SOUNDING ROCKETS STUDY [illegible] WINDS IN SPACE DRIVE CURRENTS IN THE UPPER ATMOSPHERE

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A chemical trail like the one here – this one deployed from a sounding rocket at night as opposed to in the daytime – will help researchers track wind movement to determine how it affects the movement of charged particles in the atmosphere. Credit: NASA

Some 50 miles up in the sky begins a dynamic region of the atmosphere known as the ionosphere. The region is filled with charged particles created by extreme ultraviolet radiation from the sun. At the base of the ionosphere, charged particle motions create a global current called the "atmospheric dynamo." Generally moving in loops from the equator to the poles, the dynamo changes daily based on solar heating and magnetic activity – but what keeps it moving isn't well understood.

This July, scientists will launch four rockets from NASA's Wallops Flight Facility, Va., for a five-minute journey some 100 miles up into the atmosphere. The rockets will collect data on the charged particles as well as winds of neutral particles that sweep through the lower ionosphere and how each affects the other, ultimately causing these dynamo currents.

The variations matter because all of our communications and GPS satellites send signals through the ionosphere. A disturbed ionosphere translates to disturbed signals, so scientists want to know just what causes the ionosphere to behave in specific ways.

"This experiment has never been done before," says Rob Pfaff, the project scientist for NASA's sounding rocket program at Goddard Space Flight Center in Greenbelt, Md. "We've measured the dynamo currents using rocket probes, but we've never simultaneously measured the currents along with the upper atmosphere winds and the electric fields that drive the currents."

The rockets -- known as sounding rockets from the nautical term "to sound," meaning to measure -- will launch sometime between July 5 and 23 depending on ionospheric and weather conditions. NASA's sounding rocket program at Wallops dates back to the agency's inception in 1958. Not only do sounding rockets offer a low cost way to access space, they also provide access to areas of the atmosphere too low for satellites.

In this experiment, the scientists will fly two pair of rockets. One in each pair will measure data about the charged or "ionized" gas -- called plasma -- as well as the neutral gas, through which it travels. The other will shoot out a long trail of lithium gas to track the wind movement. The instrumented rockets are 40 feet long and 17 inches in diameter, carrying a payload of 600 lbs. The lithium rockets are 14 inches in diameter and are about six feet long.

Beginning July 5, the team will set up each day from 9 a.m. to 1 p.m. EDT, ready to launch as soon as there's evidence of currents in the ionosphere as well as a crystal clear skies – necessary for successful observation of the lithium trail.

"We're studying a current that runs through the atmosphere much like the Gulf Stream moves through the ocean," says Doug Rowland a space scientist at Goddard who also helped design this mission. "In the Gulf Stream, a given parcel of water travels around the whole system, and the same thing happens with the plasma in the atmosphere. In general, during the day it travels in giant, horizontal loops from equator to pole and back."

What happens on such a typical day is not, of course, the whole story. The charged particle loops are guided by electric fields generated by winds and solar activity. But in the lower part of the ionosphere, there are a billion times more neutral particles than charged ones. The neutral particles, moving in their own wind patterns, can collide with the charged particles and slow them down.

Increased solar activity can adjust the magnetic fields around Earth and cause even more va[illegible] the ionosphere. Ideally one set of rockets will go up on a day of "quiet" solar activity, and the second will launch into increased space w[illegible]ctivity from the sun.

"The currents we are studying are part of a large global system called the atmospheric dyna[illegible]s Pfaff. "So it's important not just for understanding how it affects our satellites, but because it is a fundamental process of Earth[illegible]er atmosphere – and probably other planets with atmospheres as well."

Both sets of rockets will collect data on the currents, the electric fields, the electron density, the neutral gas density, and the motion of the neutral wind. The researchers will compare information from the two flights to better understand how the solar wind and the neutral wind interact and cause those communications-jamming instabilities in the ionosphere.

The launches will be webcast beginning at 8:30 a.m. on launch day at:
http://sites.wff.nasa.gov/webcast

For the latest status on the rocket launches, please visit:
http://www.nasa.gov/mission_pages/sunearth/news/soundingRocket-status.html

http://www.nasa.gov/centers/wallops/news/pfaffLA.html
http://sites.wff.nasa.gov/webcast/