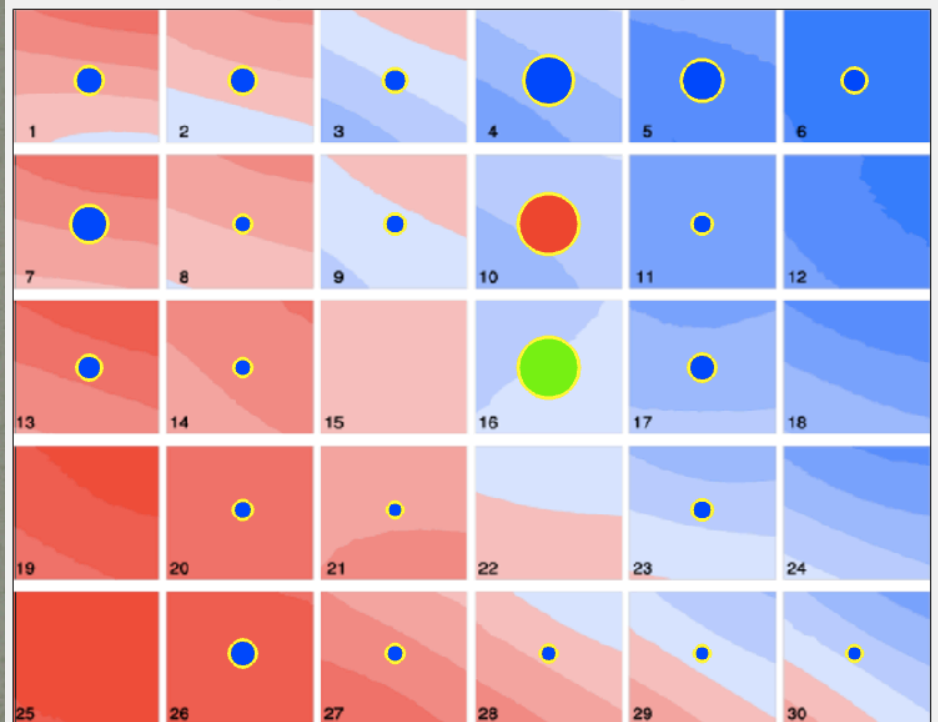


# January 2014 and 2019

3-hourly Pattern Transitions January 2014

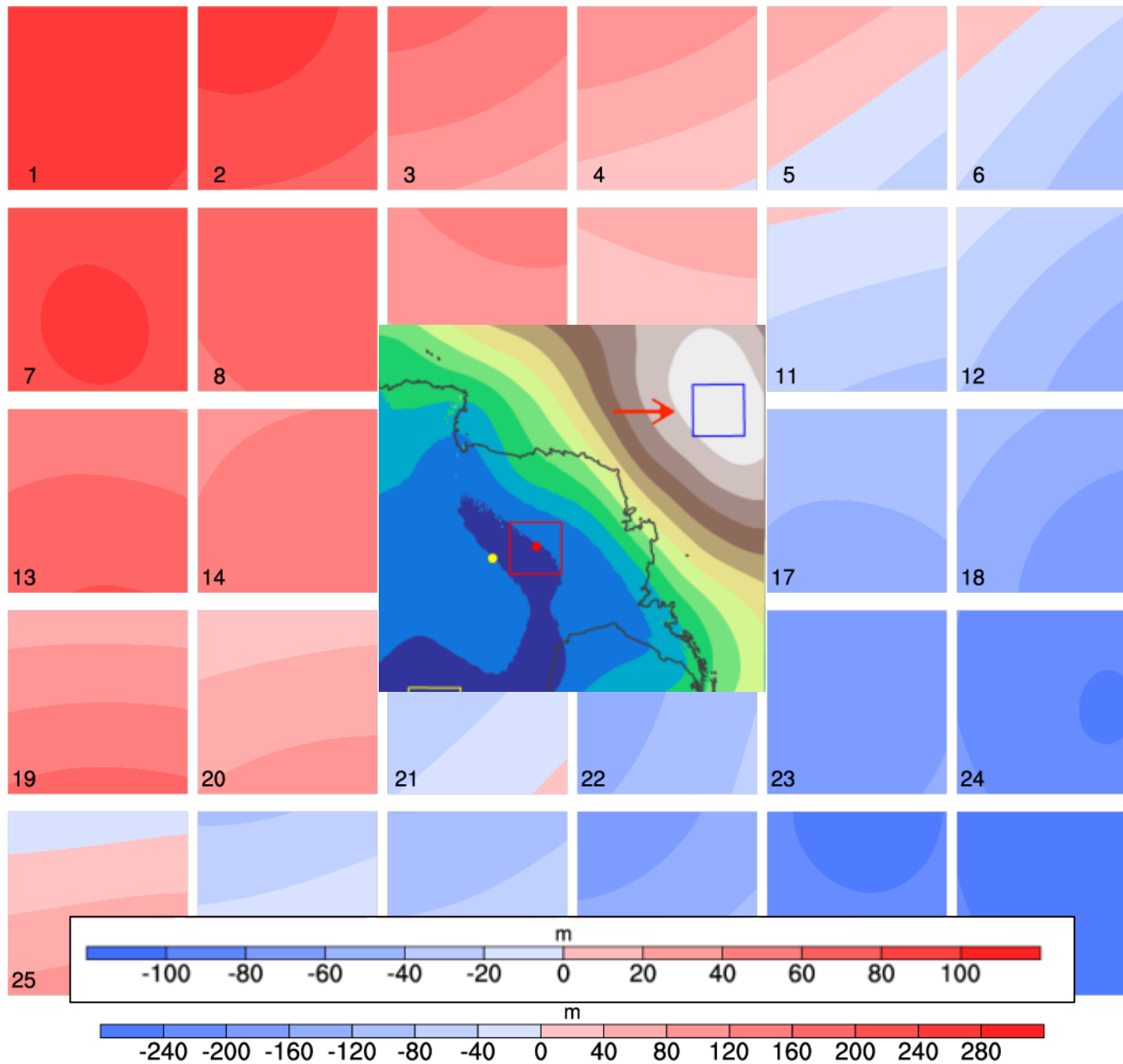


3-hourly Pattern Transitions January 2019



Largest circles are ~18%

# ASL: 3-hourly Z500, Dec-Jan 2013-2019 (gridpoint anomalies)



ASL



# Summary & Future Work

- Hercules Dome “variability”
  - Definitely at the lower end
  - SOMs show some hints of interesting behavior
  - Still a very open question...
- Future work
  - Expand to rest of the calendar year
  - Add more variables
  - Do some dedicated WRF runs (for consistency/longer record)