**Overview**

A newly selected Earth Venture Suborbital (EVS-3) investigation will explore how multi-scale dynamical and microphysical processes in winter storms interact to produce banded regions of snow in Atlantic coast-threatening snowstorms.

**Motivation**

- Snowstorms are frequent along the US East Coast and cause major disruptions to transportation, commerce and public safety.
- Snowband structures result from multi-scale dynamical, thermodynamical and microphysical processes and are poorly understood.
- Snowfall distribution and amount is often poorly predicted.
- Remote sensing of snowfall is difficult and additional observations are needed to improve algorithms.
- No major field study of East Coast US snowstorms has occurred over the last 30 years.

**Observations made during IMPACTS applies to remote sensing**

- GPM and the Decadal Survey Clouds, Convection and Precipitation Targeted Observable will both benefit from the observations taken during IMPACTS to improve remote sensing of snow in winter cyclones.

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**The Science**

**Characterize and understand snowband formation**

- What are the vertical and horizontal structures and scales of the bands and how do these structures evolve with the development of the cyclone?
- How do patterns of vertical motion (e.g. updrafts) relate to snowband structure and what dynamical and thermodynamical processes (e.g. frontogenesis, shear instability, conditional or symmetric instability, gravity waves) determine the initiation, size, evolution, and longevity of these vertical motions?
- To what extent are areas of enhanced reflectivity in bands related to increased snow water content versus changes in particle characteristics due to aggregation or riming without a significant change in snow water content?

**Apply IMPACTS observations to remote sensing and modeling**

- IMPACTS measurements will address the challenges of remote sensing of snowfall and ice processes (such as complex particle geometry and weak path-integrated attenuation) by coupling multi-wavelength radar measurements with in-situ microphysical data (e.g. size and aspect ratio spectra) and intrinsic data (e.g. cloud liquid water).
- IMPACTS observations will aid in assessment of the skill of different microphysical schemes and help address reasons why models poorly predict the distribution, intensity and amount of snowfall in storms.
- Data assimilation of IMPACTS observations into the WRF model will be used to create 4-D analyses of storms to investigate the structure and evolution of multiscale bands.

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**Observation Strategy**

- IMPACTS will use coordinated remote-sensing ER-2 and in-situ sampling P-3 flights to study the structure, dynamics, and microphysical characteristics of banded structures in winter storms.

**IMPACTS Observations will include**

- Active and passive microwave remote sensing on the ER-2 and in-situ microphysics on the P-3 aircraft.
- Dropsonde profiles over the ocean from P-3, supplemental soundings from NOAA and mobile sounding units.
- New York State Mesonet ground observations.
- Ground-based radar resources at SUNY Stonybrook.

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**IMPACTS Deployment**

- ER-2 will be based at Warner-Robbins, GA and P-3 at Wallops, VA.
- Operations will be for 6 weeks within the Jan-Mar timeframe starting in 2020 for three consecutive seasons (based on climatology).
- If there are no snowstorms along the Atlantic Seaboard, operations may move to the midwest near University of Illinois.

**SUNY Stonybrook Instrumentation**

- Ka scanning polarimetric cloud radar
- Micro Rain Radar and Doppler lidar
- Low-power phased array radar
- 95-GHz solid state radar and a Phased-array radar
- Phased-array X-band weather radar