Mid-latitude response to stationary and non-stationary tropical heating

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Events of intense localized convective activity in the tropics (e.g. ENSO and MJO) often constitute a large-amplitude coherent flow feature in an otherwise comparatively quiescent ambient environment. Such events are thought to play a major role in initiating Rossby Wave trains that propagate out of the tropics.

The present model-based study examines the meridional transmission and downstream effect of tropical forcing upon the flow on the mid-latitude wave guide (jet stream). Idealized simulations are conducted with a local specified stationary and non-stationary tropical heating distributions of different amplitude, scale and location to examine the nature and sensitivity of the response.

The numerical simulations were performed with the ECMWF Integrated Forecast System (IFS) run in the Held-Suarez setting. The experiments help to shed light on some aspects of the stationary and transient influence of tropical synoptic-scale forcing upon the extra-tropical flow. We find indications of tropical to extratropical influence yielding subsequent baroclinic downstream development along the jet stream. Response pole-ward of the jet stream was not attributable to linear Rossby wave propagation but was found to be highly linked tropical to extratropical wave-breaking on the poleward side of the jet. The differences in the response between the stationary and the non-stationary heating were found to be not significant within the first 15 days of time integration.