Tropical subseasonal convection in E3SM versions 2 and 3

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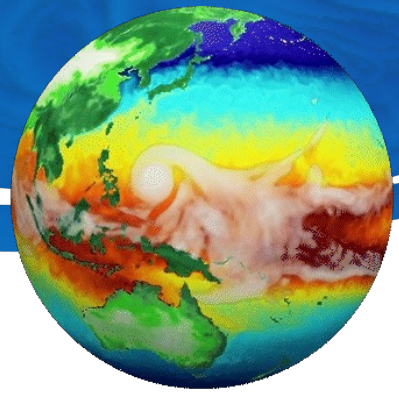

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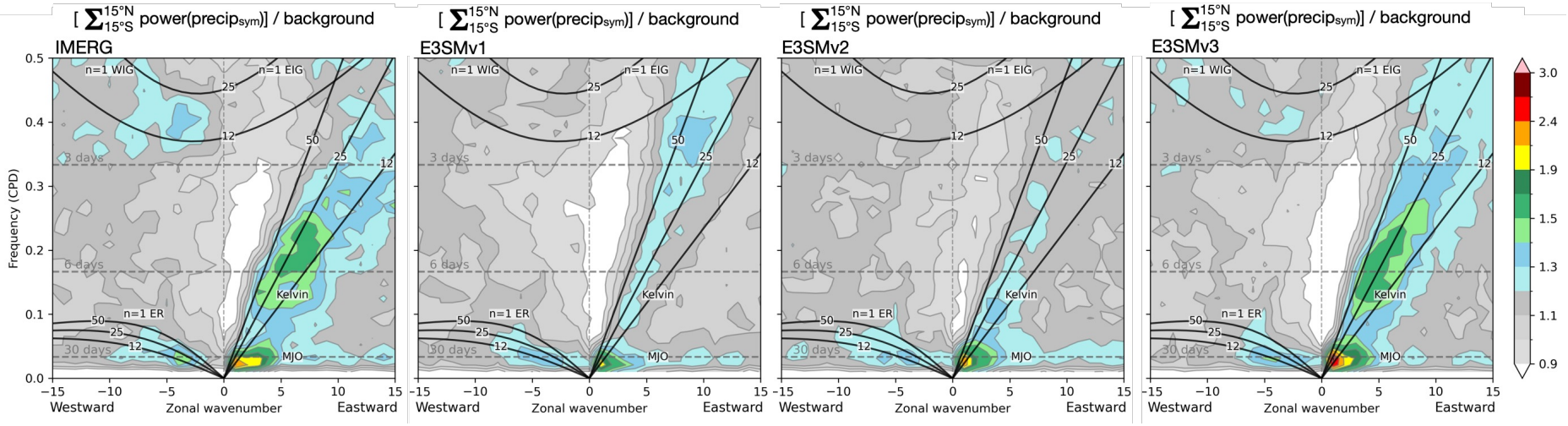
E3SM Energy Exascale Earth System Model

Tropical subseasonal convective variability in E3SM generally improves from v1 → v2 → v3

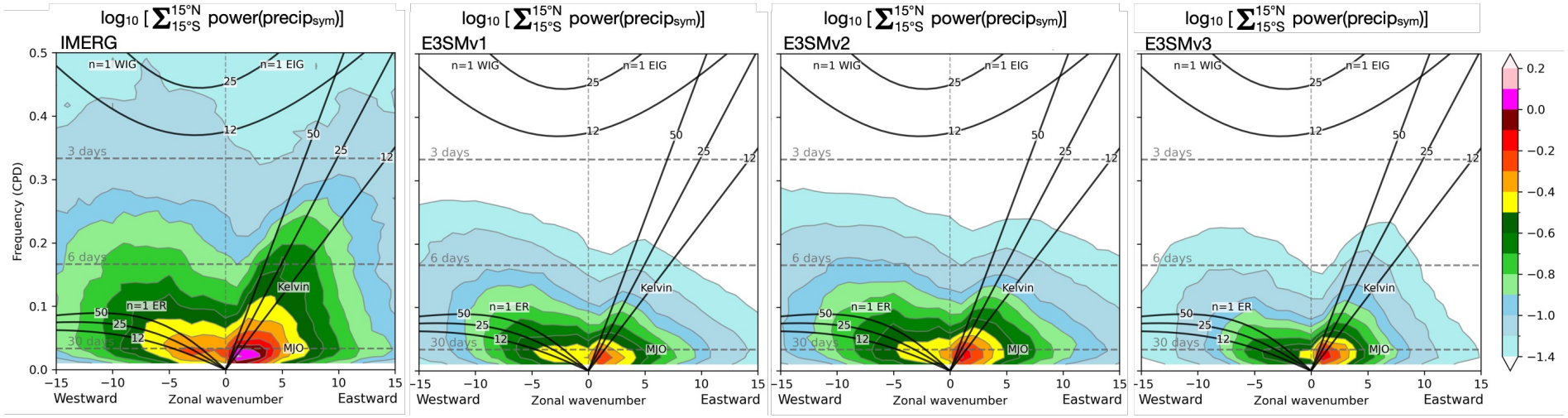
- Distribution of (normalized, symmetric) precipitation spectral power improves for key wave types:



- Changes to the deep convective scheme result in more realistic…
  - … convection-circulation coupling
  - … convection-radiation feedbacks for light and heavy (but not “moderate”) rain rates (only v1 → v2 assessed so far)
- MJO in **v2** has a larger (improved) amplitude, more realistic MJO-extratropical teleconnections
- Increased signal-to-noise ratio in **v3** is attributed to new representations of cloud microphysics (within deep convection) and mesoscale cloud scheme that improve feedbacks among moisture, clouds, circulation, and radiation

Lingering biases across E3SM development cycles

- Distribution of (**non-**normalized, symmetric) precipitation spectral power shows reduced magnitudes across scales:



- Tropical convection-related biases observed in **v2** :
  - Underestimated precipitation variability at ~all space-time scales (also verified for **v3**)
  - Continuation of “too light-too frequent” precipitation behavior
  - Underestimated precipitation diurnal cycle amplitude in Indo-Pacific region (diurnal phase is much improved) – also verified for **v3**
  - Incorrect precipitation-radiation feedbacks: too weak for light rain rates, too strong for moderate-heavy rain rates
  - Underestimated coherence of MJO eastward propagation signal
  - Low pattern correlation of MJO extratropical connections, particularly when MJO deep convection exists over Indonesia