The NCAR/NOAA Global Hawk Dropsonde System

Gary Wick\textsuperscript{1}, Terry Hock\textsuperscript{2}, and Ryan Spackman\textsuperscript{1}
\textsuperscript{1}NOAA ESRL/PSD, \textsuperscript{2}NCAR/EOL
Global Hawk Dropsonde Overview

• Developed through collaborative partnership between NOAA, NCAR, and NASA

• Relies on NCAR/EOL’s long experience with dropsonde development, aircraft launch systems, and data Q/C processing

• Uses new Global Hawk sonde: smaller and lighter than standard dropsondes

• System has 88-sonde and 8-channel capacity (track 8 sondes simultaneously)

• Automated telemetry frequency selection

• D-file returned to ground following drop

• Ground processing enables GTS transmission
Previous GH Deployments

- Winter Storms and Pacific Atmospheric Rivers (WISPAR)
  - Feb-Mar 2011, NASA Dryden Flight Research Center
  - 177 sondes released during 3 long-endurance flights
  - Soundings to 85 N

- HS3 Test Flights
  - September 2011
  - 45 soundings from Pacific flight
  - 35 sondes deployed, 27 collocated with NOAA G-IV

- Demonstrated flexibility in drop location with FAA
Sonde Specifications

- Size: 4.5 cm dia. X 30.5 cm length
- Mass: ~167 g
- Fall rate: ~11 m/s at surface
- Sensors based on Vaisala RS-92 radiosonde sensor module
  - Temperature: +60° to -90 °C, 0.01 °C resolution
  - Humidity: 0 to 100%, 0.1% resolution
  - Pressure: 1080 to 3 mb, 0.01 mb resolution
  - 2 Hz update rate
- Winds based on OEM GPS receiver and position
  - 4 Hz update rate
- Stable cone parachute design
- Remote control of power on/off and sonde release
- Designed for extreme environmental conditions
• Dropsondes sampled an extremely wide range of atmospheric conditions during N-S transect
• 45 sondes deployed
• Northern, mid-latitude soundings show strong polar jet stream
• Sounding within atmospheric river shows high moisture content but relatively weak transport at low levels
• Southern, tropical sounding shows moist boundary layer capped by inversion and drier air aloft
North Pacific Cross Sections
32 Dropsondes, 10°N – 48°N

Cold tropical tropopause
Extratropical storm
Dry subtropics

Temperature
Stratospheric air
Wind Speed

Relative Humidity

Strong polar jet stream in the upper troposphere at midlatitudes
Atmospheric River
ATMOSPHERIC RIVERS – WATER VAPOR TRANSPORT

Global Hawk Arctic Flight, 9-10 Mar 2011
IVT (x10^6 kg/s); directed from 320.0 deg 3x3 median smoothing

Jet Stream
AR Core
NCAR/NOAA GH Dropsonde System

Dropsonde System Electronics

Dropsonde Launch Assembly

Dropsonde System Launch Tube
New for 2012

- Full 8 channel capability implemented
- First operation with Ku-band communications
- Real-time GTS transmission
- Sonde diagnostics on power-up
- Automated logging of additional parameters at launch in PMHOF
- New version of Aspen
  - Synoptic map capability
  - Mac/Linux/Windows support
- Operation in new Flight Information Regions
• 500 dropsondes for 2012
• First batch off production line “outstanding”
• Extensive characterization of previous soundings
  • Meetings with Vaisala on sensor performance
  • GH/G-IV intercomparison – Hock to follow
  • Further chamber testing planned to explore dry bias above 250 mb

UW Scanning-HIS Dropsonde Comparison (Courtesy H. Revercomb)

Dropsonde 9/9/2011 16:58 UTC
Staffing

• Installation period
  • Engineering team at DFRC
  • G. Wick and NCAR software engineer at Wallops

• Mission period
  • 2 NCAR engineers at Wallops throughout
  • 2 NOAA scientists at Wallops throughout
  • Additional NOAA (HRD/ESRL) personnel offsite to assist with real-time sonde processing
System operation and real-time data monitoring from PMOF

Most recent dropsonde: Data being received during descent
HS3 Operations and Data Flow

- System operation and real-time data monitoring from PMOF
- ftp of D-file to ground following sounding completion
- Sounding assessment and skew-T generation in PMOF
HS3 Operations and Data Flow

- System operation and real-time data monitoring from PMOF
- ftp of D-file to ground following sounding completion
- Sounding assessment and skew-T generation in PMOF
- Transfer of D-file to NOAA offsite location
- Remote Aspen processing and generation of temp drop message
- GTS transmission of temp drop message
- Preliminary D-files available to science team post flight
- Post-mission QC by NCAR scientists
Closing Thoughts

- Post-mission data access
- Modified launcher mounting to support leveling good-to-go?
- Transmission of data on GTS a NOAA priority
- Work to facilitate assimilation of data underway