

WISPAR

Winter Storms and Pacific Atmospheric Rivers



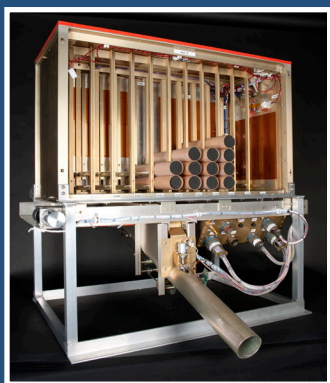
The WISPAR experiment was conducted through a collaborative effort including NOAA, NASA, and NCAR (National Center for Atmospheric Research). The primary objective of the NOAA-led WISPAR campaign was to demonstrate the operational and research applications of the dropsonde system, developed for NOAA by NCAR, on the NASA Global Hawk (GH) unmanned aircraft.



NASA Photo

The GH flew three missions for a total of almost 70 hours in February–March 2011 deploying a total of 177 sondes from near 60,000 feet altitude into atmospheric rivers (ARs), winter storms, and the remote Arctic atmosphere. NASA also provided the Real-Time Mission Monitor (RTMM) to facilitate flight planning and monitor the progress of each flight in real time. The GH was remotely operated from the GH Operations Center at NASA Dryden Flight Research Center at Edwards Air Force Base in California.

Instruments



Dropsonde launching assembly designed for installation on the NASA GH. Photo by Tony Landis, NASA.

The dropsondes provide high-resolution information about the state of the atmosphere in the form of temperature, pressure, relative humidity, wind speed and direction. These data can be used to improve the understanding of the evolution of ARs and winter storms. In addition, the NASA Jet Propulsion Laboratory installed HAMSAR, a microwave-based remote sensing instrument, on the GH during WISPAR. The HAMSAR data quantifies how much water vapor is located between the aircraft and the surface of the ocean offering important scientific context for the dropsonde data.

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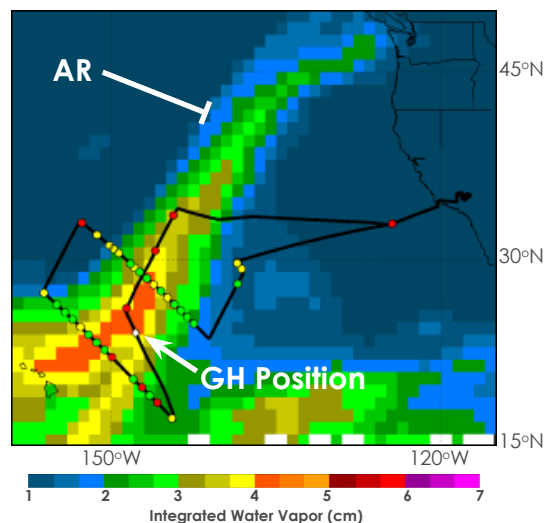
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Highlights from Science Flights

Atmospheric Rivers Flight

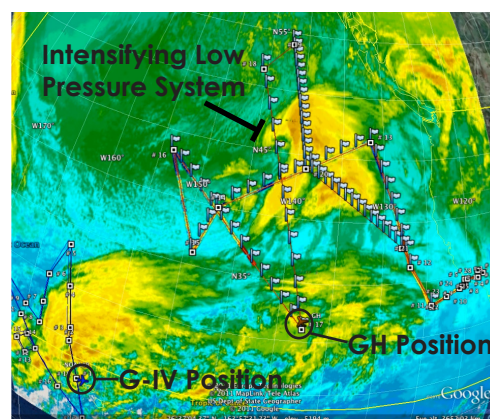
On 11-12 February 2011, the first-ever science-focused dropsonde mission for the GH dropped 37 sondes in a well-developed AR near its source of deep moisture in the tropics north and east of Hawaii. ARs are narrow regions of enhanced water vapor transport that emerge from the tropics and can lead to major rain and flooding events upon reaching land (for more information on ARs, see www.esrl.noaa.gov/psd/atmrrivers/). In some cases, ARs appear in satellite imagery to “tap” the large reservoir of water vapor in the tropics, such as in this case, but detailed measurements to quantify this tropical tap process have been extremely rare. The GH observations provide important new information on how ARs develop and evolve.



NASA GH flight track and drop locations (colored circles) overlaid on GFS analysis of integrated water vapor showing sampling of the AR emerging from the tropics.

Winter Storms Reconnaissance Flight

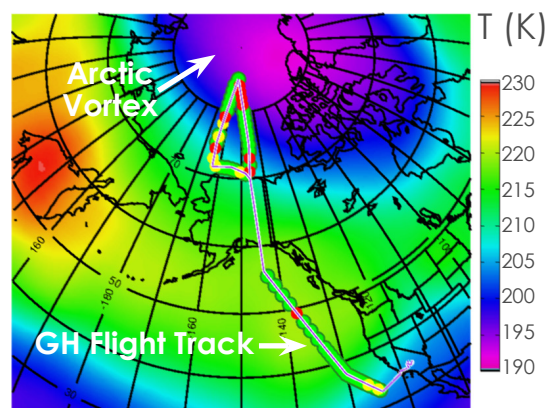
Accurate operational weather forecasting relies on targeted observations of the atmosphere. As a proof of concept, the GH deployed 70 sondes into a developing winter storm in the North Pacific during a 24 hour flight on 3-4 March. The GH flight was coordinated with a reconnaissance flight of the NOAA G-IV aircraft. The G-IV released dropsondes into an AR west of Hawaii that was associated with the developing winter storm sampled by the NASA GH and documented another case where an AR appears to have tapped tropical water vapor.



Coordinated flights of NASA GH and NOAA G-IV with GOES West-IR image showing winter storm targets. GH and G-IV aircraft positions are shown in real time in RTMM. GH flight track also shows the planned drop locations.

Arctic Flight

The GH flew an unprecedented mission into the Arctic stratospheric vortex on 9-10 March flying as far north as 85° latitude. Thirty-five sondes were released in the Arctic and another 35 were deployed in an AR and winter storm en route to and from the Arctic during the 25-hour flight. The dropsonde deployments in the Arctic demonstrate the capability of the GH to conduct operations in remote regions of the earth's atmosphere and the value of observations in the Arctic atmosphere where in situ measurements are very limited.



GH flight track with actual drop locations (colored circles) during Arctic flight showing very cold temperatures from NCAR/NCEP Version 2 reanalysis data at 70 hPa (~60,000 ft) sampled in the Arctic vortex region.



Related Resources

- **Atmospheric River General Information Web Page:** www.esrl.noaa.gov/psd/atmrrivers/
- **WISPAR NASA Press Release:** www.nasa.gov/centers/dryden/status_reports/global_hawk_03_10_11.html
- **WISPAR NOAA News article:** www.noaaanews.noaa.gov/stories2011/20110210_atmosphericrivers.html