M.S. Defense Announcement
Amanda Bowden
Friday, September 22, 2023, at 1:00 pm

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Defense
ATS Large Classroom (101 ATS) or via Teams

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Eric Maloney (Adviser)
James Hurrell
Matthew Ross (Ecosystem Science and Sustainability)

THE EFFECT OF PROJECTED SEA SURFACE TEMPERATURE CHANGE ON MJO ACTIVITY IN A WARMER CLIMATE

The Madden Julian Oscillation (MJO) consists of a convective region that propagates eastward in the tropics on repeat every 30-90 days with peak amplitude during the Boreal Winter (November - March). Since the MJO modulates extreme weather, future MJO changes in a warmer climate have implications for prediction of extreme events. Understanding precipitation pattern changes in a changing climate is critical for fresh-water resources and societal planning for oceanic regions. Decadal variability in the climate system causes patterns of sea surface temperature (SST) change in the tropical Pacific and associated precipitation, humidity, and wind change patterns changes to vary from one decade to the next. MJO changes are strongly dependent on the pattern of SST change, and so understanding uncertainty in MJO change in future decades in the context of this decadal variability is the primary motivation for this investigation. Since climate models contain climate variability on decadal timescales, different initial conditions across ensemble members can result in diverse projection outcomes in any given decade. This investigation examines the impact of projected SST and moisture pattern changes over the 21st Century on MJO precipitation and zonal wind (850 mb) amplitude changes using 80 members with the SSP370 radiative forcing scenario from the NCAR Community Earth System Model 2 (CESM2) Large Ensemble. The projected SST and moisture pattern changes can be weighted more toward the central or eastern equatorial Pacific in earlier parts of the 21st Century across ensemble members, although becomes strongly El Niño-like later in the century. Ensemble members with stronger MJO precipitation amplitude in a given period are characterized by stronger El Niño-like east Pacific warming, associated with a strengthened meridional moisture gradient. As interpreted through moisture mode theory, greater east Pacific warming supports a stronger MJO by enhancing propagation through a stronger meridional moisture gradient, and enhancing MJO amplitude through a stronger vertical moisture gradient. The investigation supports the hypothesis that projected SST and moisture pattern changes influence MJO activity, and also highlights the importance of understanding decadal climate variability for interpreting changes in water resources of oceanic regions.