Solar eclipse provides unique opportunity to study atmospheric waves

August 1 2019, by Marshall Swearingen

Witnessing one total solar eclipse—the one that swept across the continental U.S. in 2017—wasn't enough for Montana State University senior Jaxen Godfrey. But when she flew to Chile in July to experience another, it wasn't just for the thrill. It was to continue studying an elusive atmospheric phenomenon.

Godfrey, a Great Falls native majoring in physics in the Department of Physics in MSU's College of Letters and Science, was part of a Montana Space Grant Consortium team that used the rare celestial event to conduct an experiment on gravity waves ¾ disturbances in the Earth's envelope of gases that drive weather patterns and affect wildfire behavior and wind turbine performance, among other things.

"Gravity waves are basically like waves on water," Godfrey explained. The waves, which occur between layers of the upper atmosphere, are relatively common and can be caused when winds flow over a mountain range, but they remain poorly understood. An eclipse presents a special opportunity to study the phenomenon because the sudden blockage of sunlight creates abrupt thermal changes. The moon's shadow "is like a boat moving through water," Godfrey said.

During the 2017 eclipse, Godfrey, along with students from MSU, the University of Montana and Chief Dull Knife College, launched 19 helium-filled weather balloons from sites in Wyoming as part of the Montana Space Grant Consortium's Eclipse Ballooning Project. The balloons carried sensors called radiosondes to altitudes of 80,000 feet or

more. The palm-sized devices measured temperature, pressure and other variables in an effort to detect gravity waves during an eclipse for the first time.

According to Jen Fowler, Montana Space Grant Consortium assistant director, the results hinted at the waves' presence but fell short of measuring them directly. "We thought it was because we didn't target the proper altitudes," she said.

This time, the team of six launched slightly bigger balloons capable of rising to greater altitudes. From their launch site at the Collowara Observatory in the mountains north of Santiago, they launched more balloons than in 2017, and launched them every hour during a 24-hour period leading up the eclipse.

When the moon's shadow blanketed the observatory, Godfrey took a break from launching balloons and downloading data to experience the same eerie, midday darkness she did two years ago. "But this time I had my camera," she said.

Since July, Godfrey has been working with Fowler and Thomas Colligan, master's student in the Department of Computer Science at UM, to analyze the data. "We have one or two strong candidates for gravity waves caused by the eclipse, but we need to look at the data more closely," said Godfrey, whose involvement with this year's project and the one in 2017 has been supported by an internship with the Montana Space Grant Consortium's high-altitude ballooning program called BOREALIS. The Montana Space Grant Consortium, which includes 23 Montana colleges and universities, is part of a NASA-sponsored national network that works to strengthen aerospace research and education.

According to Fowler, the team's measurements constitute a valuable dataset that could help atmospheric scientists more accurately predict

when and where gravity waves will occur. And the three-year study has provided a unique opportunity for undergraduates like Godfrey to be involved in a long-term science project.

Godfrey, who is planning to go to graduate school for physics, will present the team's findings at an American Geophysical Union conference in San Francisco in December. "It has been great research experience," she said.

More information: spacegrant.montana.edu/borealis.html

Provided by Montana State University