Kelvin Waves and Tropical Cyclones in a Lagrangian Framework
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Equatorial westerlies from Kelvin waves help close the pouch’s circulation
- Kelvin waves are tilted westward with height
- Cyclogenesis occurs when the Kelvin wave westerly anomalies reach mid-levels (600 hPa)
- This tilt may explain the 0–3 day lag between Kelvin wave passage and genesis.

Convectively coupled Kelvin waves
- Eastward propagation at 10–20 m s⁻¹
- 3–10 day period, 2000–4000 km wavelength

Kelvin Waves modulate key factors for cyclogenesis
- Low-level vorticity, convection, vertical wind shear
- But net impact on tropical cyclone activity is uncertain

Tropical cyclones inhibited for 3 days before Kelvin wave passage and enhanced 3 days after

Circulation seems to be the dominant factor
- Low-level vorticity
- Upper-level outflow

Kelvin waves frequently interact with the MJO and easterly waves during genesis

Summary

Pouch Composites

Composite maps of easterly wave-relative zonal winds at 850 hPa (left) and 600 hPa (right). Green and orange contours identify wet and dry envelopes of the Kelvin waves, respectively. Similarly the red and blue are the westerly and easterly phases.

Convection and storm-relative low-level westerlies intersect easterly wave 2–3 days before genesis
- Westward tilt of Kelvin waves mean that its midlevel westerlies intersect the easterly wave at genesis
- Easterly wave’s westerlies are stronger and deeper from their overlap with the Kelvin wave

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Pouch Phase Speed

Composite cross-sections of easterly wave-relative zonal winds Red and blue contours identify are the westerly and easterly phases of the Kelvin waves.

- Easterly wave phase speed is estimated from composite Hovmöller of tropical cyclogenesis with Kelvin waves
- This phase speed is subtracted from the composite zonal winds to produce Lagrangian streamlines

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