Cloud Physics Lidar on the Global Hawk

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Status of Data Products for HS3_13:

- Data processing is complete, with images and text files available on the web.
- Global Hawk flights are broken up into ~ 6hr segments for processing, with product files created for each.
- The NRB and OP binary files containing backscatter profiles, layer locations, and optical properties can be ordered from the web (at the bottom of each flight segment page).
- HDF5 files for attenuated total backscatter (ATB) and optical properties (OP) can be pulled from the Marshall Space Flight Center Archive FTP server or ordered from our web site.
- Data products are 1 second averages (~170 m horizontal X 30 m vertical) produced from the raw 10 hertz data.
CPL Data Products at the Site:

- Three subdirectories under “cpl” directory:
  - “HS3_2012”, “HS3_2013”, and “Read_Routines”
- The following files are available for each flight and year:
  a) CPL_ATB*.hdf5 (atten. total backscatter + layer loc.)
  b) CPL_OP*.hdf5  (optical properties + layer loc.)
  c) imgsum*.gif    (summary ATB image for each segment)
  d) layers*.txt    (layer locations)
  e) map*.gif       (flight route for full flight and each segment)
- The Read_Routines directory contains IDL code to read the two HDF5 files.
Denotes CPL meaningful dust detection
Dust top height 2.0-4.5 km
HS3 CPL Products
Saharan Air Layer Locations 08/24 – 8/25/13

Full CPL Global Hawk track on 24–25Aug13

- Denotes CPL meaningful dust detection
- Denotes CPL Segment C

Dust top height 3.5-6.0 km
HS3 CPL Products
Saharan Air Layer 08/25/13 Segment C

Backscatter corrected for attenuation

Depolarization Ratio
Top Layer Avg. = .32
PBL Layer Avg. = .16

Cumulative Optical Depth

Only Aerosol layers shown
HS3 CPL Products
Saharan Air Layer Locations 08/29 – 8/30/13

Full CPL Global Hawk track on 29–30Aug13

Denotes CPL meaningful dust detection

Dust top height 2.5-5.0 km
2014 Update:

1. The instrument/laser was successfully turned on after the ATTREX deployment to test and diagnose a laser issue. Suspect cables were returned to GSFC with one subsequently found to be damaged. A repaired cable will be brought to integration and we anticipate improved performance.

2. Both real-time and preliminary products are unchanged from last year.

3. As a default, we will save (and transfer to MTS) an image once every 5 minutes during flights, which covers the time span in one image, plus some overlap. During focus periods, we can increase that rate down to 1 minute.
Examples of real-time displays:

With Ku

Without Ku
Global Hawk CPL

First Global Hawk Landing at Wallops Flight Facility, Virginia
September 7, 2012

The End
Global Hawk: (Sortie 12207D)
Segment Time> 16:47:24-17:20:23 utc
Segment Latitude> 36.61826 - 37.29256
Segment Longitude> -68.19118 - -71.97696

ER-2 (Sortie 12924)
Segment Time> 16:53:55-17:20:44 utc
Segment Latitude> 36.62517 - 37.30912
Segment Longitude> -68.19151 - -71.97642 (same direction)

Exact Coincidence
Time> 17:23:30.125 utc (3 minutes after end of segment)
Global Hawk Latitude/Longitude> 37.36726 / -72.33559
ER-2 Latitude/Longitude> 37.36649 / -72.32977

Remarks:
Exact coincidence occurs after the segment ends during ER-2 crossover point.
At the eastern end of the coincidence, the two aircraft are ~6 minutes apart, improving to 0 minutes apart at the western end. The whole segment is useful for comparison.
Global Hawk track (red)
ER-2 track (black)
Exact Coincidence (G)
Segment endpoints (X)
ER-2 CPL Inter-comparison
1064 nm Attenuated Backscatter Profiles

CPL Attenuated Backscatter for 09/23/12 1064nm

Global Hawk

ER-2

LONGITUDE RANGE = -68.1912 : -71.9770

LONGITUDE RANGE = -68.1915 : -71.9769

Time of Day (UTC)

Altitude (km)
ER-2 CPL Inter-comparison
Depolarization Ratio Retrievals

CPL Depol Ratio Retrieval for 09/23/12 1064 nm
Latitude (degrees)

Global Hawk

CPL Depol Ratio Retrieval for 09/23/12 1064 nm
Latitude (degrees)

ER-2

LONGITUDE RANGE = -68.1912 : -71.9770
LONGITUDE RANGE = -68.1915 : -71.9769
ER-2 CPL Inter-comparison
1064 nm Extinction Profiles
ER-2 CPL Inter-comparison
1064 nm Cumulative Optical Depth

CPL Optical Depth Retrieval for 09/23/12
1064 nm

Latitudes:
36.6183, 36.7306, 36.8430, 36.9654, 37.0678, 37.1802, 37.2926

Global Hawk
Time of Day (UTC)

Latitudes:
36.6243, 36.7384, 36.8624, 36.9666, 37.0806, 37.1946, 37.3087

ER-2
Time of Day (UTC)

Longitude Range:
-68.1912 : -71.9770
-68.1915 : -71.9769
Global Hawk Instrumentation:
Cloud Physics Lidar (CPL)

Publications describing processing algorithms:


Publications describing data quality:


Outline of CPL Data Products:

Global Hawk flights are broken up into ~ 6hr segments for processing, with two large binary files created for each:

Products produced from the NRB (normalized relative backscatter) binary file (within ~60 hours of landing):
1. Curtain plots of attenuated backscatter for full segment
2. Curtain plots of att. backscatter for each 30-minute slice
3. Layer boundaries for PBL, elevated aerosol layers, clouds
4. Depolarization ratio profiles (1064 nm) for ice/water phase

Products produced from the OP (optical properties) binary file (usually after the mission is over):
1. layer optical depth and column tot. (aerosol, cloud, total)
2. layer extinction-to-backscatter ratio (lidar ratio) used
3. extinction profiles inside identified layers
4. particulate backscatter profiles corrected for attenuation
5. Plots of extinction and optical depth for each 30-min. slice