Paul E. Roundy
Atmospheric and Environmental Sciences

Sponsor: National Science Foundation (NSF)
Dates: April 1, 2014 to March 31, 2017
Amount: $369,969

The Madden Julian Oscillation, Tropical Cyclones, and Extratropical Circulation Responses

Both the Madden Julian oscillation (MJO) and tropical cyclones are associated with substantial signals in the extratropical atmospheric circulation. Since the MJO influences the formation and movement of TCs, part of the extratropical signal associated with composite MJO events might include circulation outcomes associated with TCs. Also, although clearly not a necessary condition for MJO formation, tropical cyclones that form in association with different phases of the MJO in different geographical locations might also influence its propagation and development or breakdown.

The scientific merit of the work is that it investigates the previously unknown association between the MJO and extratropical circulation outcomes when TCs are located in particular geographical regions or are absent, with special emphasis on TCs in the Northwest Pacific basin during Northern Hemisphere fall. It also investigates the potential influence of tropical cyclones on the organization of convection associated with the MJO. Composite analysis of the global atmospheric circulation patterns associated with TCs will be applied to identify geographical regions in which TCs tend to be associated with favored extratropical circulation patterns. Circulation patterns associated with TCs in these regions will then be analyzed during a range of MJO states. Predictability of the associated circulation patterns and of the MJO itself when interacting with TCs will then be assessed by a similar analysis of the GFS and CFS V2 reforecast datasets.

The work will identify relationships between tropical cyclones and canonical or non-canonical circulation outcomes associated with the MJO. It will also diagnose whether TCs enhance or reduce the predictability of the MJO and its associated extratropical circulation patterns.

Broader impacts of the work will extend into predictability of extreme weather events or regime transitions that often develop in association with downstream impacts of MJOs and TCs. Both TCs and the MJO have previously been associated with extreme weather events across the middle latitudes. Results will provide insights that might

benefit commodity and energy markets as well as disaster planners, some of whom already consider the MJO and northwest Pacific TCs in their assessments of future risks of extreme temperature and rainfall or drought events.