Ph.D. Defense Announcement
Nathan Kelly
November 7, 2022, at 11:00 a.m.

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Ph.D. Defense

Monday, November 7, 2022
11:00 a.m.

Defense
ATS Large Classroom (101 ATS) or Teams

Post Defense Meeting
ATS Main Conference Room (209 ATS)

Committee:
Russ Schumacher (Adviser)
Michael Bell
Kristen Rasmussen
Peter Nelson (Civil and Environmental Engineering)

Rain and RELAMPAGO: Analysis of the Deep Convective Storms of Central Argentina

When, where and how much precipitation falls are fundamental questions to research interests spanning the weather to climate spectrum, yet is difficult to solve. The various methods used to answer "how much" each have sources of error, making it important to obtain knowledge about the characteristics of an individual dataset. This is especially true for rare events such as extreme precipitation. IMERG, TRMM 3B42, MERRA2 and ERA5 precipitation datasets were regridded to the same resolution and compared for 3-hourly heavy rainfall (99th and 99.9th percentile) in subtropical South America , which has some of the strongest convective storms on Earth. Seasonal and dirunal distribution are compared, with similar seasonal distributions between the datasets but at the diurnal scale MERRA2 and ERA5 show more afternoon events than TRMM and IMERG. Thermodynamic environments were compared with MERRA2 events tending to occur in more marginal environments than TRMM 3B42 and ERA5 environments over much of the analyzed region. Overall the satellite datasets showed the highest amounts. Brief case studies are included to illustrate these differences, which reinforce that choice of dataset can be an important factor in precipitation research.

How the precipitation falls is also addressed using a case study from the RELAMPAGO field program in Argentina. Many observations are available of this case, which occurred during the mobile operations period of the field program. Mobile surface stations, increased temporal resolution from fixed sounding sites, and six mobile sounding systems provide a high level of detail on the evolution of this storm system. Additionally, a trove of radar data and a GOES mesoscale sector are available. This case is demonstrative of a common occurrence in the region: a strong MCS over the Sierras de Córdoba mountain range. The extent of the backbuilding observed with this MCS was not predicted by the operation convective allowing models used for field program forecasting. To study this event two simulations are presented: one in which backbuilding of the MCS occurs and one where such backbuilding does not occur. The difference between these simulations is the number of vertical levels used in the model which impacts moisture availability upstream of the system via the effect of mountain wave downslope winds.

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