



ICER- 1540729 and 1540724

Undergraduate Student Experiences as Part of the NSF-IUSE Geoscience Engagement and Outreach Program: Overview, Projects, Results from Years 1 and 2



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INTRODUCTION

Few students enter undergraduate programs understanding what the **geosciences** are or that geosciences are part of a science or **STEM** curriculum. Yet high-paying, high-demand jobs in the geosciences and the need for diversity means these students may miss an opportunity to put their interests in science to work. This collaborative effort across Santa Fe College (SFC), the University of Florida (UF) and the Orlando Science Center (OSC) is a 3-year project funded by the National Science Foundation's IUSE (Improving Undergraduate STEM Education) Pathways into Geoscience Program.

PROJECT GOALS

- GOAL A** - Recruit, retain, and transfer primarily underrepresented Santa Fe College students in a two-year Associates degree to Bachelor's degree programs in geosciences.
- GOAL B** - Establish collaborations among Santa Fe College students, University of Florida faculty mentors, and Orlando Science Center informal science educators.
- GOAL C** - Increase interest in careers in geosciences by engaging in education and outreach.

- Phase I – Spring: Orientation, Coursework at SFC, and Initial Collaboration (A, B, C)
- Phase II – Summer: Research at UF, Education and Outreach at Orlando Science Center (B, C)
- Phase III – Fall: Capstone Experience at SFC, Research and Outreach Presentations (A, B, C)

PROJECT TIMELINE

- Activities for each cohort span 17 months
- Recruitment of SFC students begins in August and the cohort is accepted in December
- Two courses (Seminar featuring team-building activities and research in the geosciences; Physical Geography) and research with UF mentors are undertaken in the spring
- Summer A is dedicated to full-time research with one of 3 UF mentors, with a presentation of their work to date delivered to all SFC, UF and OSC participants
- Students receive a stipend to live in Orlando during Summer B and develop hands-on educational activities at OSC
- In the fall, students take a capstone course that includes exposure to geosciences careers and completing their transfer application to a 4-year degree program, finalize their research, and make formal presentations of their OSC activities and research results

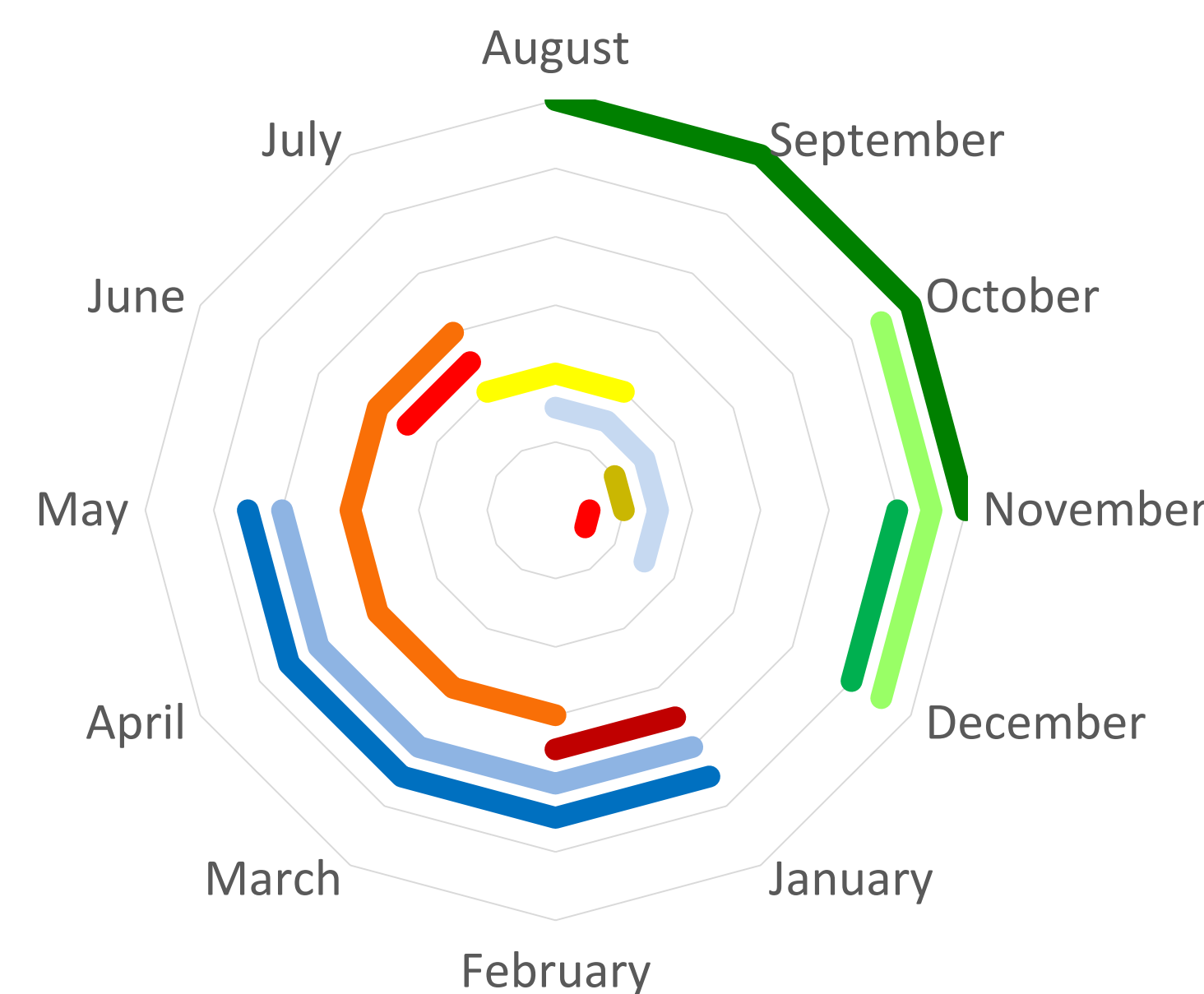


Fig. 1. Timeline of grant activities for each cohort. Plot should be read clockwise from outside to inside. Student selection is depicted in green, coursework in blue, research in red/orange, and internship in yellow/gold.

- Recruitment
- Seminar Course
- UF Research
- Capstone Course
- Interviews
- Physical Geography Course
- Present Research Results
- Demo OSC Activity
- Cohort Selection
- UF Mentor Matching
- Internship at OSC



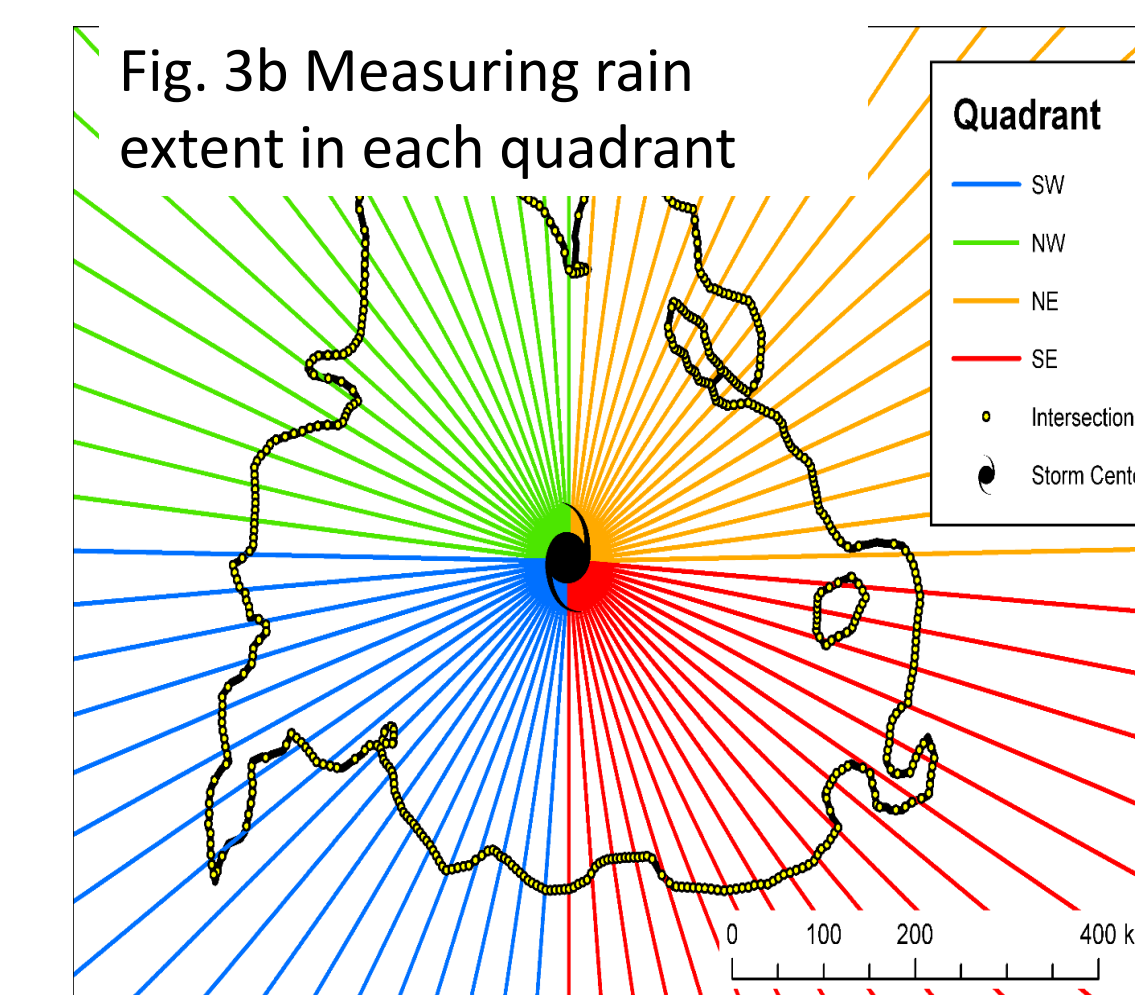
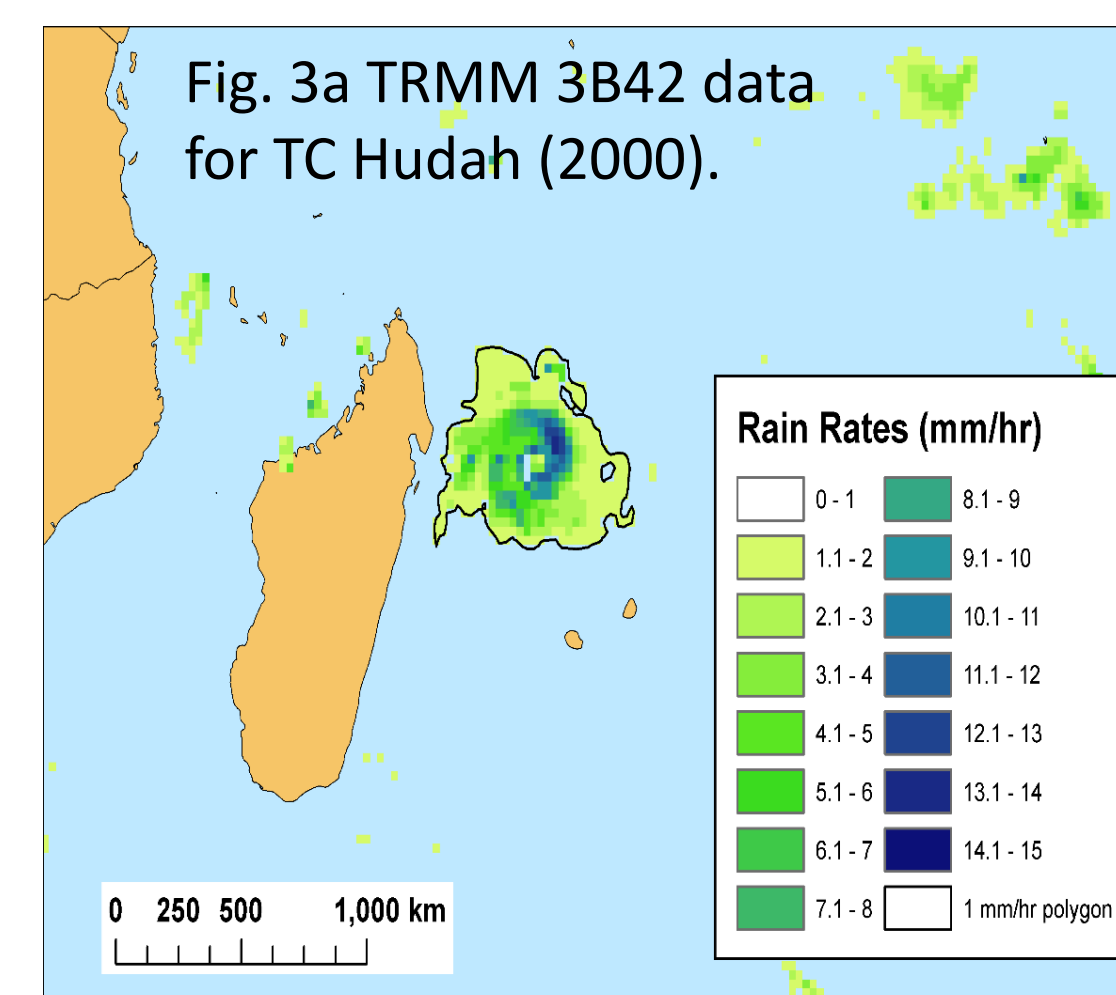
Fig. 2. a) Team-building field trip to bat cave (students and mentors), b) Research mentoring in UF Geography's computer lab, outreach activities at OSC's Otronicon with c) earthquake table, and d) Science on a Sphere.

RESEARCH WITH UF MENTORS

Dr. Matyas: Atmospheric Science and Geography

Examining satellite estimations of rain rates (Fig. 3a), students gain skills performing spatial analysis using GIS with provided Python scripts and making figures, organizing and updating spatial databases, making calculations and graphs in Excel, and conducting statistical analysis using SPSS.

Research questions: How do the spatial extents of rain rates produced by tropical cyclones moving over the SW Indian Ocean and Mozambique Channel vary amongst the storm's four quadrants (Fig. 3b) and across storms? Do these variations have a spatial bias from topographical influences? Are they related to storm intensity?



Dr. Stofer: Science Communication

Students produce images of scientific data using different color ramps and interview the public about their perceptions of what the data portray. Students learn how to design a survey instrument and submit a project for the Internal Review Board. They interact with the public and calculate simple statistics to analyze survey results.

Dr. Judge: Hydrology and Soil Science

Field work experience is gained by students as they dig pits and place instruments to measure soil temperature and moisture. They are part of a large collaborative project to examine the role of soils in the carbon cycle under different moisture conditions. Test sites provide ground truth for remotely-sensed observations.

PROJECTS CREATED DURING OSC INTERNSHIP

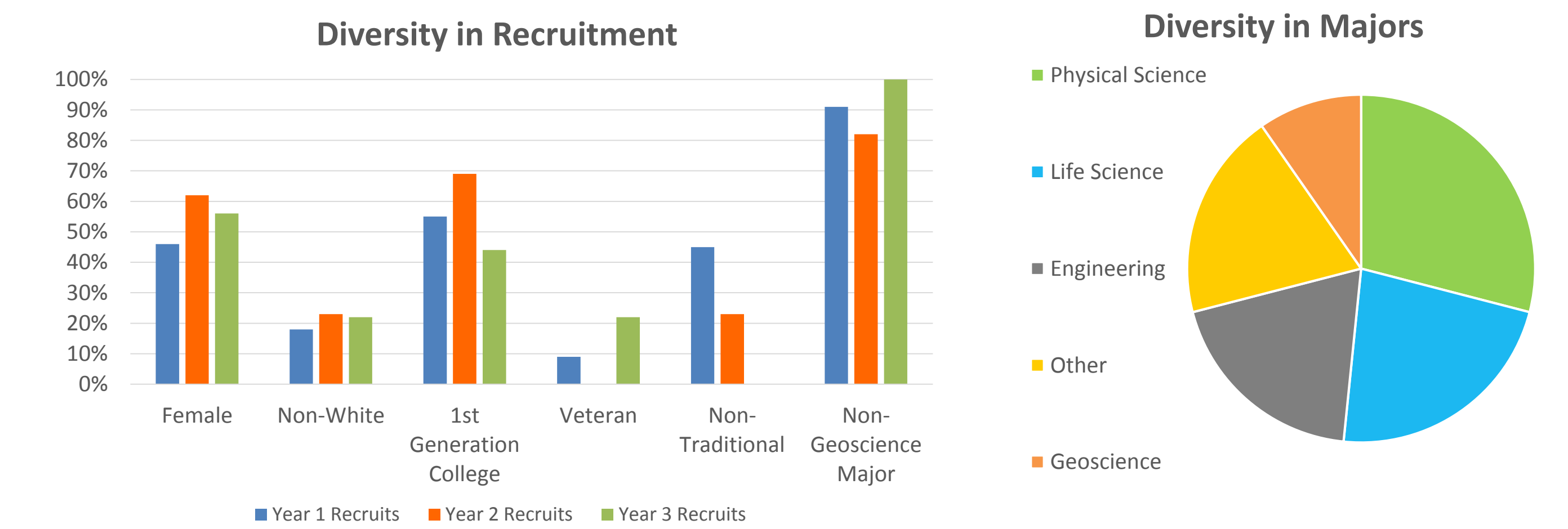
GOALS: 1) Create hands-on exhibits for visitors of the OSC in Dr. Dare's Lab and imagery for a show displayed using Science on a Sphere (SOS). 2) Create hand's on activities that can be delivered to K-12 teachers that meet Sunshine State standards in the Geosciences. Special challenge: avoid using phrase "climate change" as it is viewed by some Floridians as controversial.

Dr. Dare's Lab: Activity 1: explain soil properties and create soils for plants so that visitors could take home small plants in the correct soil for that plant. Activity 2: use a shaking table to simulate earthquakes. Visitors created structures out of note cards and tape and placed on the table to be shaken.

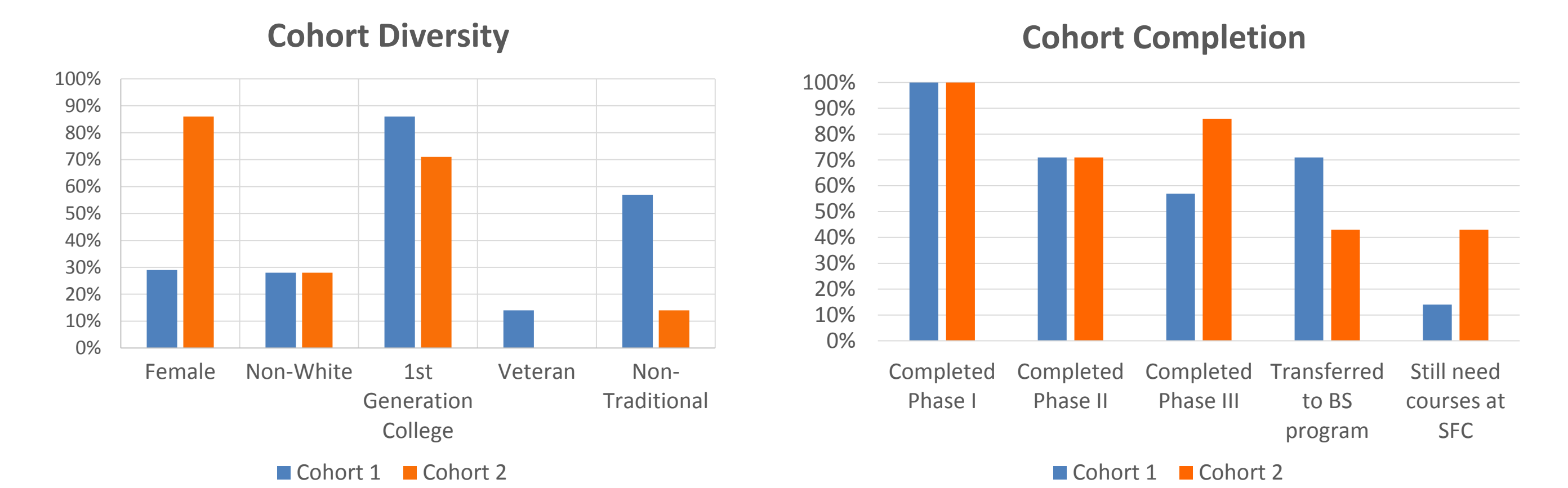
SOS project title: Our Changing World. This display teaches about the carbon cycle, which included an exercise for children with balls representing carbon and methane.

K-12 Activity: Use inexpensive probes to measure temperature and moisture in different types of soil layers and relate to latent and sensible heat exchange.

RECRUITMENT



RETENTION



SUCCESSES

- Recruiting students from diverse backgrounds and majors.
- Highly diverse group of students entering the program, particularly first generation college students. Program students have their own academic advisor at SFC (Bobby Hom) and report he aids their success in college.
- 100% completion rate for Phase I and more than 50% have successfully entered a BS program. High satisfaction with OSC internship in Year 2.
- Research with UF mentors has led to publication-quality results, including Matyas' Year 2 student (see poster 457 on Tuesday here at 2018 AMS).

Year 1 Challenge	Steps Taken to Overcome
Equipment: Students don't own laptops needed for research	OSC purchased laptops that students borrow each year
Communication methods	Use multiple Slack channels for scheduling meetings, sharing files and photos, uploading research updates
Research software and data exchange across campuses	Get SFC students access to UF resources for data storage and software for analysis
OSC internship did not reach full potential	Incorporate OSC mentors in research updates, trip to OSC in spring, OSC mentors participate in team-building activities, don't provide entire stipend up front as SFC initially required, reserve part of stipend for completion
Research did not progress as planned	Hire UF undergrads to be peer mentors, weekly progress reports, monthly update presentations, feedback with rubrics, solving of tech issues
Mixed responses from students on value of research experience	Match students with mentors based on skill sets rather than topical interest
Students not understanding time commitment and challenges for research	Incorporate research activities in the first class rather than wait until mentor matching in February. Students dropped out early in Year 2 due to time commitment issues (in time to be replaced)- an improvement over Year 1 where they dropped out in summer and fall.