Evaluating Depolarization Streaks in Radar as an Indicator for Lightning Potential
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Project Description:
"Bolts from the blue" and infrequent lightning events present many challenges for National Weather Service (NWS) forecasters to predict. The events are particularly dangerous since the public is usually unaware of the risk due to the apparently calm weather. This project tries to determine if depolarization streaks from dual-polarization weather radar are a good indicator of lightning potential and would be useful for NWS forecasters to be more proactive with infrequent lightning forecasting. Depolarization streaks are found in differential reflectivity (ZDR) with values close to 0 in multi-cell stratiform precipitation. Using radar dual-polarization measurements and lightning data from the National Lightning Detection Network (NLDN) and the Geostationary Lightning Mapper (GLM), we will determine if the flashes coincide with same geographic location as the radar depolarization streaks. Previous student work has indicated some potential in correlating depolarization streaks as a precursor to lightning flashes, but only a handful of cases have been evaluated. This project aims to expand the database of both confirmed and null cases in collaboration with the National Weather Service Huntsville Forecast Office and NASA MSFC Earth Science Office with the Short-Term Prediction – Research Transition program (SPoRT).

Data and Analysis Tools:
Data for each lightning case in stratiform precipitation in the last 2 years will be provided by NASA SPoRT and NWS Huntsville for north Alabama. NWS dual-polarization radar and UAH ARMOR radar data will be pulled from existed data archives at UAH. Different software programs/tools will be utilized to analyze the data, such as GR2Analyst, Py-ART, GLM Tools, and SHARPpy. GR2Analyst is used for visualizing storms in three dimensions, which will be helpful for distinguishing different storm structures. Py-ART and GLM Tools are Python modules used to analyze radar data and lightning data. SHARPpy is a Python program which is used to analyze weather balloon sounding data, and will be helpful for comparing the different storm and lightning environments.

Training and Execution:
This project will take place between Tuesday, June 1, and Friday, August 6, 2021, and this will be a remote/online research project. The student will be mentored by Mr. Ryan Wade (UAH), Dr. Christopher Schultz (NASA), Ms. Kelly Murphy (UAH), and Mr. Brian Carcione (NWS). These mentors have experience remote mentoring other students as part of the NSF REU program, and will heavily use Google Meet & Microsoft Teams for weekly meetings, Google Drive for data storage and collaboration, and VPN to the UAH-NSSTC data

servers to download data and use existing software. A computer in the SWIRLL Ops Center will be provided for the duration of the project for either in-person or remote desktop access.

The training / research plan is listed below:

<u>Weeks 1-2:</u> Participating in an AES Dept. data tools boot camp which will be held both online and in the SWIRLL buildings on the UAH campus. Valuable skills will be learned at this boot camp in order to be able to complete the best research possible.

<u>Weeks 3-4:</u> Spinning up on the data and software, as well as background research in reading journal articles.

<u>Weeks 5-6</u>: Working through lightning cases to create a database of both verified and null cases for the presence of depolarization streaks with lightning flashes.

<u>Weeks 7-8</u>: Evaluating the statistical correlations between verified and null cases. Creating data plots of all cases.

<u>Weeks 9-10</u>: Finalizing data plots and results. Discussion with mentors on significance of results. Begin working on research poster.

The student will participate in daily check-ins via Google Meet or Microsoft teams with at least one mentor, and a full research team meeting with all mentors at the end of every week.