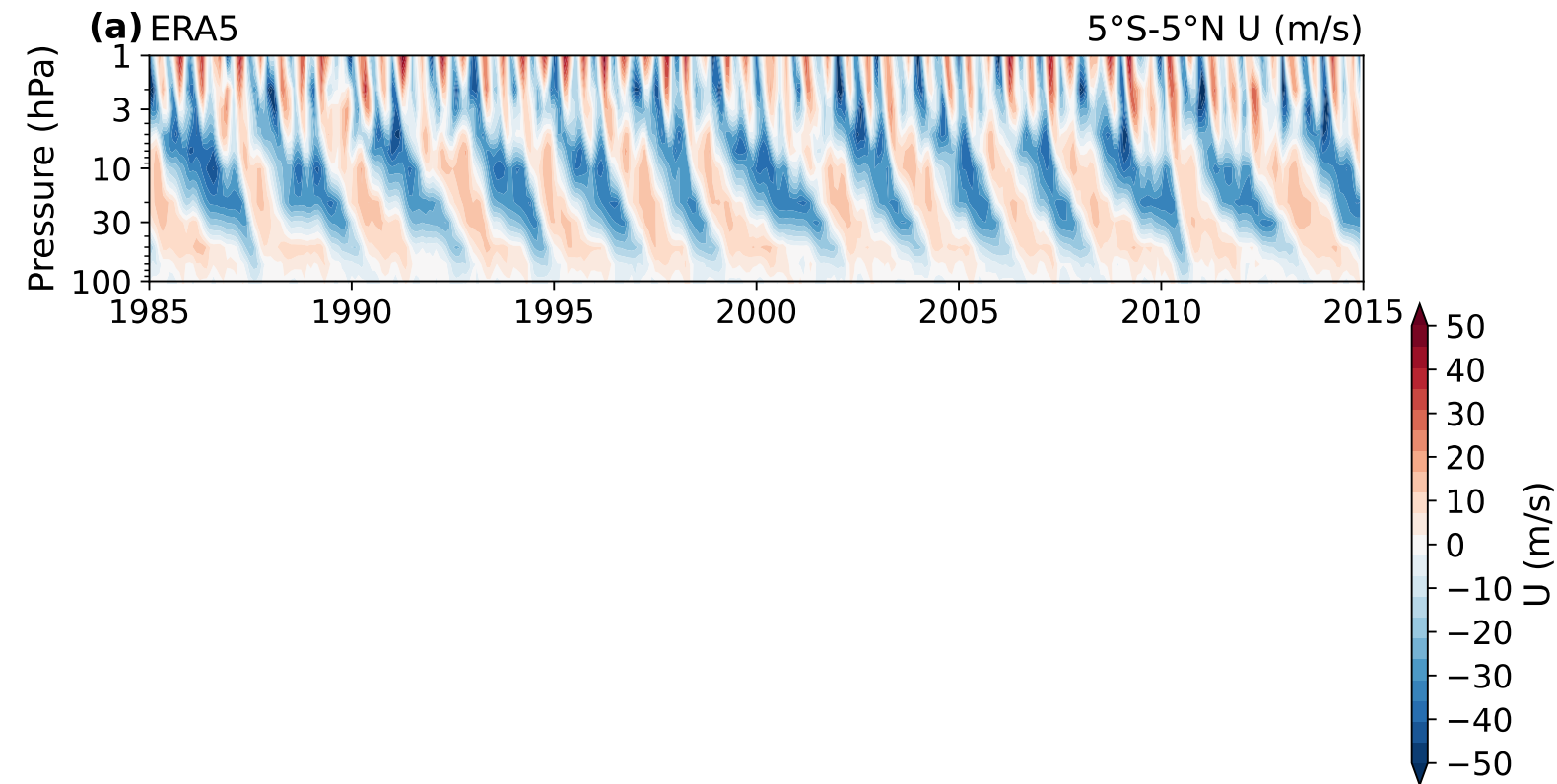# Improving the QBO Forcing by Resolved Waves with Vertical Grid Refinement in E3SMv2

Wandi Yu[1], Walter M. Hannah[1], James J. Benedict[2], Chih-Chieh-Jack Chen[3], Jadwiga H. Richter[3]

[1] Lawrence Livermore National Laboratory [2] Los Alamos National Laboratory [3] National Center for Atmospheric Research
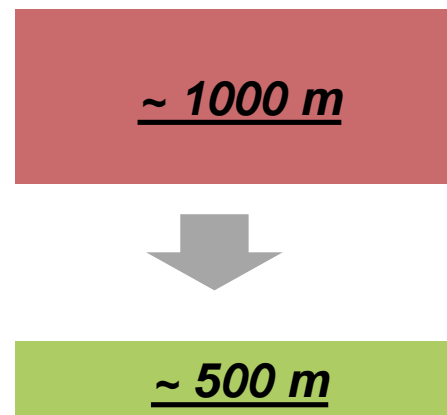
(a) ERA5   5°S-5°N U (m/s)

QBO = Quasi-Biennial Oscillation
- Tropical stratospheric zonal wind changes direction
- 20-34 months, mean period 28 months
- Propagate down

E3SMv2 Lower stratosphere vertical spacing

~ 1000 m

~ 500 m

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Lower stratosphere vertical spacing **1000 m → 500 m**

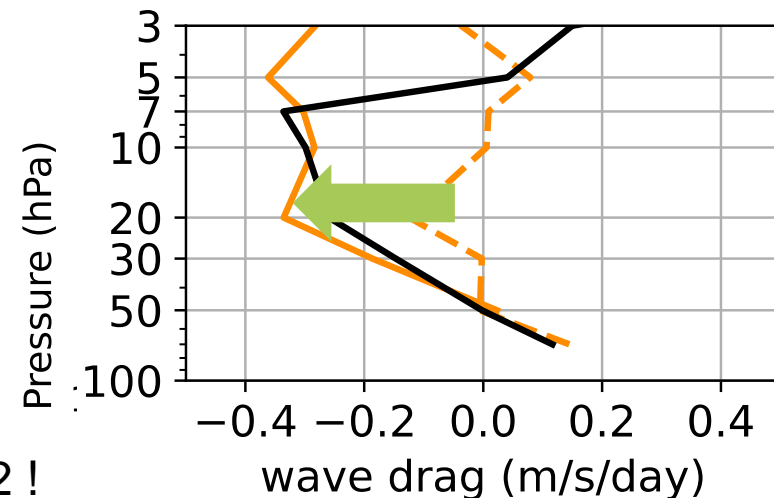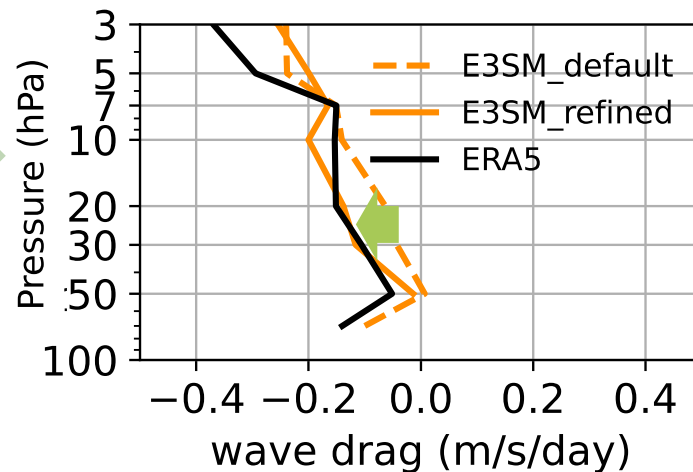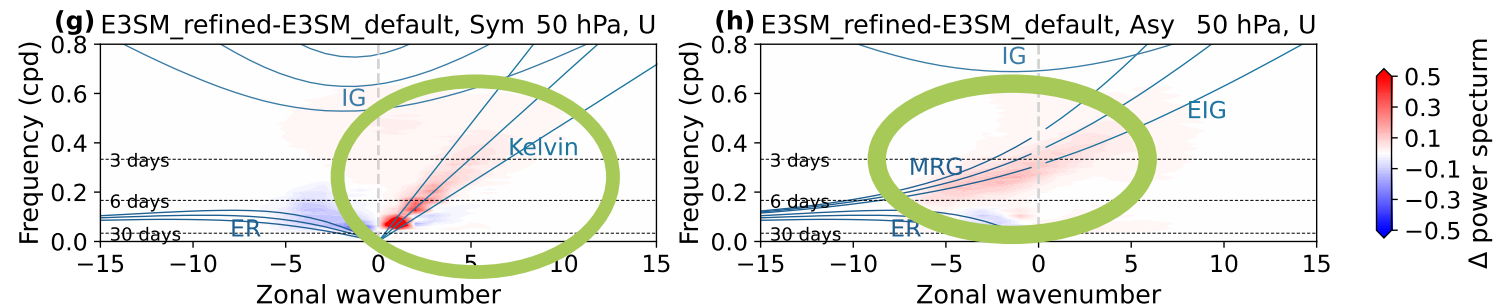Better resolved wave representative

Better resolved wave forcing

Better wave-mean flow interaction

Better parameterized wave forcing

More realistic QBO

(g) E3SM_refined-E3SM_default, Sym 50 hPa, U

(h) E3SM_refined-E3SM_default, Asy 50 hPa, U

Δ power spectrum

IG
Kelvin
ER
3 days
6 days
30 days

IG
EIG
MRG
ER
3 days
6 days
30 days

Frequency (cpd)
Zonal wavenumber

E3SM_default
E3SM_refined
ERA5

Pressure (hPa)
wave drag (m/s/day)

Pressure (hPa)
wave drag (m/s/day)

For more details, please check our poster #10.2 !