

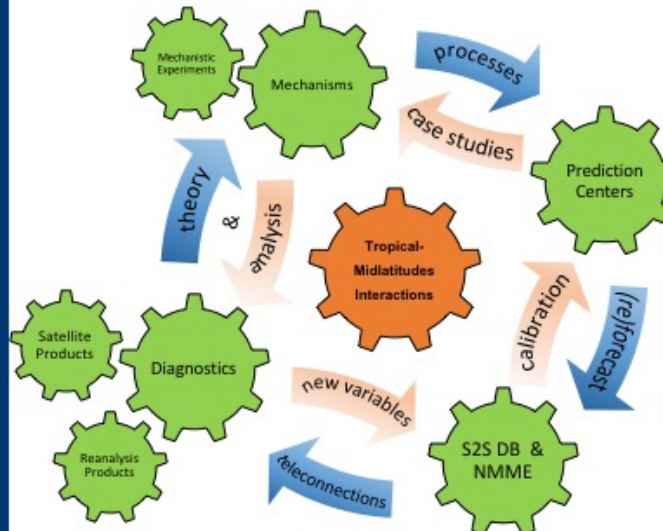


Year of Tropics-Midlatitude Interactions and Teleconnections

YTMIT

Better understand and predict sub-seasonal tropical-extratropical interaction pathways

Virtual
Field
Campaign



mid 2017 – mid 2019



Project Prospectus

The teleconnections between the tropical and extra-tropical regions on subseasonal-to-seasonal time scales are emerging as a leading candidate to explain high-impact weather events in low- and midlatitudes in a changing climate. For example, the major storm that swept through Southern California in December 2014 was very likely the result of the interaction between the subtropical jet, a fragmented branch of the polar jet, and organized convective activity in the Tropics. Palmer (2014) suggested that record-breaking 2013-2014 winter in the Midwest U.S. was caused by an intensification of the Northern Hemisphere jet stream in response to the enhanced convective activity in the tropical West Pacific. Vitart's (2013) evaluation of the ECMWF model indicates a significant improvement of the NAO forecast skill due to simulation of realistic MJO teleconnections in the Euro-Atlantic regions.

While the existence of teleconnections from tropical heating and SST variability has been well documented, fundamental questions regarding the underlying mechanisms remain unanswered. Are mid-latitude teleconnections from the fluctuating tropical heating fundamentally just time-lagged stationary wave responses to the heating, or does time-dependent wave interference play a role? Why are the North Atlantic weather regimes so influenced by MJO-related heating in the distant Indian and Pacific Oceans? Is the excitation of fundamental modes of barotropic instability an important player? What is the role of synoptic-scale transients? On shorter time scales, how does intense tropical storm-related heating impact the low-frequency extra-tropical circulation fluctuations?

We know that tropical convection itself may be excited and/or maintained by extra-tropical influences, yet many unanswered questions remain. Is the impact of extra-tropical forcing associated primarily with the initiation of tropical convection, or can it organize tropical convection on intraseasonal time scales? What is the role of PV streamers? What regions favor the propagation of extratropical signal into the tropics? Does extratropical excitation have a significant impact on the life cycle of tropical intraseasonal oscillations? How do intense mid-latitude storms and poleward propagating tropical storms interact with the polar vortex?

In order to extend our ability to predict the probability of significant circulation anomalies and associated weather events beyond the limit of deterministic weather predictability, we need to make progress in understanding tropical-extratropical two-way interactions. We must identify those properties of tropical heating that are critical in producing extra-tropical subseasonal responses, and similarly for the extratropical influence on the tropics. Toward these ends we propose *an intense coordinated effort involving existing observational data, forecasts and applications, diagnostics, theory and modeling experiments*: The Year of Tropics-Midlatitude Interactions and Teleconnections (YTMIT). This program is designed to foster relationships between research, forecasting, and stakeholder communities, and will facilitate the sharing of common interests to explore the links between the tropics and midlatitudes. This international program will include an integrated observations component (using existing products of Global Observing System, reanalyses, and field campaigns), an operational forecast and reforecast component (using the S2S and NMME databases), an applications component, and a research component aligned with the research priorities of the S2S/Teleconnection sub-project science plan, WWRP and WCRP missions. The research component will consist of a combination of theoretical, diagnostic, and modeling studies and will be focused on understanding the physical nature of the tropical-midlatitude interactions and teleconnections and their potential as sources of predictability. All the components will interact and provide feedbacks as suggested by the cover diagram, to help make more rapid progress.