

CESM2-WACCM6 Subseasonal -to-Seasonal Simulations

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CESM2 S2S Hindcasts and Forecasts

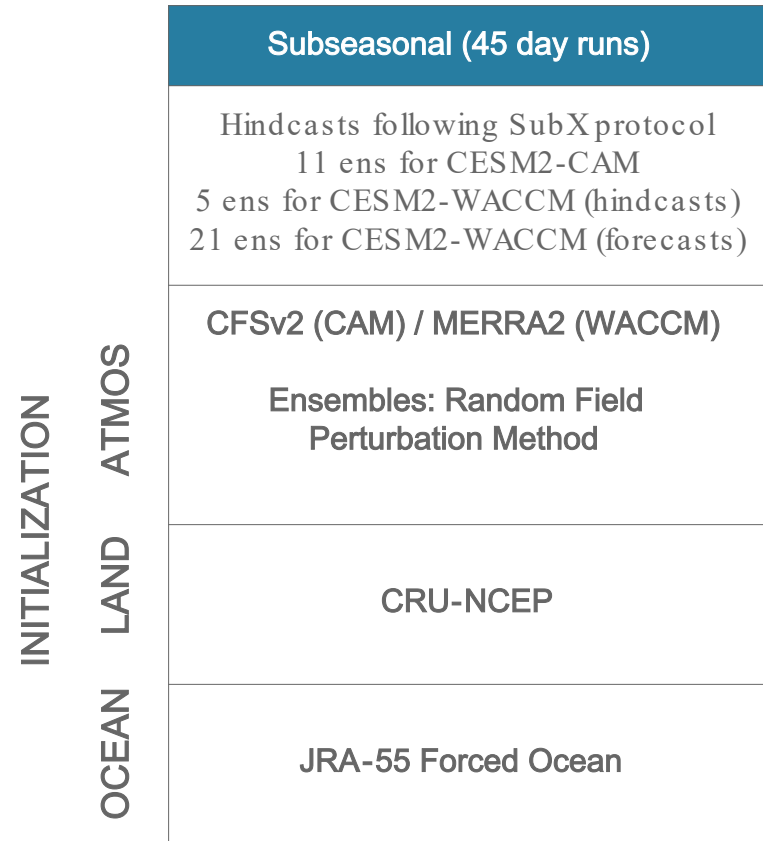
CESM2-CAM

- 1° horizontal resolution
- Top at ~40 km, 32 levels
- Only orographic GW parameterization
- No interactive chemistry
- S2S Hindcasts for 1999 – 2019 complete

CESM2-WACCM

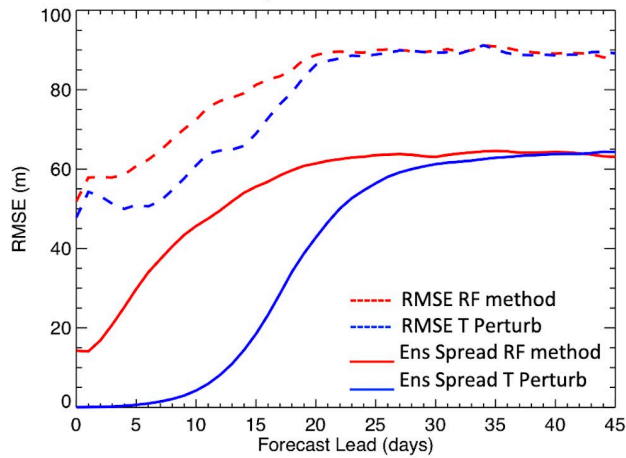
- 1° horizontal resolution
- Top at 140 km, 70 levels
- Interactive non-orographic parameterizations (Convection + Fronts)
- Fully interactive tropospheric and stratospheric chemistry
- S2S Hindcasts for Oct – Mar starts 1999 - 2020 (complete)

*Running real -time since September 2020 (every Monday)
-> Data contributing to NOAA/CPC week 3/4 outlook*

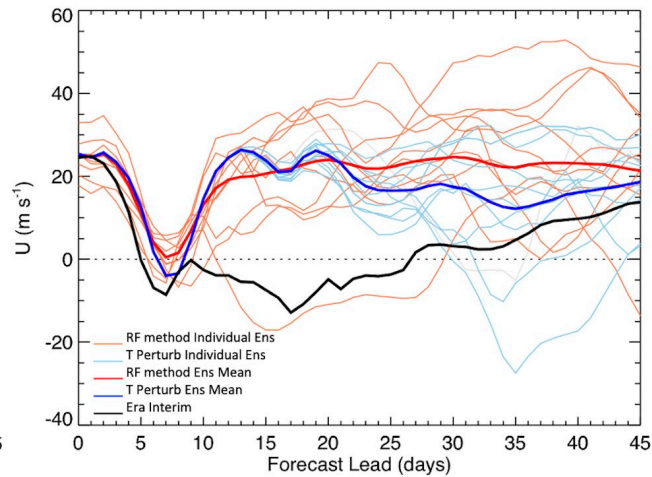


Initialization with random field perturbations improves model spread compared to initial condition perturbations

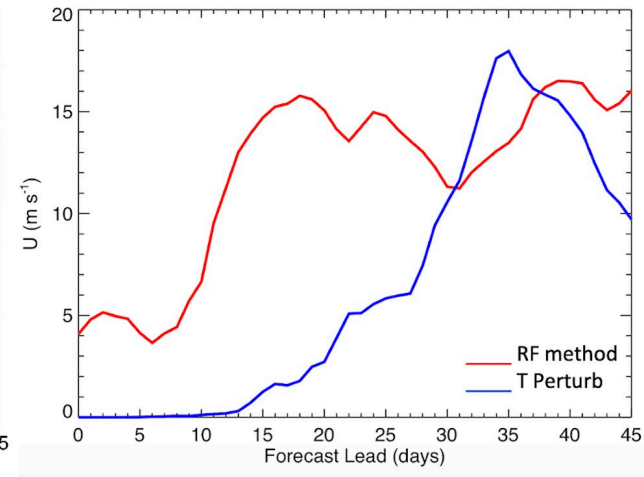
a) Global Z500



b) U 60°N 10 hPa



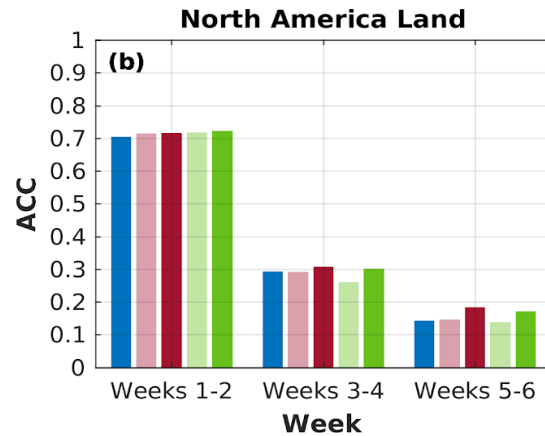
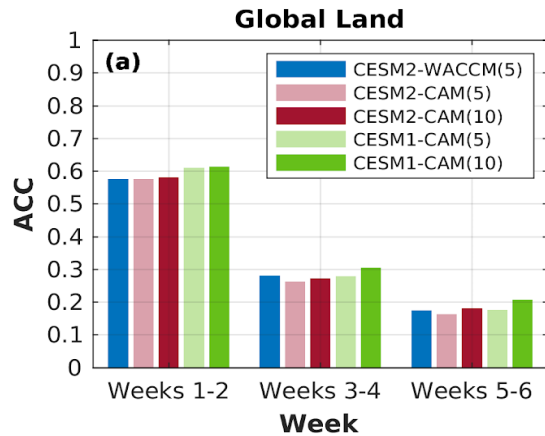
c) Std Dev U 60°N 10 hPa



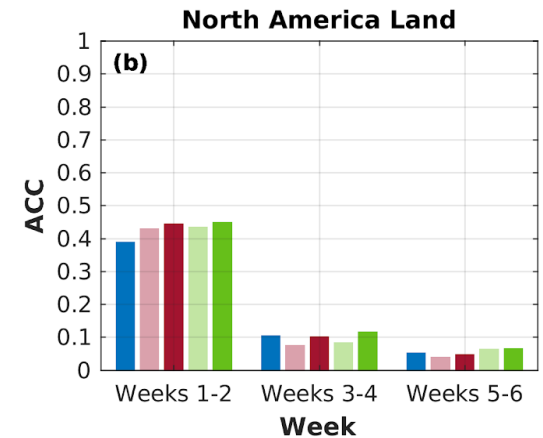
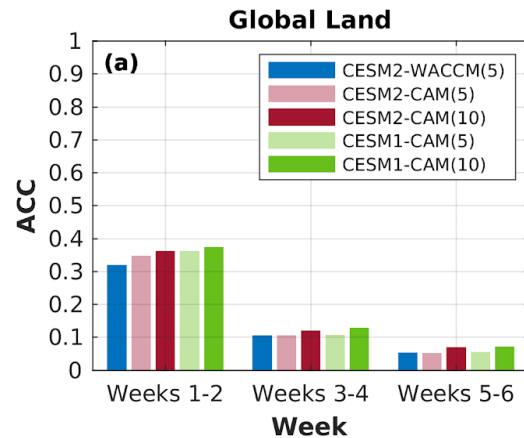
Richter et al. (2020), WAF

Skill of all models is comparable for DJF surface temperatures and precipitation

Surface Temperature ACC for DJF

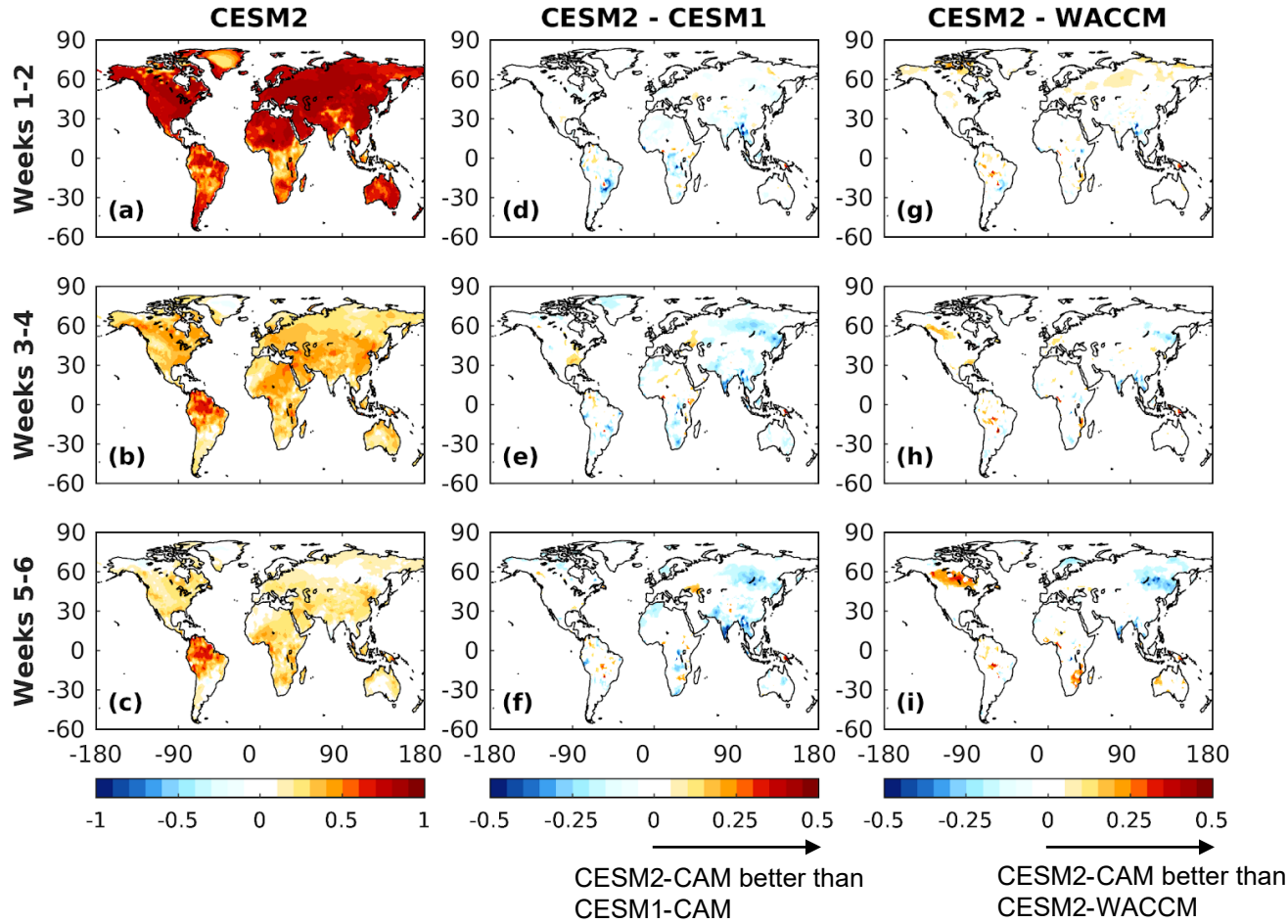


Total Precipitation ACC for DJF



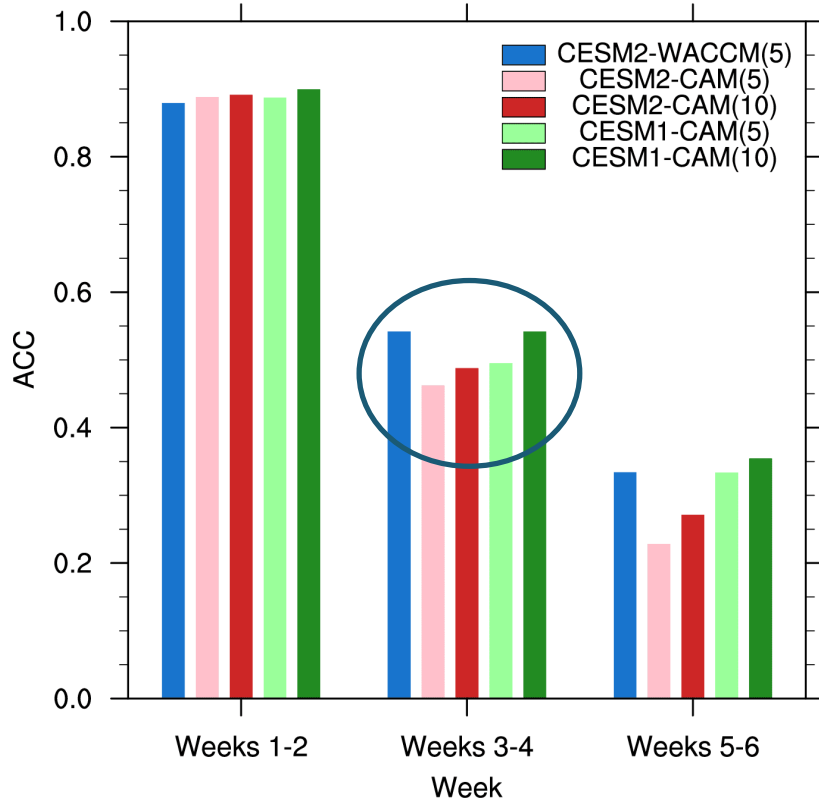
Spatial patterns of surface temperature ACC show limited regional differences between CESM2 -CAM and CESM1 -CAM and CESM2 -WACCM

Surface Temperature ACC for DJF

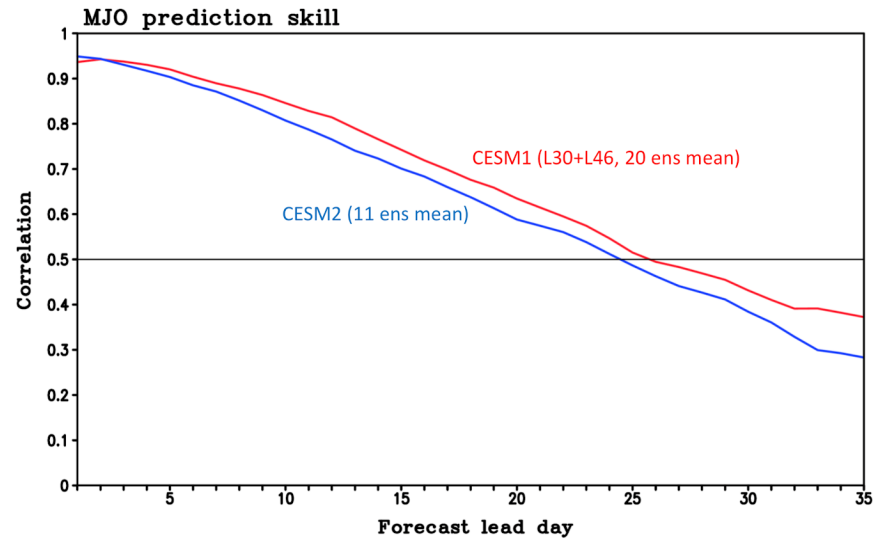


The predictability of the NAO and MJO is generally similar in CESM1 and CESM2

NAO ACC in DJF



CESM2-WACCM potentially best at weeks 3-4 (not statistically significant)

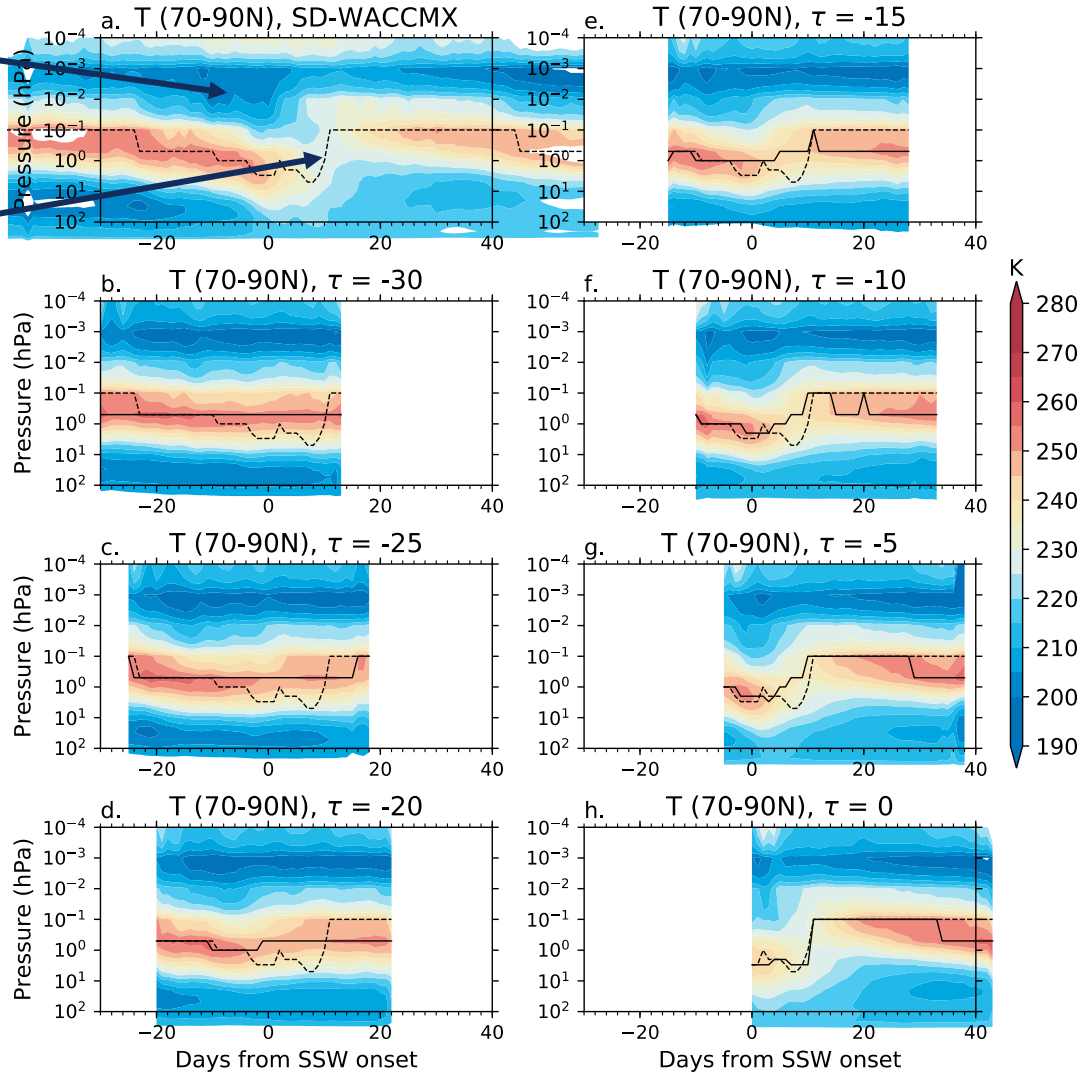


1999-2015, NDJFM only, all days

CESM2-WACCM enables investigations of the predictability of the mesosphere and lower thermosphere

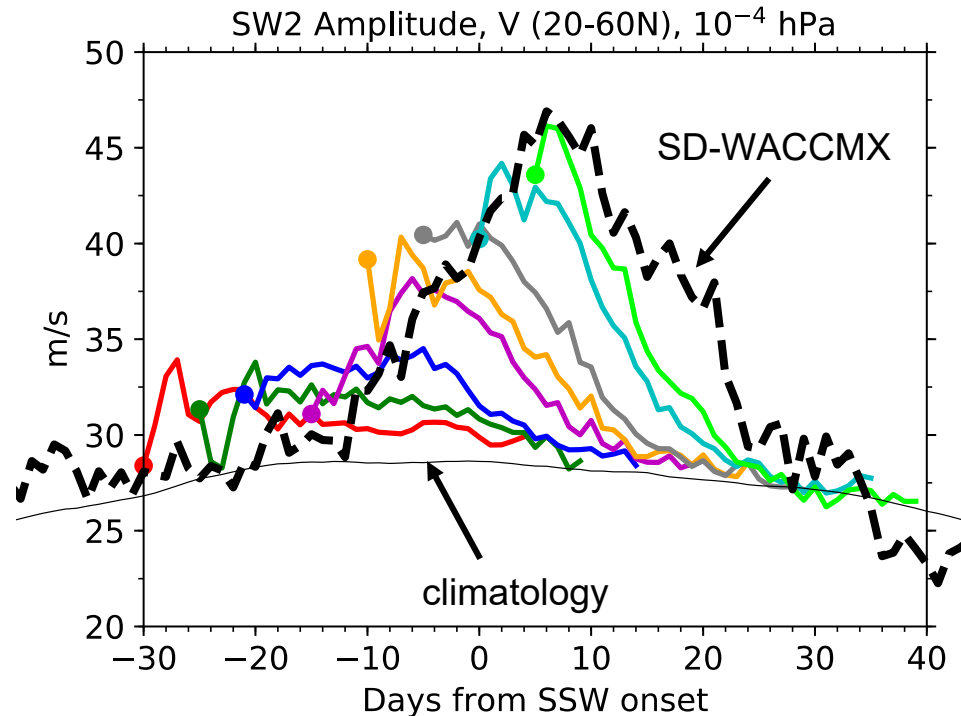
MLT cooling during SSWs

Stratopause jump following SSWs



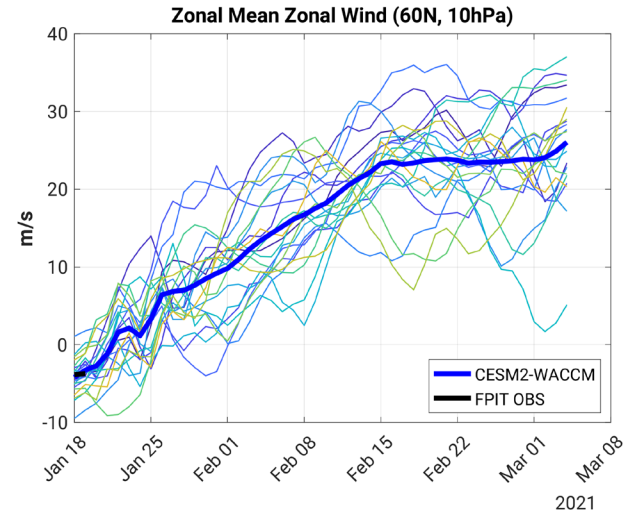
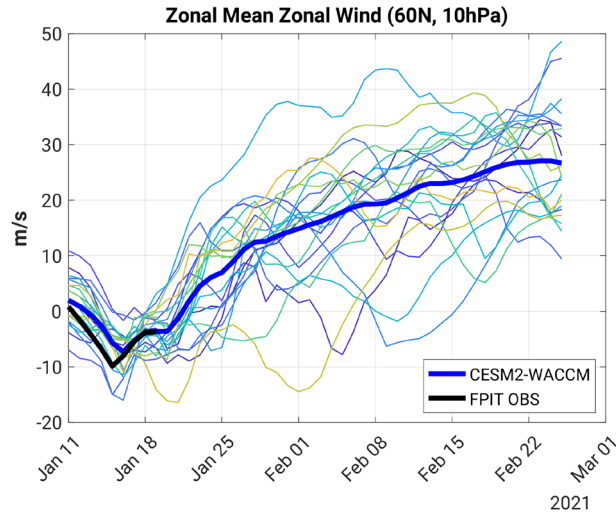
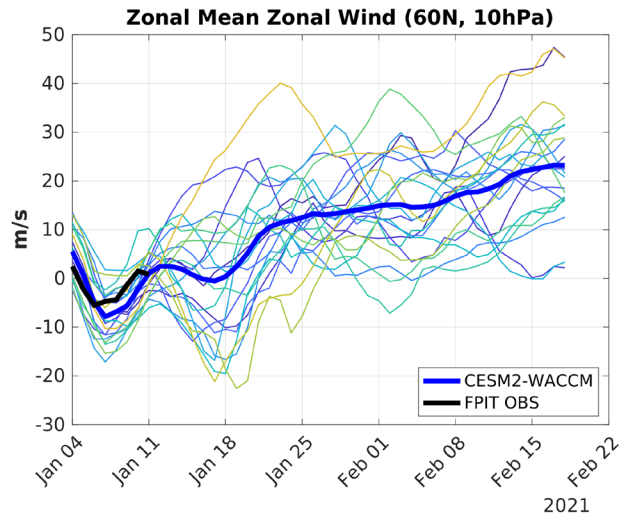
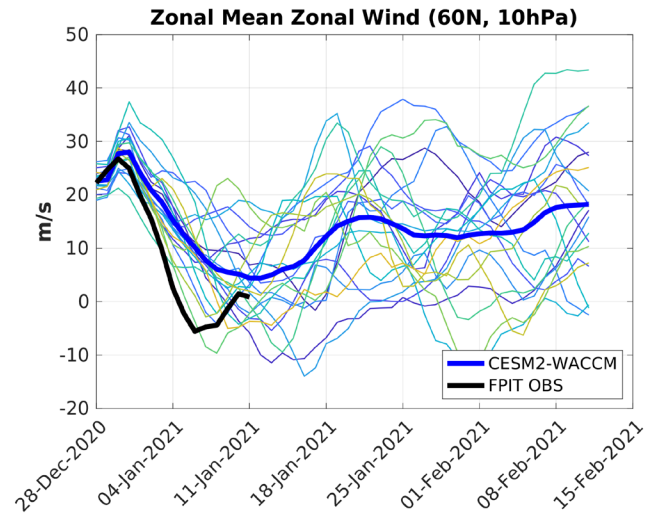
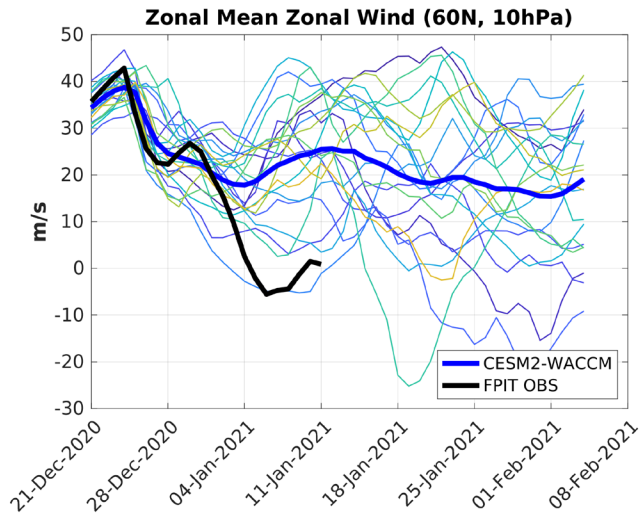
CESM2-WACCM hindcasts capture the MLT cooling in hindcasts initialized ~20 days prior to the SSW onset.

CESM2-WACCM enables investigations of the predictability of the mesosphere and lower thermosphere

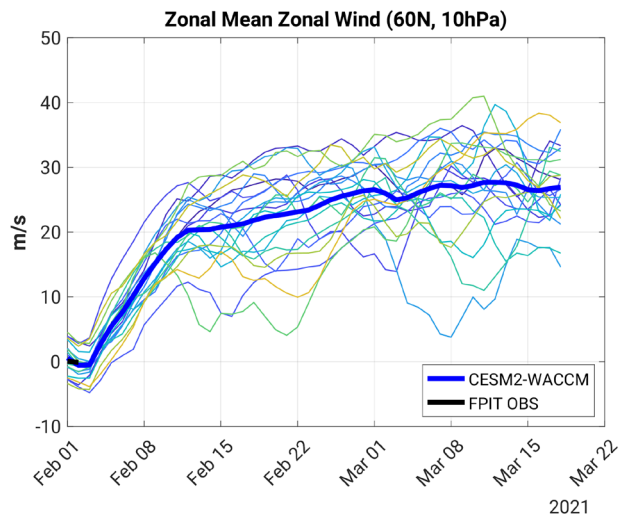
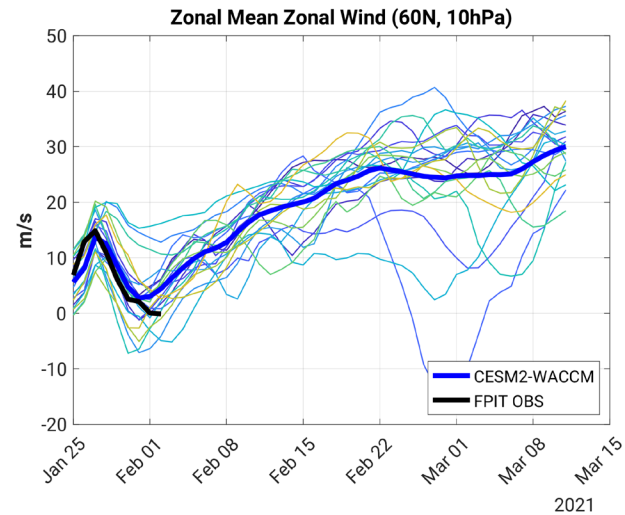
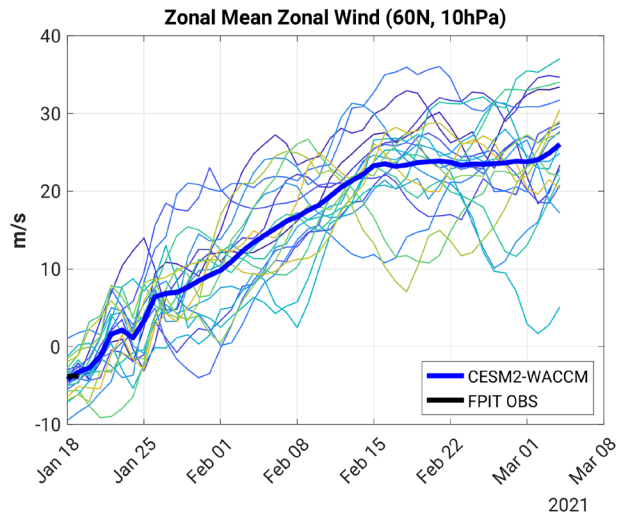


- Migrating semidiurnal tide (SW2) is enhanced during SSWs.
- SW2 is an important source of ionosphere variability.
- SW2 enhancement seen in CESM2-WACCM hindcasts, though decreases too quickly following the SSW.

CESM2-WACCM forecasts of the 2021 SSW



CESM2-WACCM forecasts of the 2021 SSW



Summary and Future Directions

- CESM2-WACCM6 hindcasts/forecasts are the first S2S simulations in a model with upper boundary in the lower thermosphere.
- Will release all of the CESM2 (CAM + WACCM) to the community for use in subseasonal-to-seasonal investigations.
 - Currently working with CISL to make the data available via the Climate Data Gateway
 - Data can be made available now to those with access to Cheyenne
- Established CESM S2S framework provides foundation for future predictability research.
- Beginning to utilize framework for seasonal to decadal predictions.

