

# Recovering sub-monthly TWS variations with a new daily GRACE mascon estimate

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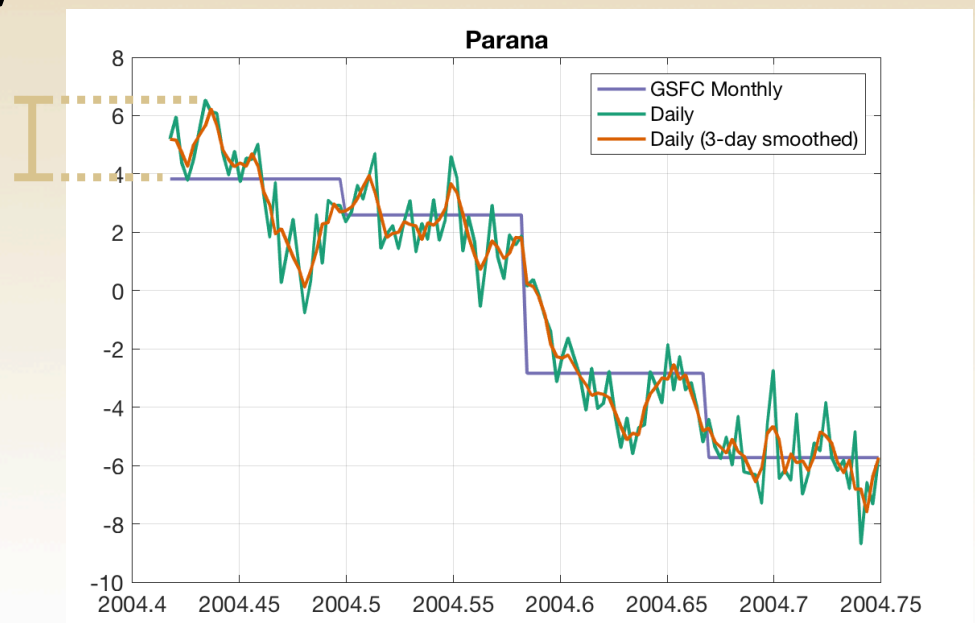
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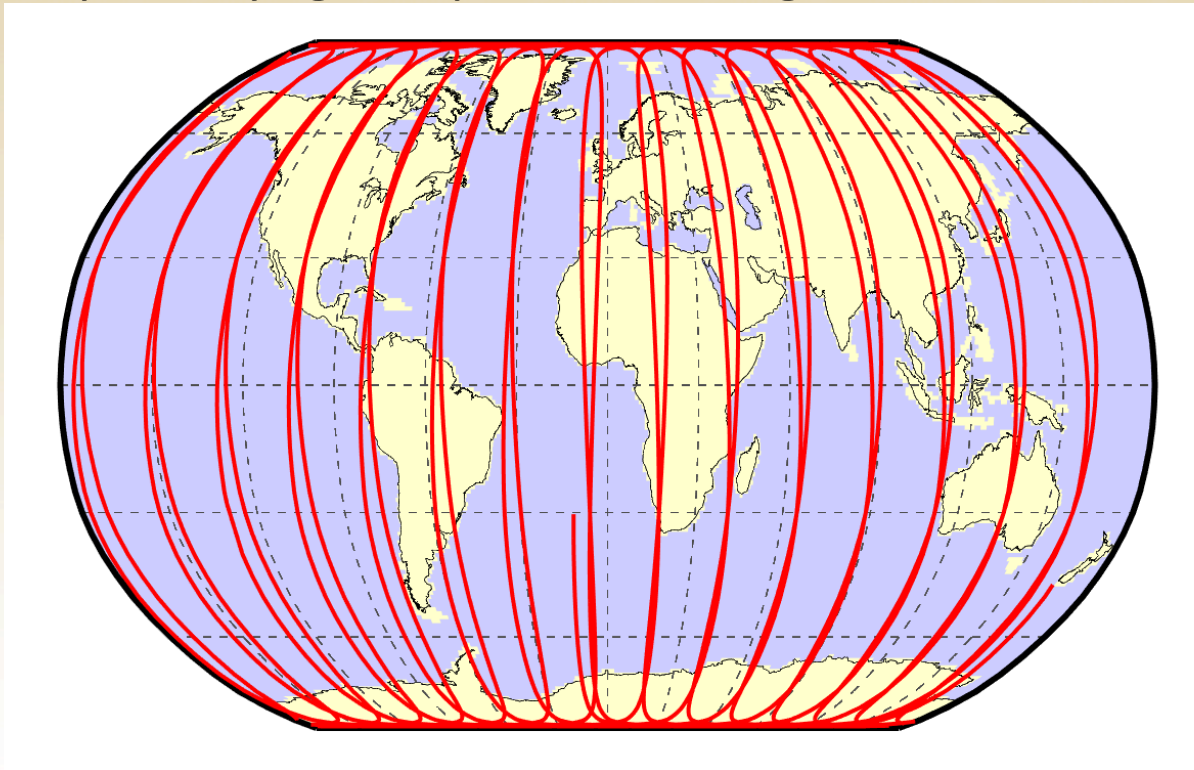
# Resolve sub-monthly TWS signals with a mixed approach

- Built off the monthly GSFC Global Mascon technique
  - Utilize the same batch least squares approach
  - Include the monthly solution as part of LS reference forward model of gravity field
- Estimate sub-monthly deviations from that solution



# Considerations for a daily TWS estimate

- 41,168 equal-area 1-degree mascons
- Observations every 5 seconds, with gaps  $\rightarrow$   $\sim 17,280$  obs/day
- $\sim 15$  orbits per day: good polar coverage, coarse elsewhere



# Considerations for a daily TWS estimate

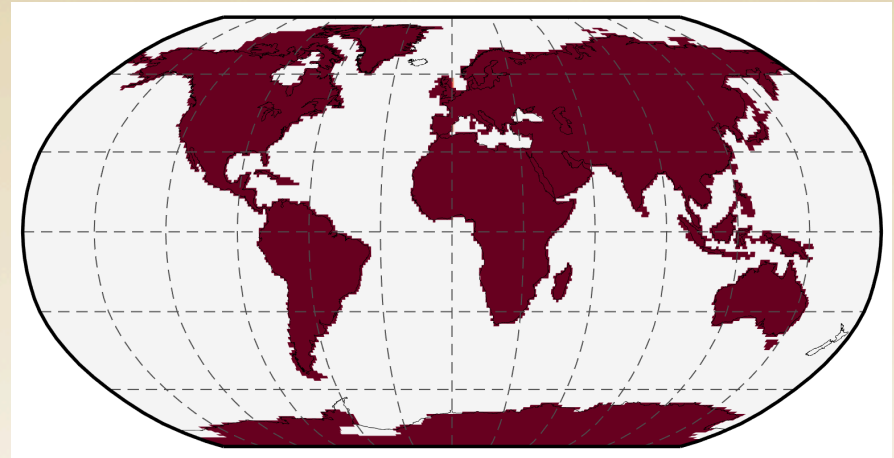
## Reduce # of estimated parameters:

- Assume ocean reference model is well enough defined

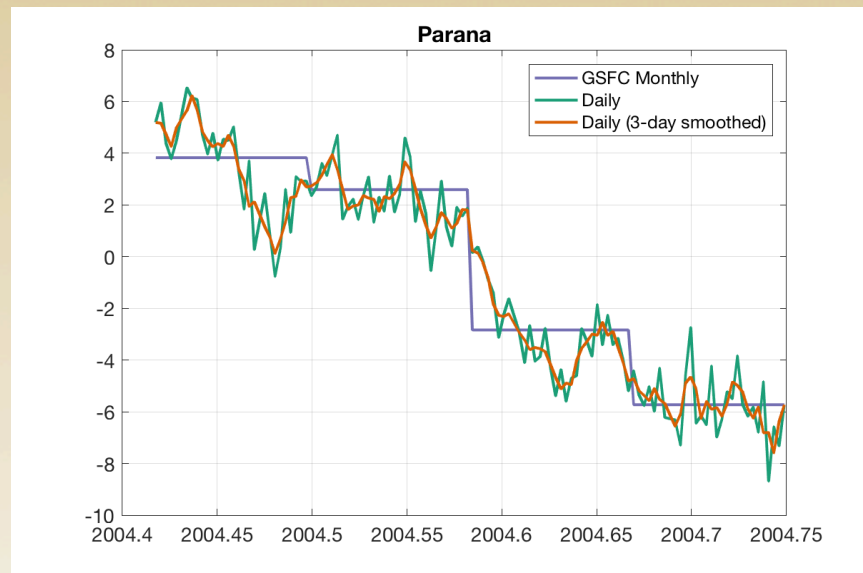
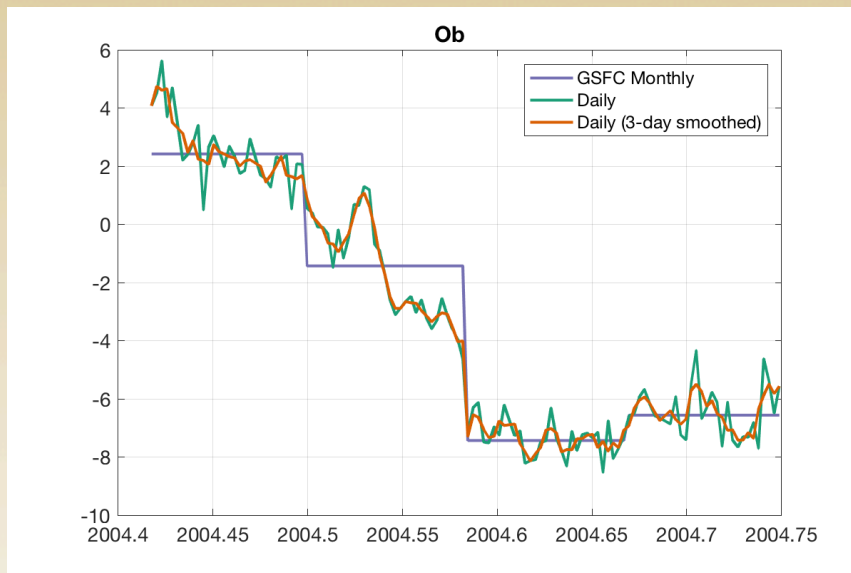
  - Hold ocean mascons fixed

- Hold isolated areas fixed

- Estimate all remaining mascons each day (~14,000)



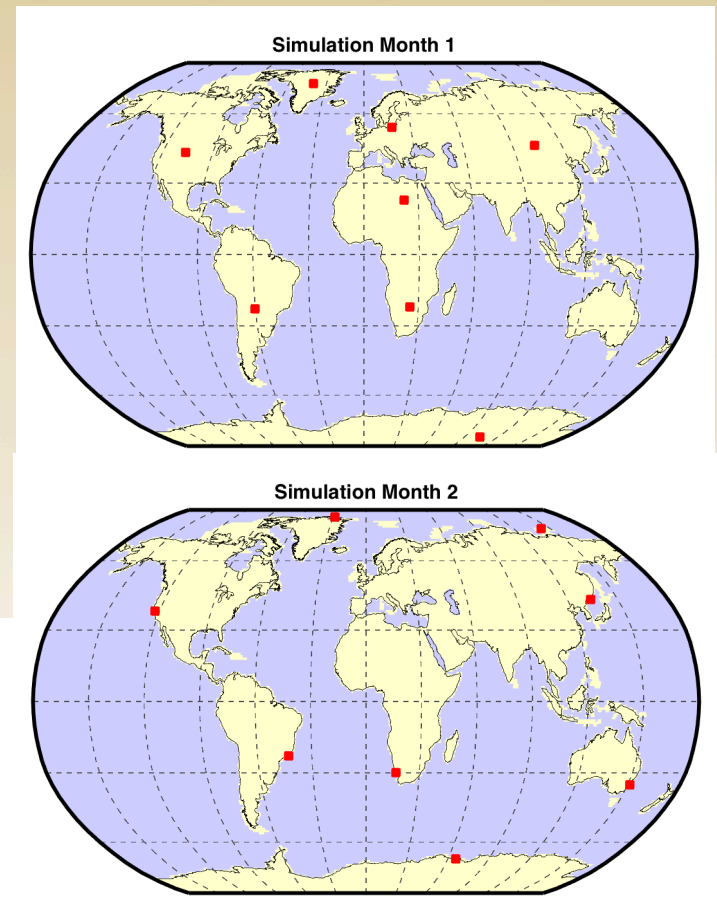
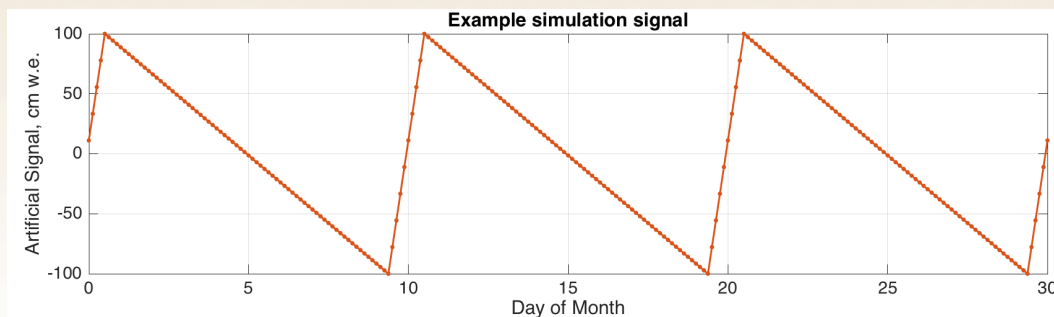
# Initial daily regional estimates



➤ How can we validate our method?

# Quantifying signal recovery skill using a “pseudo-simulation”

- Add artificial signals to individual mascons within the forward model
- Inland & coastal locations
- Zero-mean, 10-day periods
- Large but realistic in magnitude





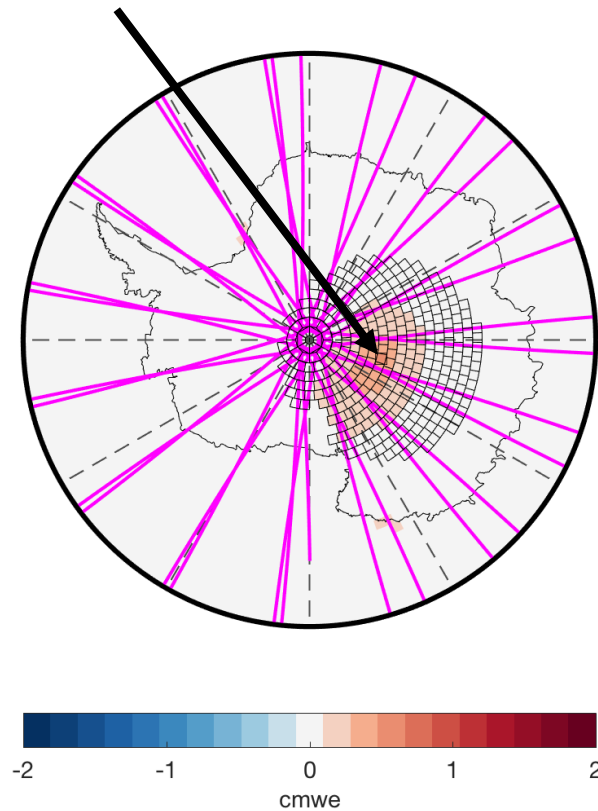
# Challenge Evaluating Simulation

- Using real GRACE orbits, observations
  - Recovered signal =  
(Simulated Signal) plus (Real Sub-Monthly Information)
- However, there is a way to isolate simulated signals:
  - Process twice, once with simulation and once without
- Simulation Recovery =  
(Full Recovery w/ Sim.) minus (Full Recovery w/o)

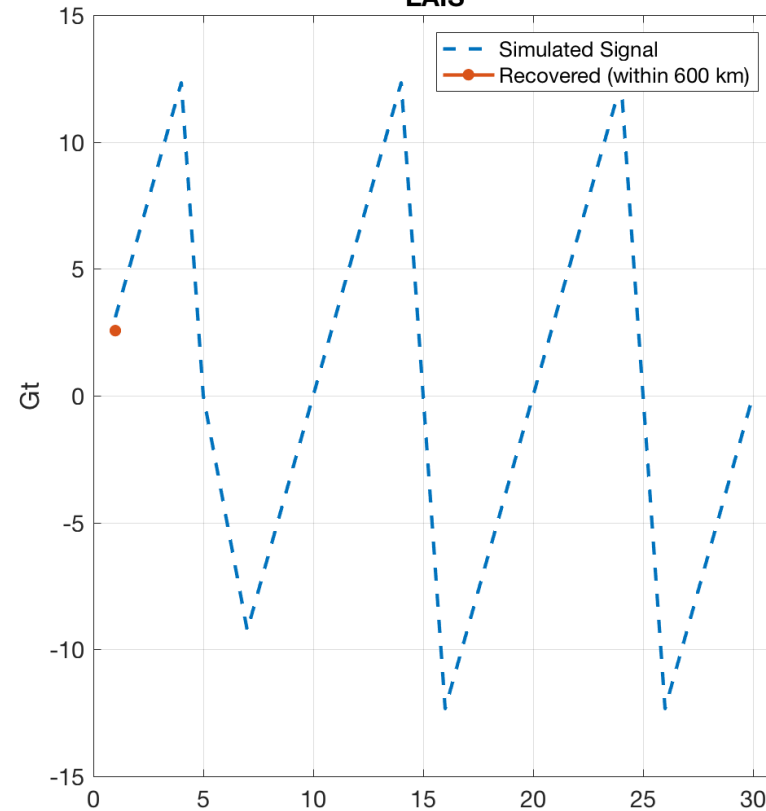


# Assessing Simulation Skill

Mascon w/ Simulated Signal



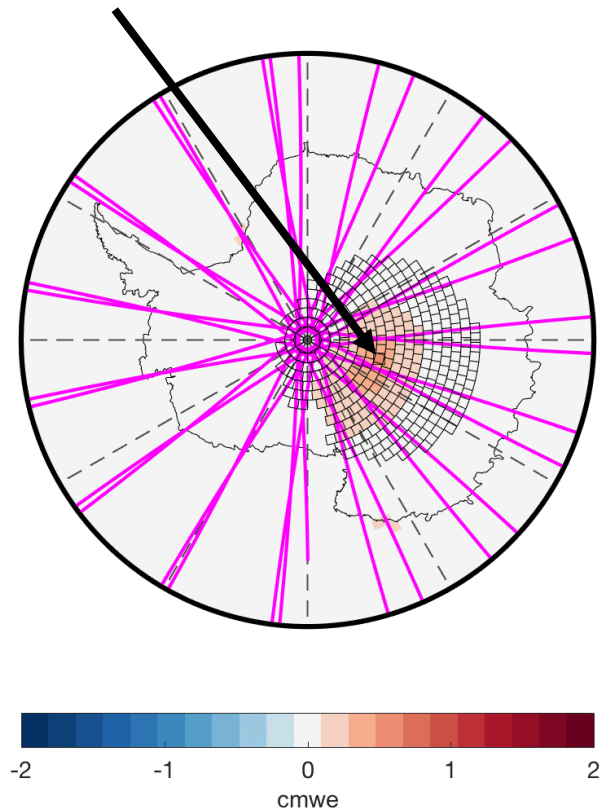
EAIS



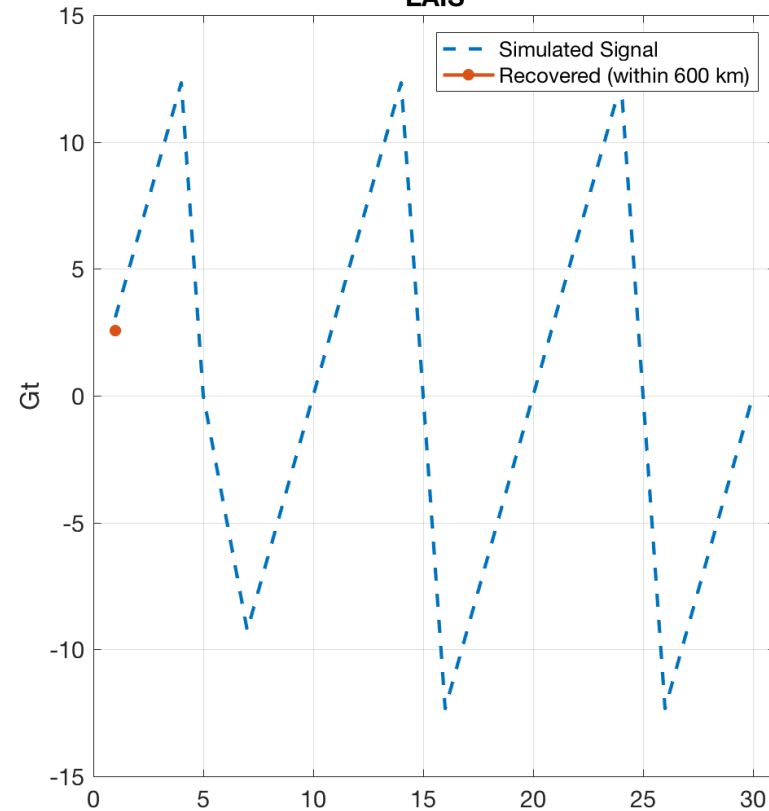


# Assessing Simulation Skill

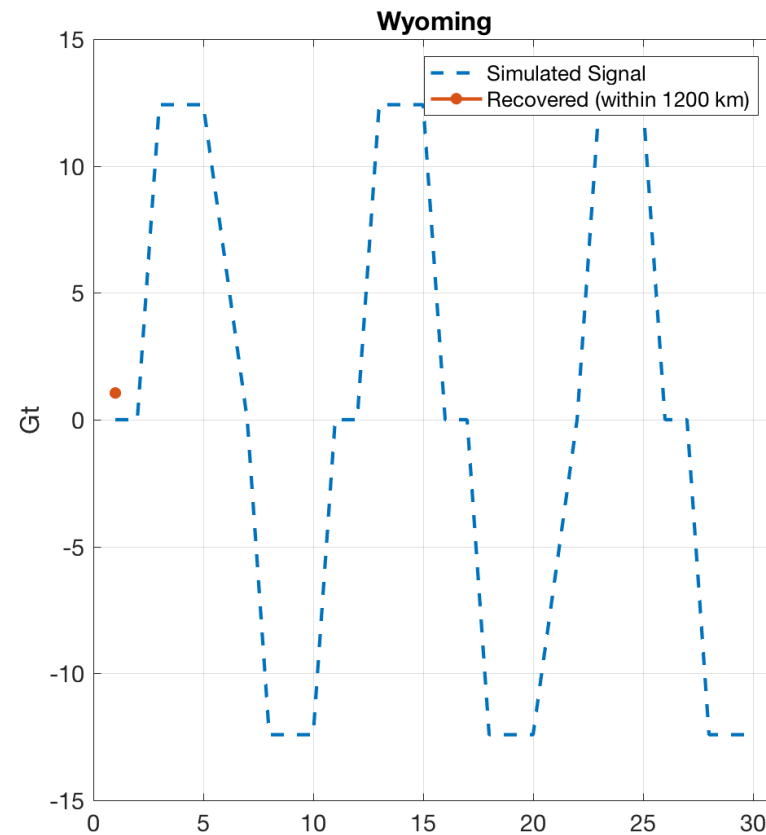
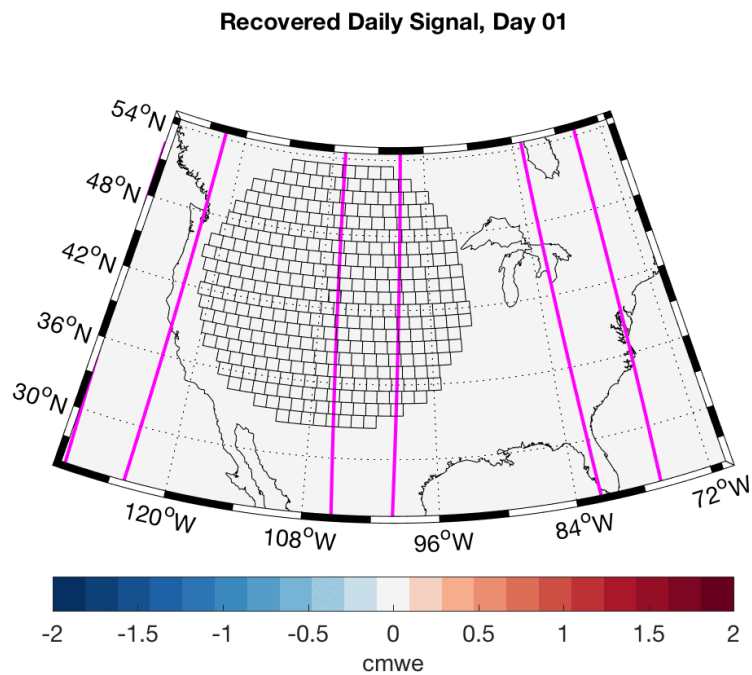
Mascon w/ Simulated Signal



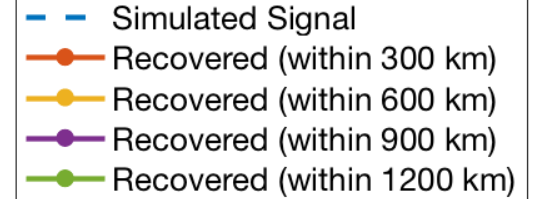
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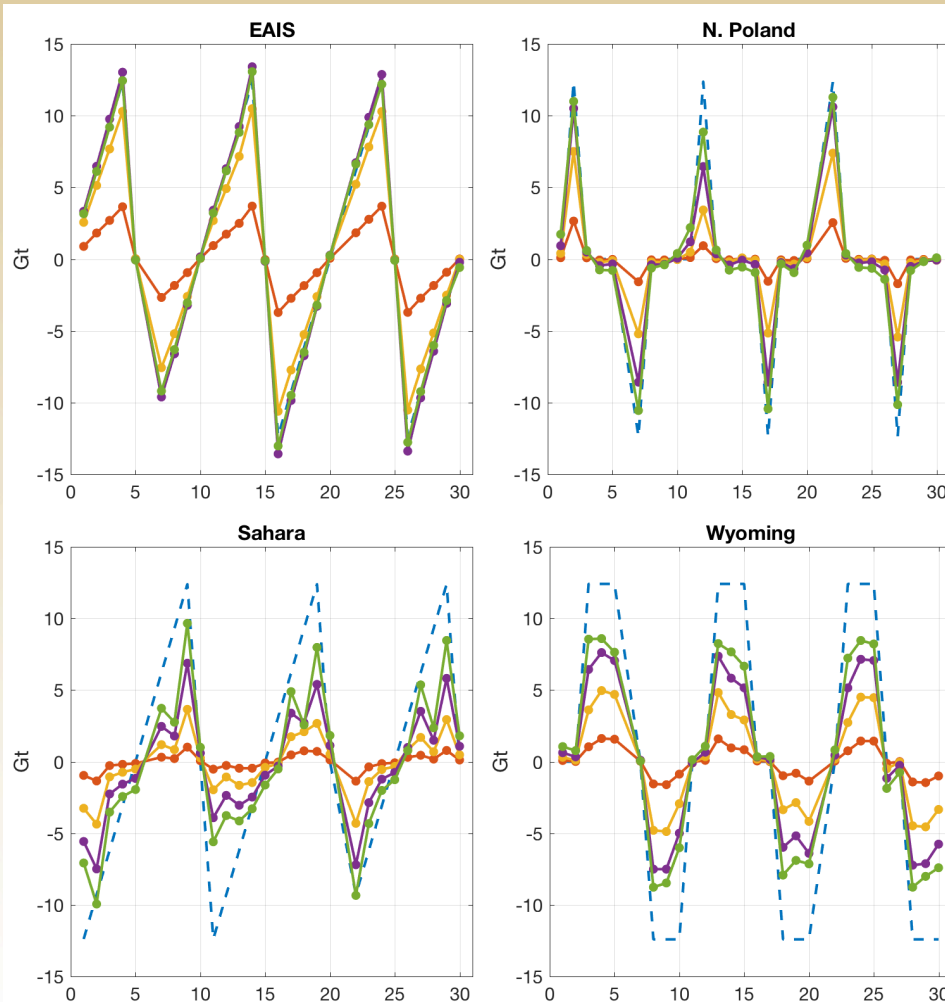
# Assessing Simulation Skill



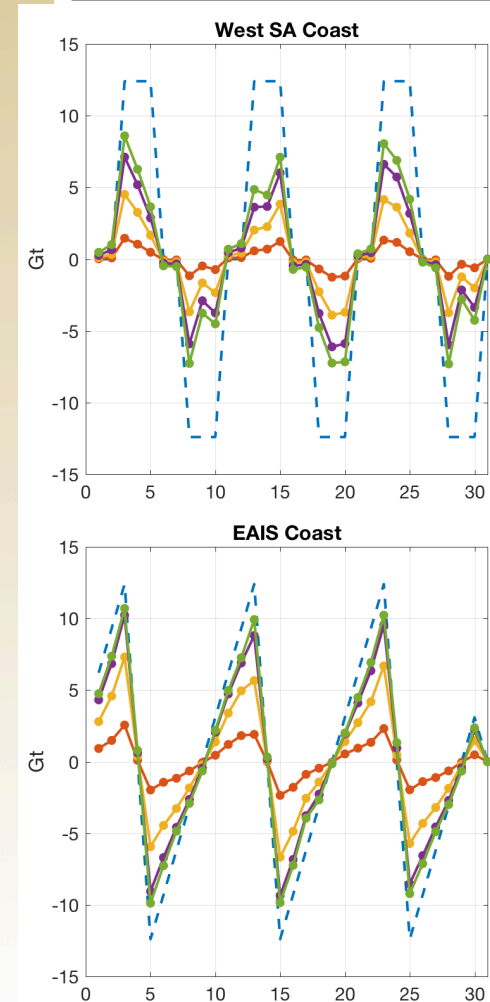
# Assessing Simulation Skill



Inland Locations:



Coastal Locations:



# Where to go from here:

- Can recover sub-monthly signals, but sacrifices spatial resolution
- Locations near poles far easier to recover, localize
- Pseudo-simulation provides a testable signal recovery opportunity
- Further refinement of mascon regularization possible with simulation results

