National Aeronautics and Space Administration

JPL High Altitude MMIC Sounding Radiometer (HAMSR) for Atmospheric State Reconnaissance

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← HAMSR timeline →

1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

AIRS New concepts

IMAS Requirements

Technology development

IIP-98 Instrument development

ER-2 configuration

CAMEX-4 ER-2

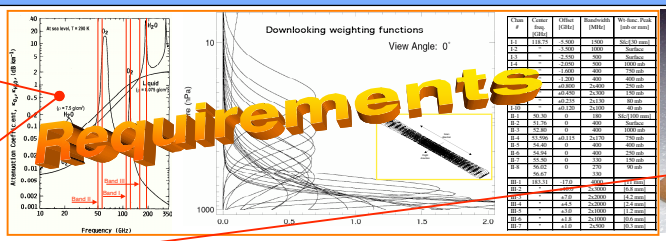
TCSP ER-2

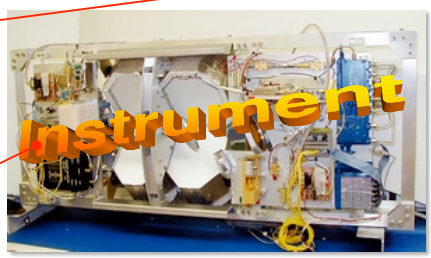
DC-8 configuration

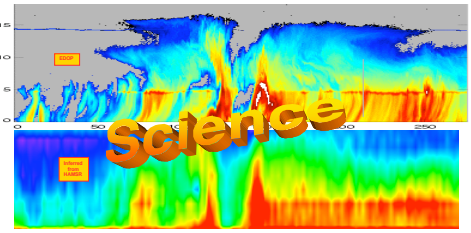
NAMMA DC-8

AITT Reconfigure f. Global Hawk

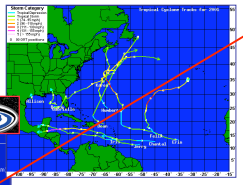
GRIP Global Hawk

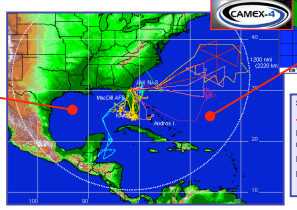




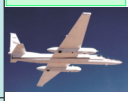


•Objective: Hurricane processes, landfall
•HAMSR role: Provide core atmospheric measurements
•Deployment: Right-forward ER-2 superpod
•Field base: Jacksonville Naval Air Station, FL
•Period: August 15 - September 24, 2001
•Status: Successful flights; moderate early problems



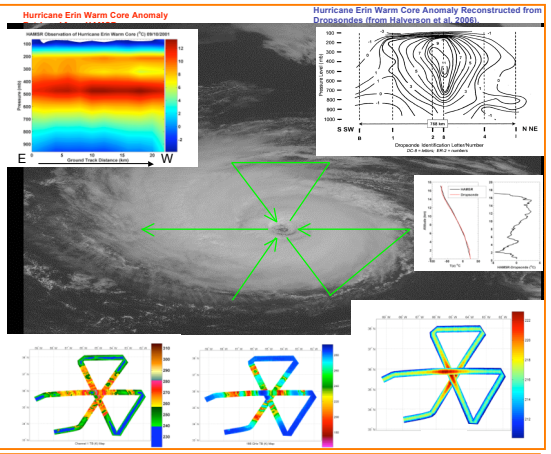


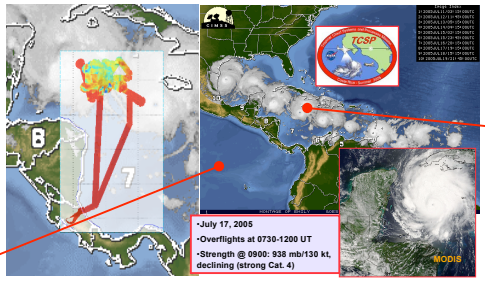
Sponsored by NASA (R. Kakar)
Joint with NOAA/HRD & others
ER-2 payloads: 3 MW + 1 IR radiometer, 1 doppler radar, dropsondes, more…
Formation flying with NASA DC-8, NOAA P-3's
Data are publicly available
http://camex.nsstc.nasa.gov/



Hurricane Erin 09/10/2001

Hurricane Erin, which developed from a tropical wave off the coast of Africa, reached tropical storm status on September 2nd, 2001 and reached hurricane status on September 5th. It reached peak intensity on September 8th and was weakening when it was observed by the ER-2 on September 10th between 16-20 UTC. At the time of the overflights, it is estimated that the central pressure was 970 mb and the maximum sustained winds were 90 kts (NHC Tropical Cyclone Report). The warm core temperature anomaly was imaged along track on the east-west flight track. It was computed by differencing the temperature profiles retrieved in the eye from those retrieved greater than 600 km from the eye, on the approach to the storm. The maximum magnitude of the warm anomaly is observed to be near 11-12ºC and occurs between 400-600 mb. The HAMSR retrieved warm core image in the eye is very similar to that reconstructed from a number of dropsondes released from the ER-2 and DC-8 (Halverson et al., 2006; *J.Atm. Sci.*), including a dropsonde which was released into the eye. A comparison of the retrieved temperature profile in the eye from HAMSR and the dropsonde released into the eye is shown. The differences are generally less than 2ºC.



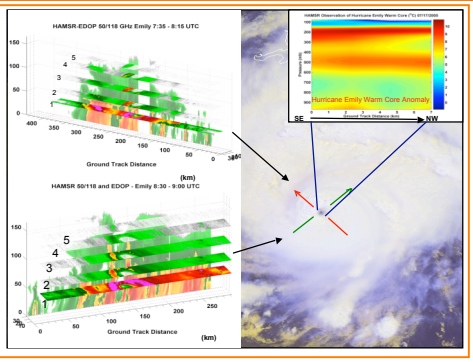


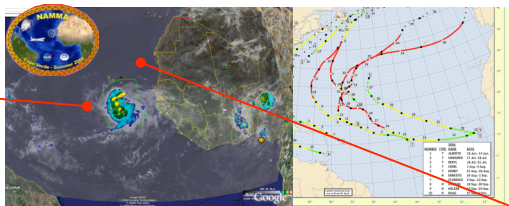
•July 17, 2005
•Overflights at 0730-1200 UT
•Strength @ 0900: 938 mb/130 kt, declining (strong Cat. 4)

Hurricane Emily 07/17/2005

HAMSR observed Hurricane Emily from the ER-2 on July 17, 2005. Emily became a tropical depression on July 10 and reached Category 5 status briefly around 0 UTC on July 17th before weakening to Category 4 status on July 18th. It is estimated that the surface pressure and maximum sustained winds at the time of the ER-2 overflights (7-12 UTC) were 940 mb and 135 kts, respectively (NHC Tropical Cyclone Report). A direct fly over of the eye allowed HAMSR to retrieve the warm core anomaly, which is shown along track below. The warm core anomaly is computed by subtracting the temperature profile retrieved in the eye, from an environmental profile retrieved on the approach to the storm, > 600 km from the eye. The maximum magnitude of the warm anomaly peaks near 11-12 ºC between 150 and 250 mb. A second peak near 8ºC is observed around 500 mb.

HAMSR "cloud slices" reveal intense convection in the eyewall region, with storm tops reaching above 15 km on North-West side of the eyewall. Two transits across the eye wall are shown, the first in a N-W heading and the second in a N-E heading. It is evident that HAMSR is able to assess the three-dimensional structure of the storm.





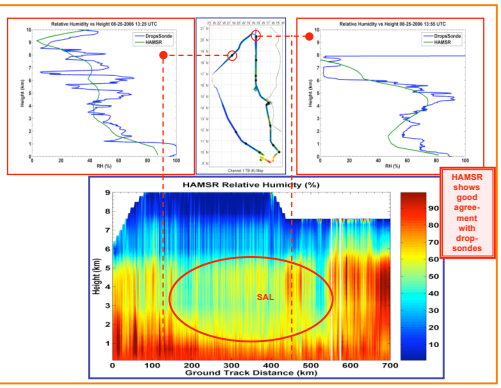
•Objective: AEWs, SAL, microphysics, cyclogenesis
•HAMSR role: Provide core atmospheric measurements
•Deployment: DC-8
•Field base: Sal, Cape Verde
•Period: August 15 - September 14 2006

DC-8 payloads: HAMSR, PR-2, LASE, multiple in-situ probes, dropsondes
Coordinated with NOAA P-3's in E. Carribbean
Data are publicly available
http://namma. nsstc. nasa.gov/

Saharan Air Layer 08/25/2006

HAMSR observed the extremely dry air associated with the phenomenon called the Saharan Air Layer (SAL). The SAL is usually associated with a thick dust layer emanating from the Sahara desert. On August 25 there was a SAL outbreak, and the dust and dry air had propagated well off the African coast. The flight that day, originating from the Cape Verde island Sal, encountered the SAL at about 1330 UTC. The first panel (left) shows a retrieved HAMSR water vapor profile, along with a drop sonde, just before encountering the SAL. This profile is typical of the region, showing high humidity near the surface. The second panel (right) shows a retrieved HAMSR water vapor profile more than 300 km closer to the African coast, deep into the SAL. This profile is atypical, showing a very dry layer, at 2-3 km above the surface, underlying a very moist layer at 5-6 km. The bottom panel shows relative humidity derived from HAMSR along the flight path, from just after takeoff to a point off the coast near Dakar. The end of this sequence is well south of the SAL and into a typical tropical, moist atmosphere.

There is considerable interest in the SAL in the context of tropical cyclone development, and debate continues as to whether the SAL prevents cyclogenesis or possibly enhances it. The HAMSR data will contribute to the resolution of this question.



This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology under a contract with the National Aeronautics and Space Administration.

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