Data User Guide

Hurricane and Severe Storm Sentinel (HS3) Global Hawk Navigation

Introduction

The Hurricane and Severe Storm Sentinel (HS3) Global Hawk Navigation dataset consists of the real-time navigation and housekeeping data that was acquired by various instruments aboard the Global Hawk including the LN-100G IMU navigation system and the Global Hawk flight computer. This datasets was broadcast on the Global Hawk aircraft network by the NASDAT (NASA Airborne Science Data Acquisition and Transmission unit) as 1 Hz Universal Datagram Protocol (UDP) packets. These UDP packets were generated in IWG1 format, a type of ASCII format supported by all NASA and NCAR aircraft.

Citation

Sorenson, Carl. 2016. Hurricane and Severe Storm Sentinel (HS3) Global Hawk Navigation [indicate subset used]. Dataset available online [https://hs3.nsstc.nasa.gov/pub/hs3/NAV_GH/] from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/

Keywords:

Navigation; Atlantic Ocean; hurricanes, tropical cyclones; atmospheric pressure; atmospheric temperature; atmospheric winds; flight level winds; flight data logs, platform characteristics; viewing geometry

Campaign

The Hurricane and Severe Storm Sentinel (HS3) was a five-year NASA mission specifically targeted to investigate the processes that underlie hurricane formation and intensity change in the Atlantic Ocean basin. The goals for HS3 included: assessing the relative roles of large-scale environment and storm-scale internal

processes, and addressing the controversial role of the Saharan Air Layer (SAL) in tropical storm formation and intensification as well as the role of deep convection in the inner-core region of storms. To achieve these goals, sustained measurements over several years was needed to acquire a large enough sample of storms therefore, field measurements were collected from 2012 through 2014 for one month during each hurricane season. The HS3 campaign utilized two Global Hawks, one with instruments geared toward measurement of the environment, and the other with instruments suited to inner-core structure and processes. The environmental payload included the scanning High-resolution Interferometer Sounder (S-HIS) and the AVAPS dropsonde system; the over-storm payload included the HIWRAP conically scanning Doppler radar, the HIRAD multi-frequency interferometric radiometer, and the HAMSR microwave sounder. More information about the HS3 campaign can be found here https://hs3.nsstc.nasa.gov/.

Platform Description
The Global Hawk is a robotic airplane that can fly autonomously to altitudes up to 65,000 feet, or roughly twice as high as a commercial airliner can fly. It can cruise as far as 11,000 nautical miles, which is half the circumference of Earth, and has the capability to take more than 1500 lb (680 kg) of payload while cruising at 350 knots. The Global Hawk operators pre-program a flight path, then the plane flies itself for as long as 31 hours, staying in contact through satellite and line-of-site communications links to a ground control station at NASA's Dryden Flight Research Center at Edwards Air Force Base (EAFB) in California's Mojave Desert. Although the plane is designed to fly on its own, pilots can change its course or altitude based on interesting atmospheric phenomena ahead. No other science platform provides the range and time to sample rapidly evolving atmospheric phenomena as the Global Hawk does. This allows scientific research in regions that could not be reached, and for extended periods of time that are impossible with conventional aircraft.

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File Naming Convention
The HS3 Global Hawk Navigation data are named using the following convention:

Raw data:
hs3_navgh_Tail_ID_YYYYMMDD_0raw.txt

Quality controlled housekeeping and navigation data:
hs3_navgh_Tail_ID_IWG1_YYYYMMDD-hhmm.txt
hs3_navgh_Tail_ID_YYYYMMDD_0.dat
hs3_navgh_Tail_ID_IWG1_YYYYMMDD-hhmm-Preliminary.txt
hs3_navgh_Tail_ID_Aircraft_YYYYMMDD_RA.ict

Mission monitor log:
hs3_navgh_Tail_ID_YYYYMMDDmsg.txt

XML file:
hs3_navgh_Tail_ID_IWG1_YYYYMMDD.xml

Table 1: File naming convention variables

Variable	Description
Tail_ID	N871NA or N872NA
YYYY	Four-digit year
MM	Two-digit month
dd	Two-digit day
hh	Two-digit hour
mm	Two-digit minute
.ict	ICARTT file format http://www-air.larc.nasa.gov/missions/etc/IcarttDataFormat.htm

Data Format Description

The HS3 Global Hawk Navigation Data was transferred from the Global Hawk at one second intervals, enabling easy access to aircraft data by experimenter-operated computers. The navigation data files are formatted in the Interagency Working Group for Airborne Data and Telecommunications Systems (IWGADTS) definition of the Interagency Working Group standard format number 1 (IWG1), ICARTT, and XML file format. IWG1 is a simple ASCII CSV format designed to provide a common aircraft housekeeping data format, and will replace all other legacy formats used for different aircraft. More information on IWG1 format and the associated data variables can be found here: IWG1 Def.

In general, most flights contain the following types of files: a mission monitor log which records important flight events, raw and quality controlled navigation and housekeeping files which contain detailed aircraft information, and an XML file. For more information on the dataset characteristics, please refer to Table 2.

Note:

The XML files are automatically generated by the NASA Airborne Science Data Acquisition and Transmission unit (NASDAT). These files describe the data format, however are primarily intended to enable future programs to automatically parse and ingest these and other similar data streams.

Table 2: Data Characteristics

Characteristic	Description
Platform	Global Hawk UAV
Instrument	GPS, INS
Spatial Coverage	N: 45, S: 0, E: 0, W: -100 (Atlantic Ocean)
Spatial Resolution	N/A
Temporal Coverage	Start date: 09-07-2012 Stop date: 09-30-2014
Temporal Resolution	Daily
Parameter	Navigation
Version	1
Processing Level	1
Data Format	ASCII, XML

References

Braun, S.A., Vasques, M. 2015. "Hurricane and Severe Storms Sentinel (HS3) Data Management Plan." Earth Science Division, NASA Science Mission Directorate.

Contact Information

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