New insights into atmospheric predictability through spherical harmonics transformation

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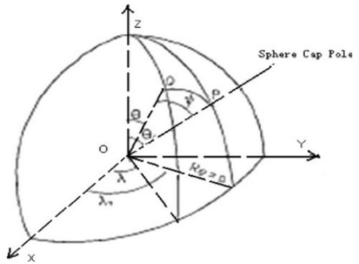
KE spectrum and model predictability

- Canonical structure of KE spectrum
  - Global scale: shallow
  - Synoptic scale: steep (-3)
  - Mesoscale: shallow(-5/3)
- Model predictability
- Dynamics ?
-
- Spherical harmonics transformation



(Skamarock, 2014)

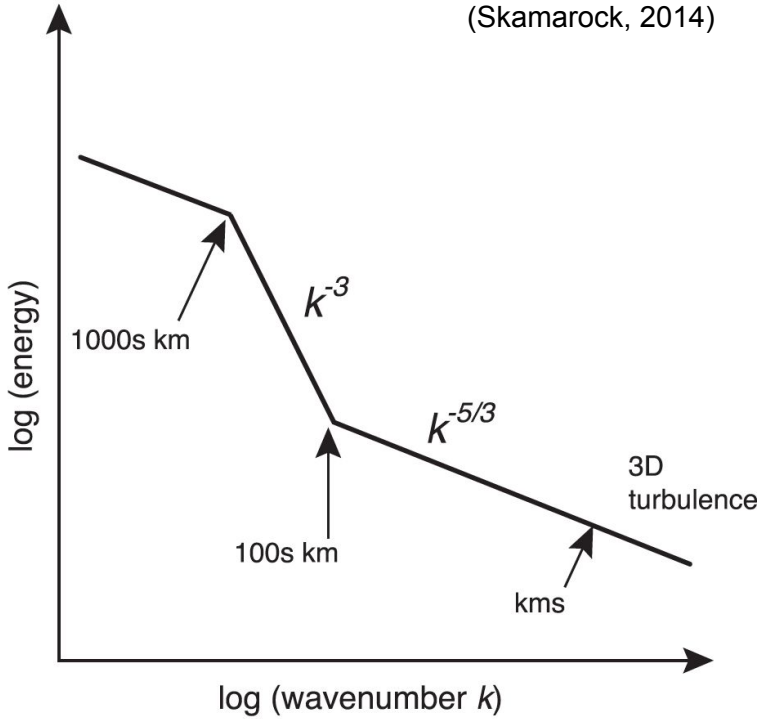
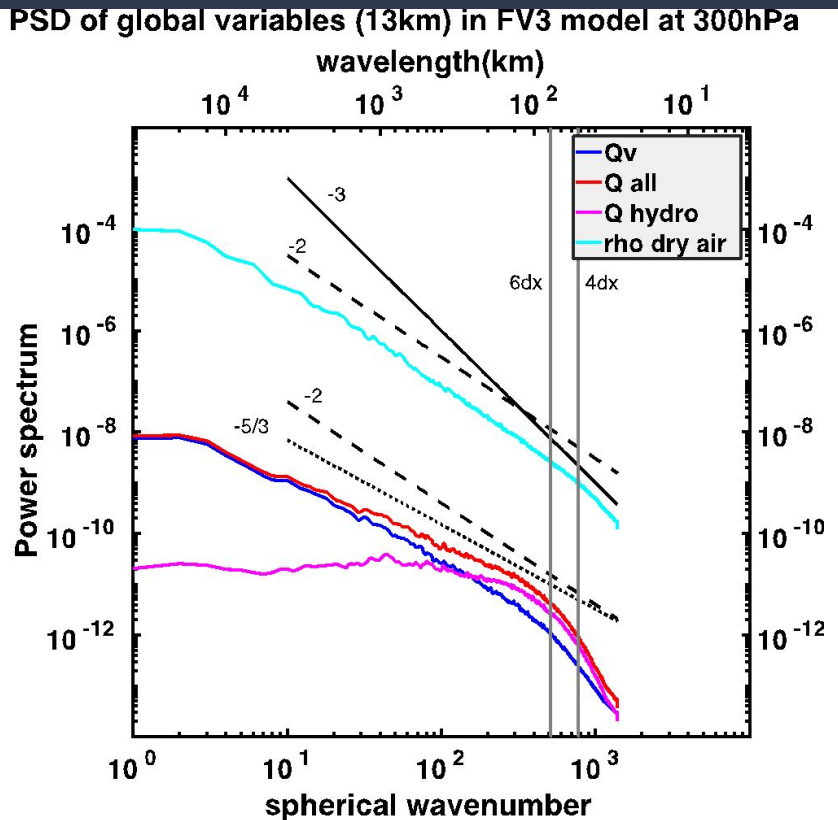
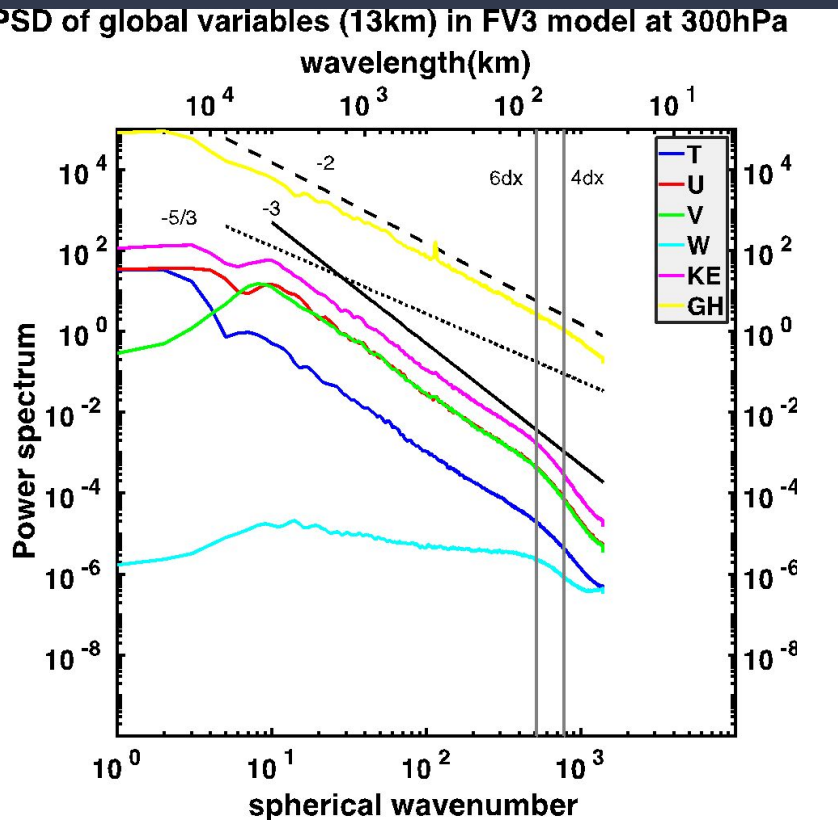


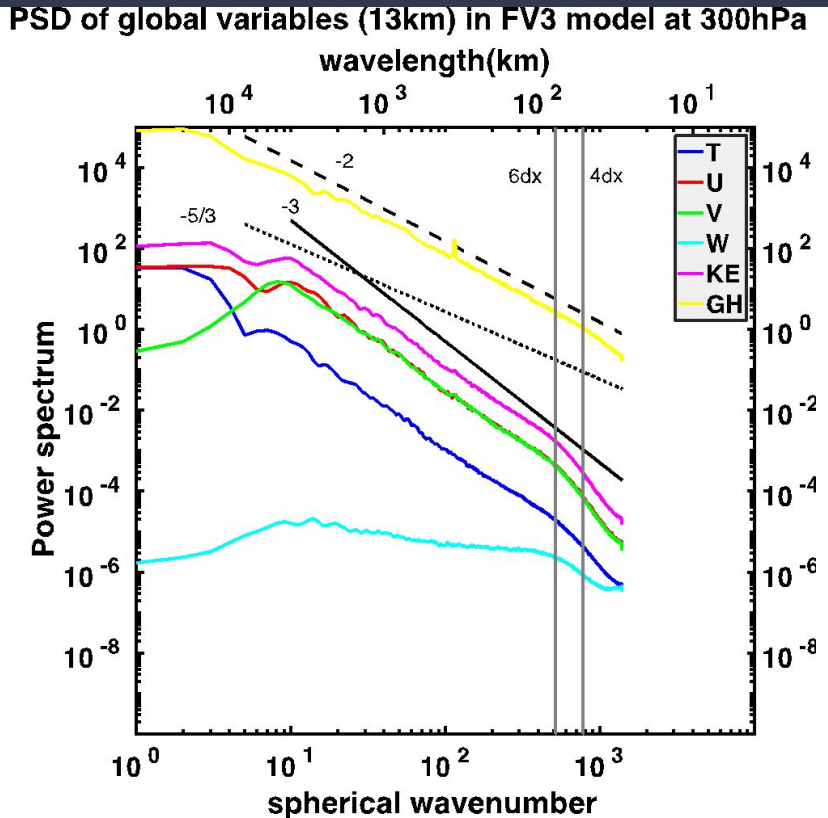
FIG. 1. Schematic of canonical atmospheric kinetic energy spectra.

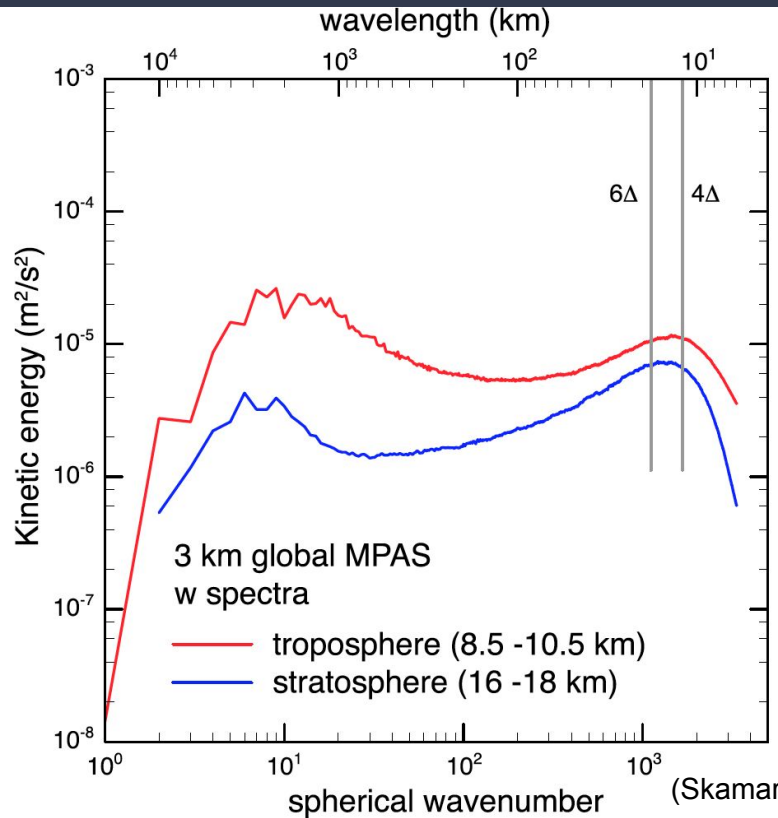
PSD of global variables at 300hPa in FV3 model





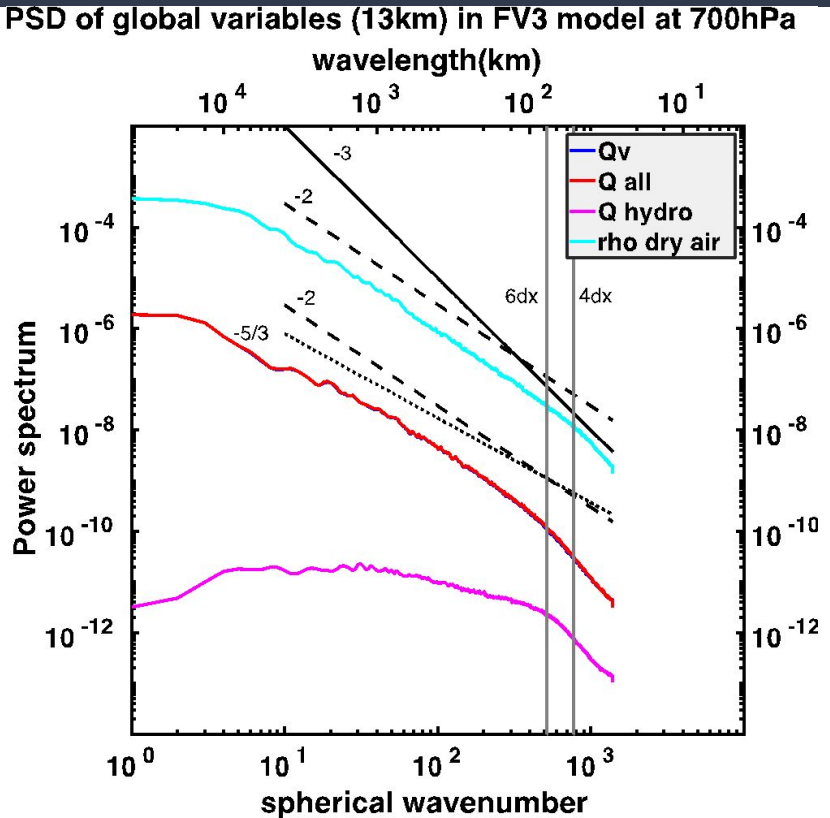
PSD of W in FV3 model VS previous work

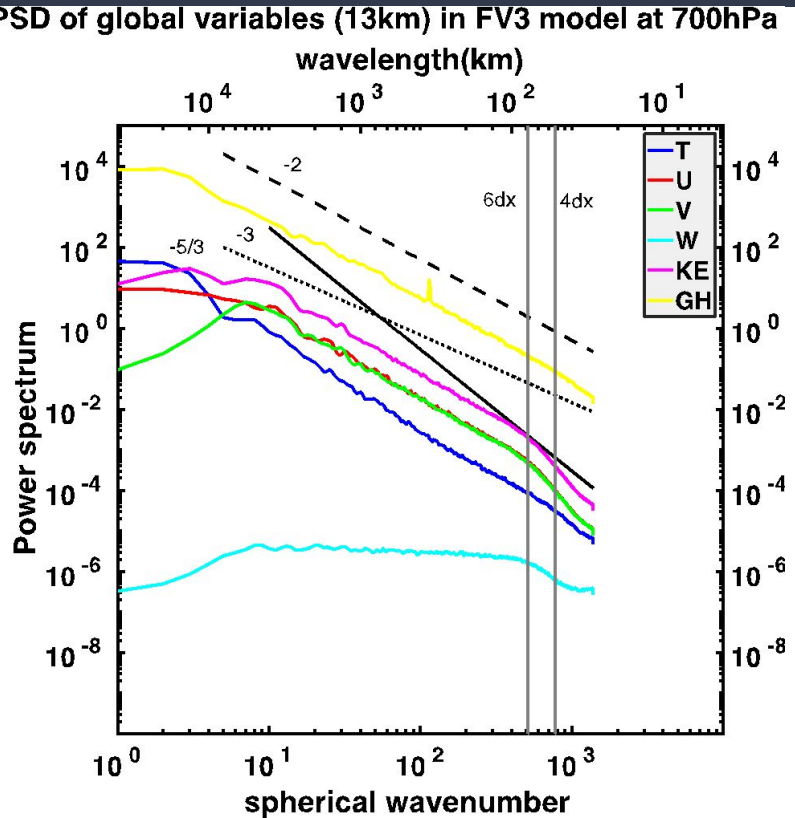




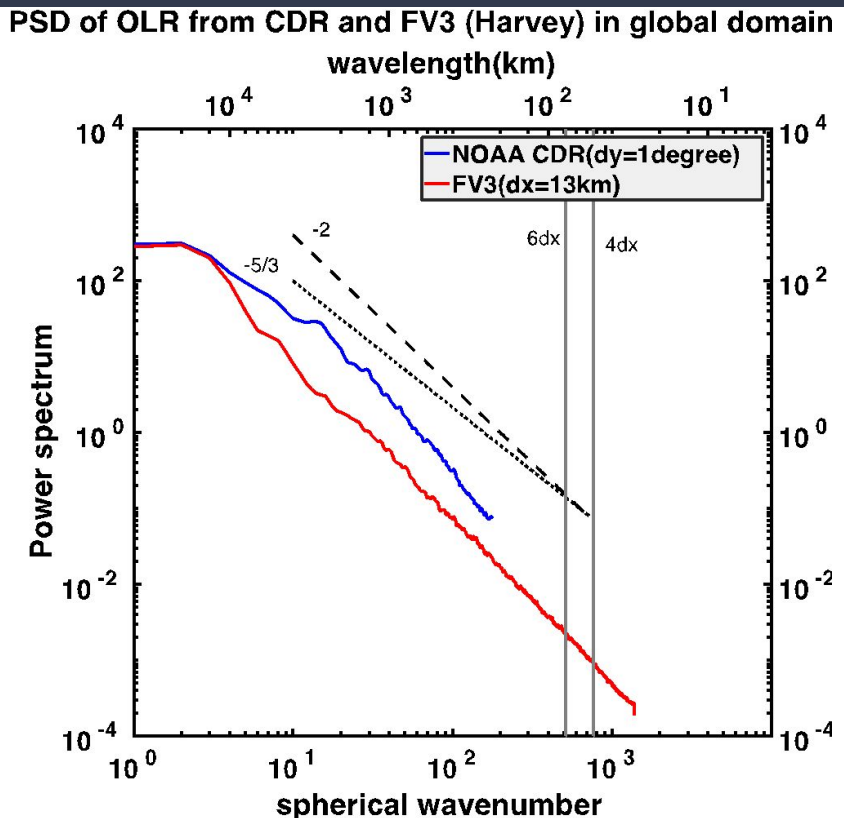
(Skamarock, 2014)

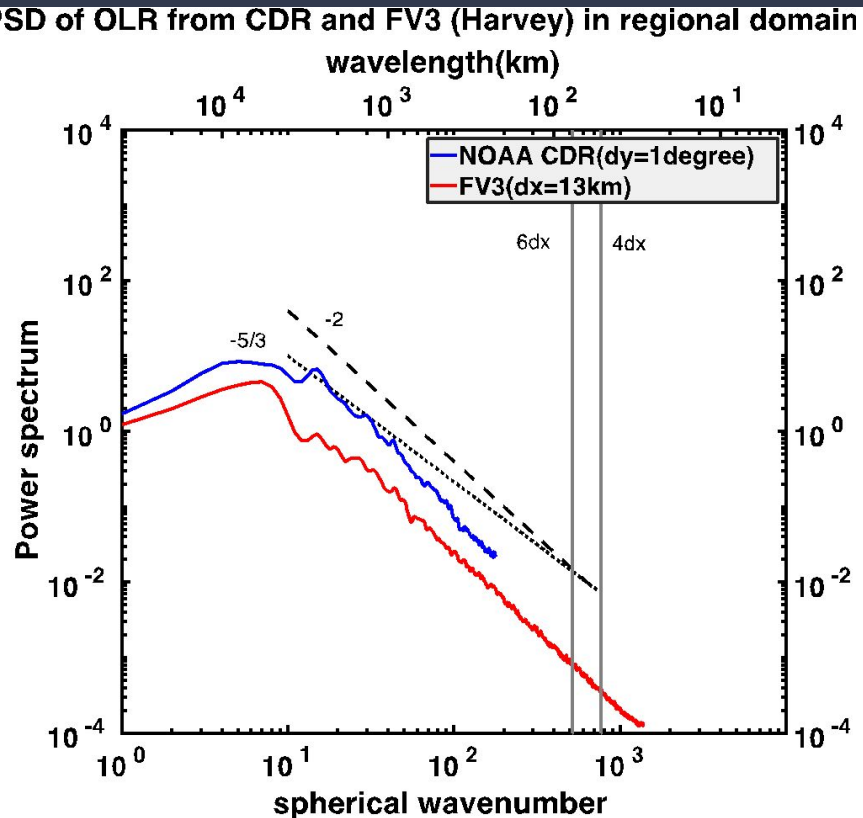
PSD at 700hPa: stirred by a discontinuous flow field (Callies 2013)



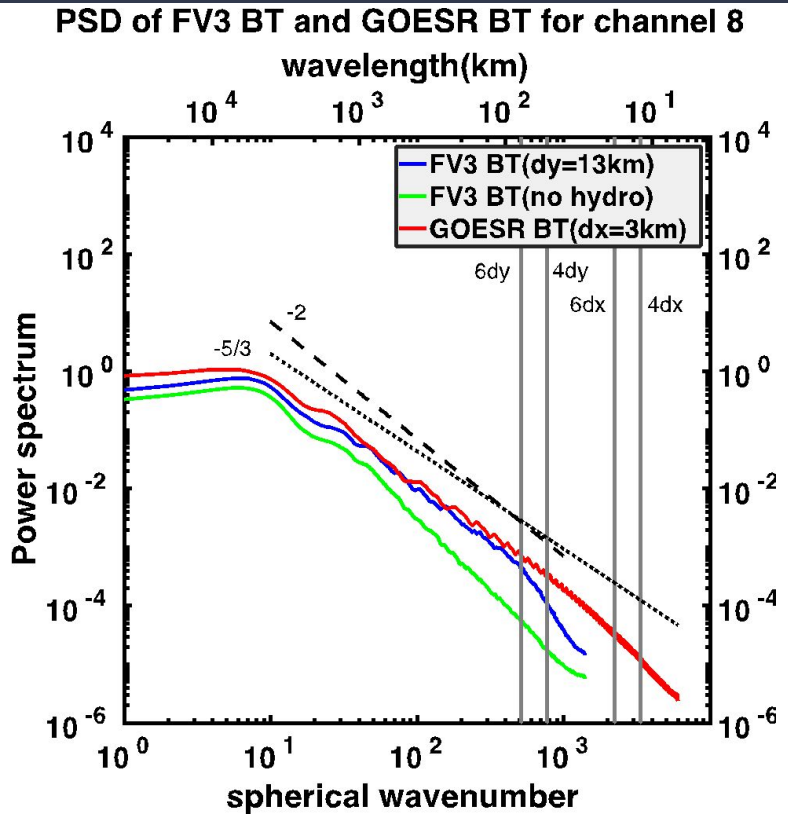


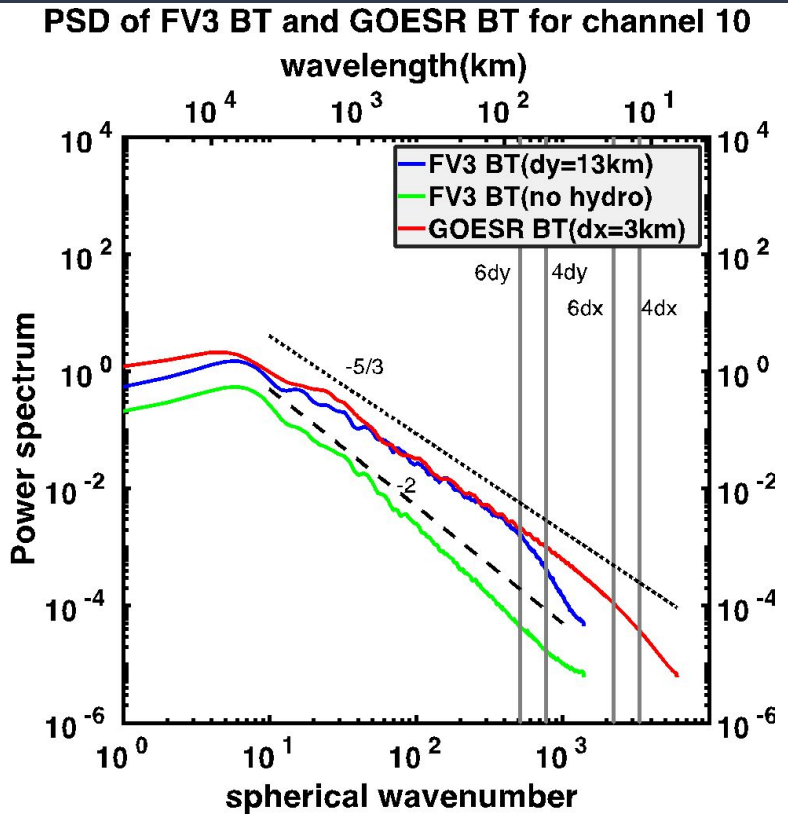
PSD of OLR for NOAA CDR and FV3 model





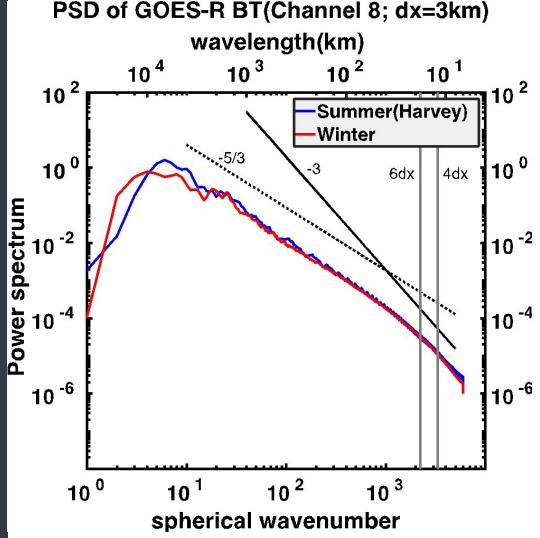
PSD of regional BT for GOES-R and FV3 model

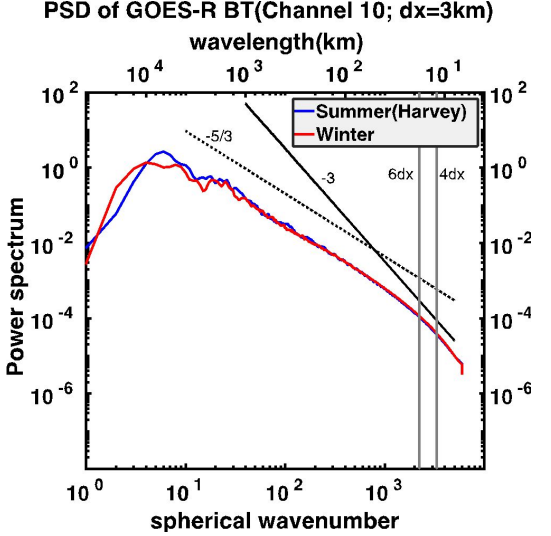


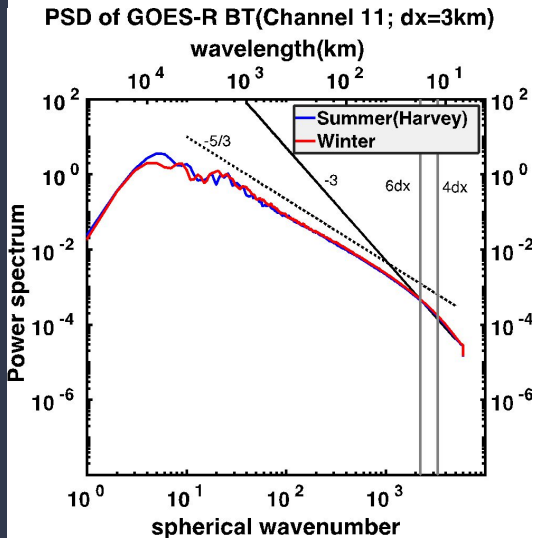


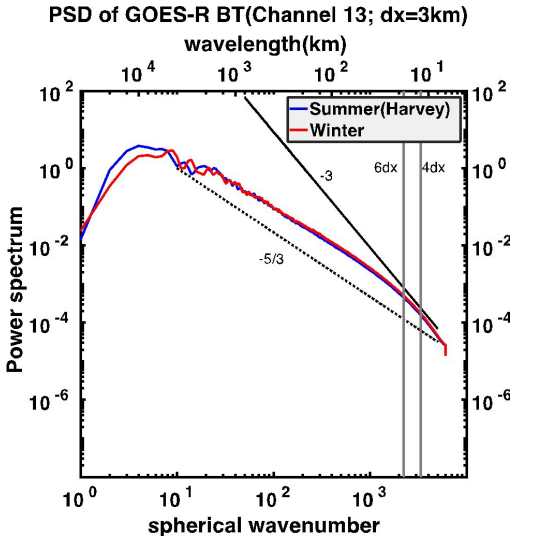
PSD of GOES-R BT for channel 8, 10,11 and 13

- -5/3 in synoptic and mesoscale for both summer and winter
- (Maybe) Another canonical structure that could be used to examine model predictability





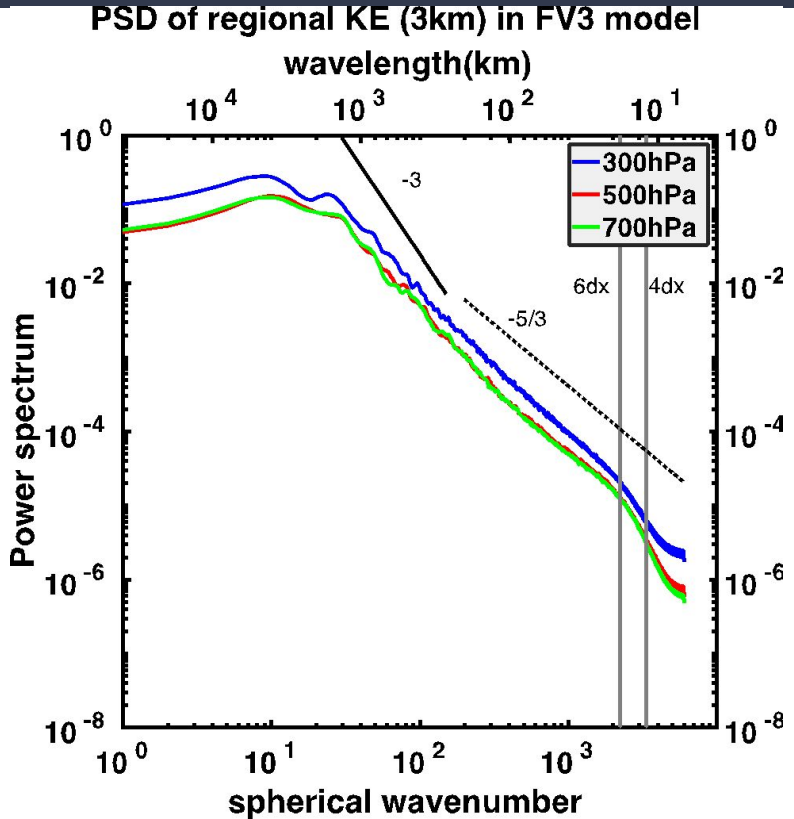




Summary

- The effective resolution for FV3 model is 6dx with the resolution of 13 km.
- The slope of -2 for several variables like T, KE, Qv, at lower level are due to stirring by a discontinuous flow field.
- PSDs of GOES-R BT and FV3 BT agree well at synoptic. The slope for GOES-R BT remains -5/3 in both synoptic and mesoscale for different channels and different seasons.

Regional KE spectrum (3km)



PSD of variables in regional domain in FV3 model