

# **Cloud Physics Lidar on Global Hawk**

**HS3 Science Team Meeting**  
**May 7-8, 2012**

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# CPL for Global Hawk



# **Global Hawk CPL Data Products**

**cpl.gsfc.nasa.gov**

- 1. Summary curtain images for each flight.**
- 2. Layer boundaries for PBL, elevated aerosol layers, clouds.**
- 3. Optical properties, including**
  - layer optical depth (e.g., aerosol, cloud, total)**
  - layer extinction-to-backscatter ratio (lidar ratio) used**
  - extinction profiles inside identified layers**
  - backscatter profiles corrected for attenuation**
  - images for extinction and optical depth**
  - depolarization ratio (1064 nm only) for ice/water phase**

**All data products are 1 second averages (200 m horiz. X 30 m vertical) produced from the raw 1/10 second data.**

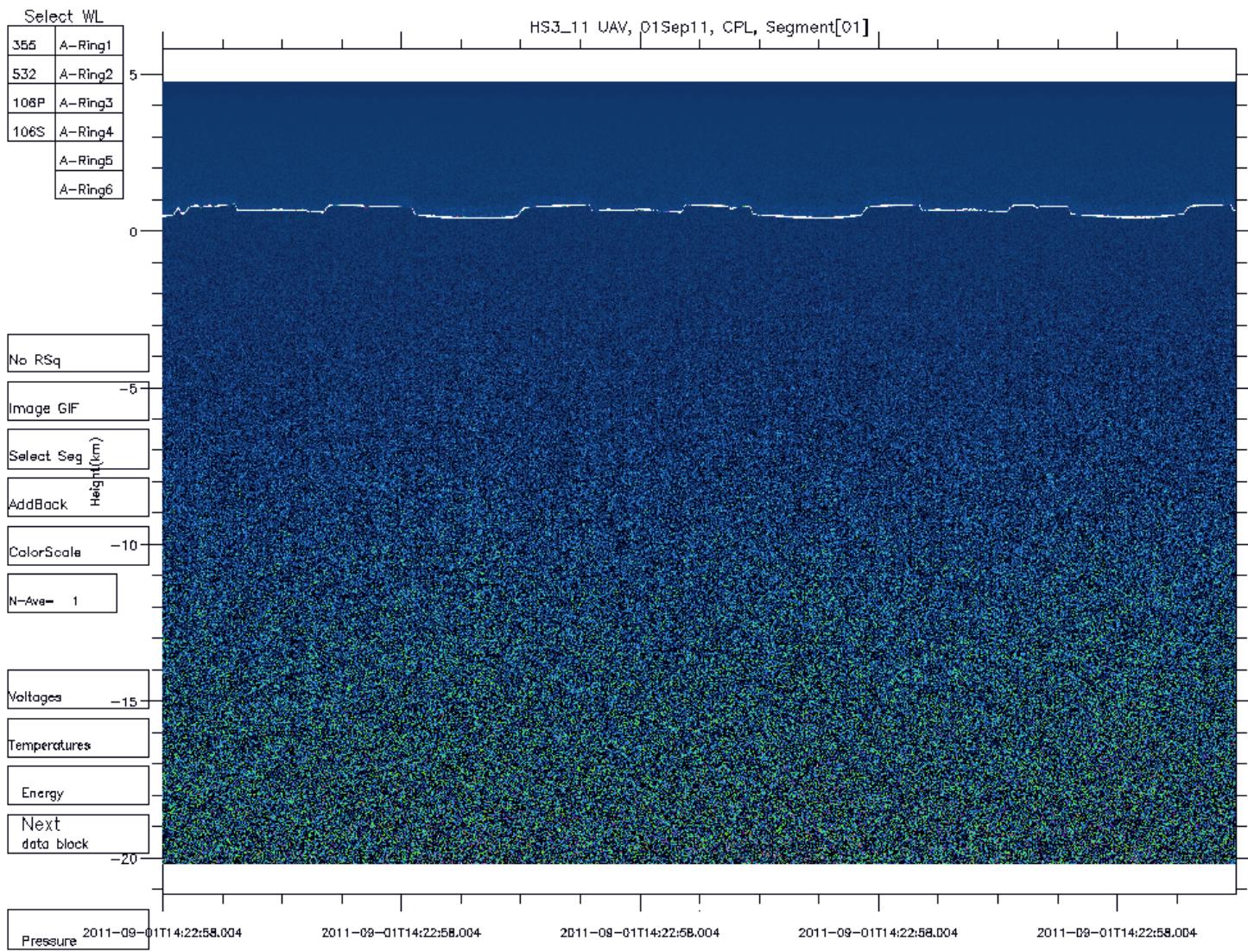
**All data products are produced for each wavelength.**

**Global Hawk flights are broken up into ~ 6hr segments for processing.**

**Real-time data downlink via Iridium (slow, minutes between updates) or via KU band downlink (fast, can send 532 nm raw profiles each second), can do real-time visualization and project to GHOC screen.**

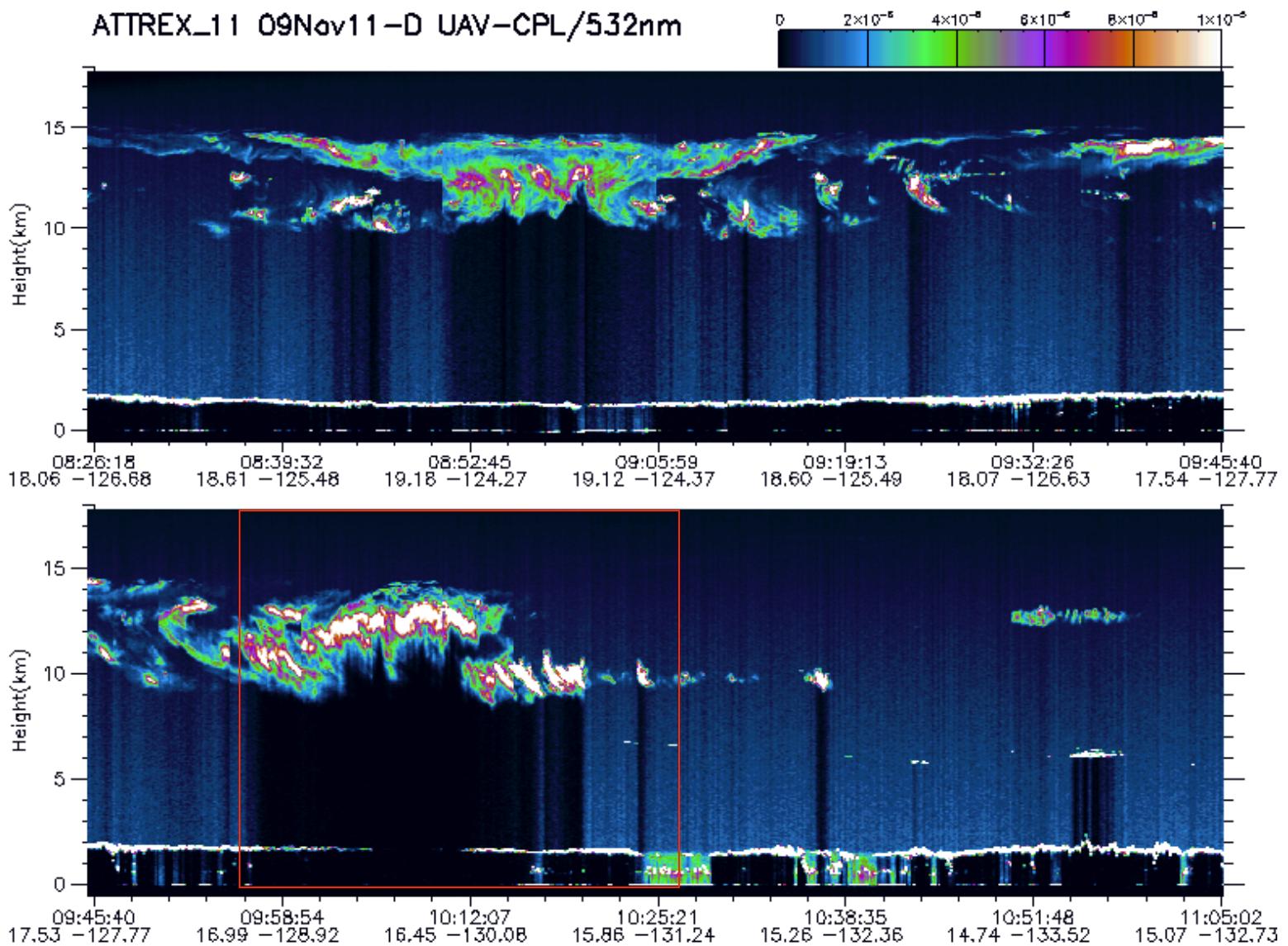
# Global Hawk CPL Data Products

## HS3 Test Flight 09/01/11



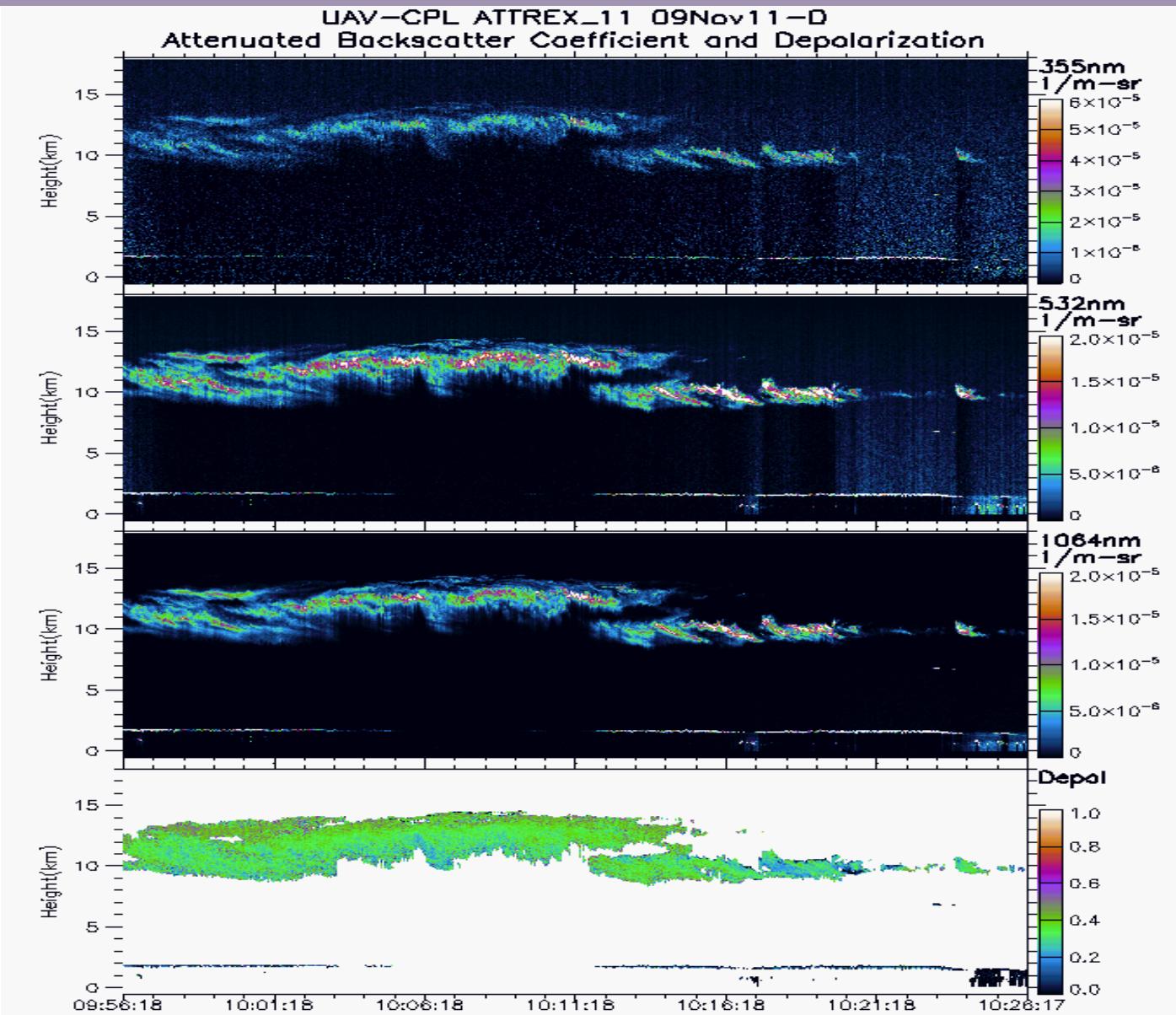
# Global Hawk CPL Data Products

## ATTREX Flight 11/09/11



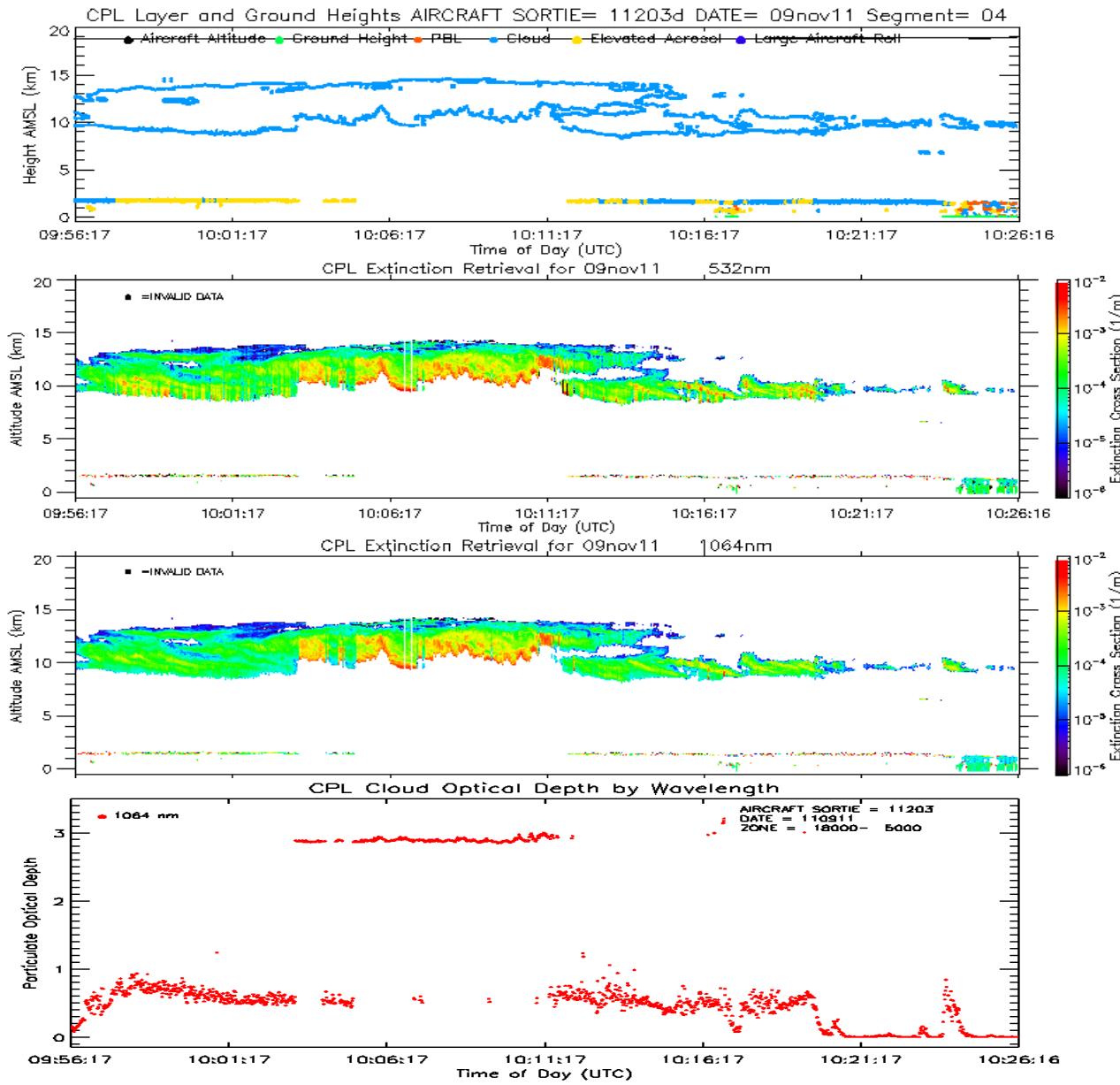
# Global Hawk CPL Data Products

## ATTREX Flight 11/09/11



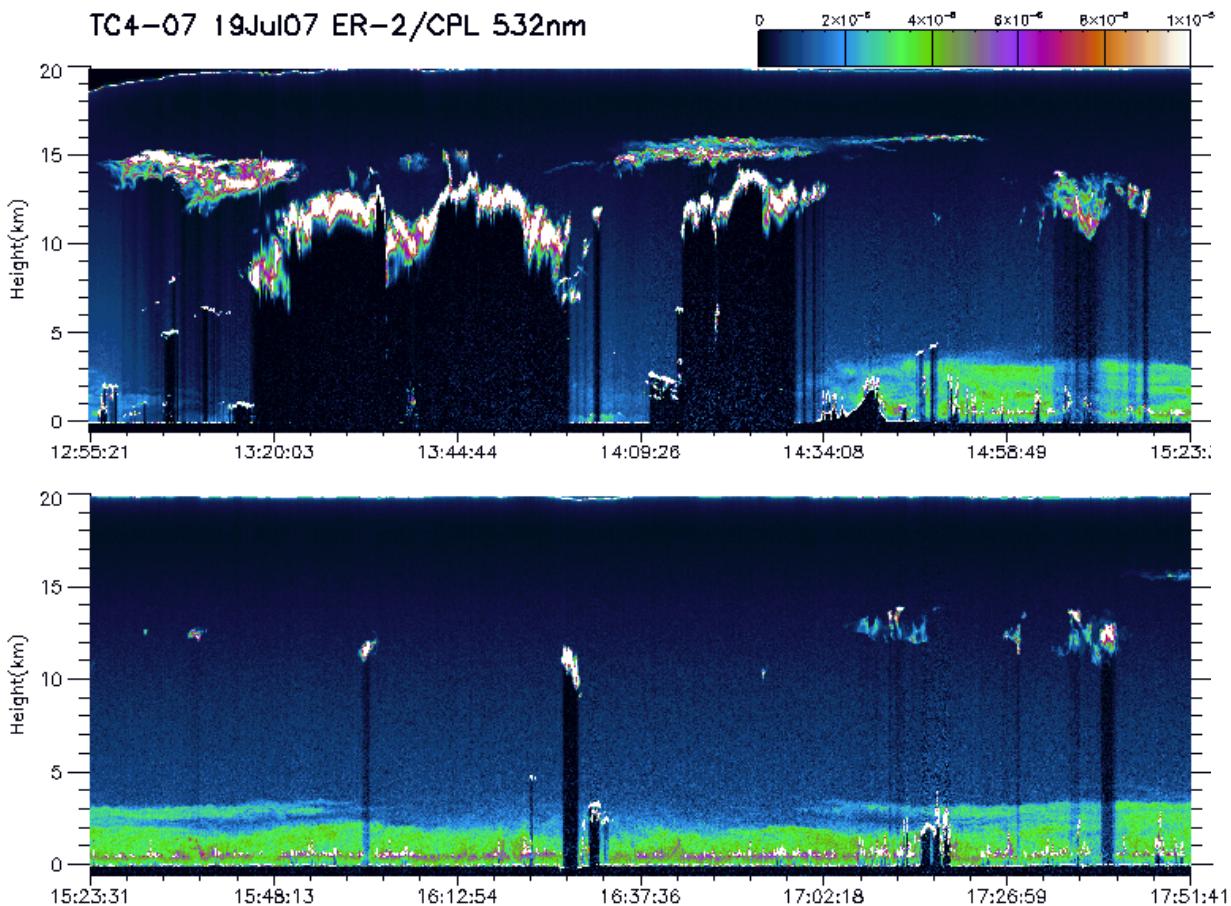
# Global Hawk CPL Data Products

## ATTREX Flight 11/09/11

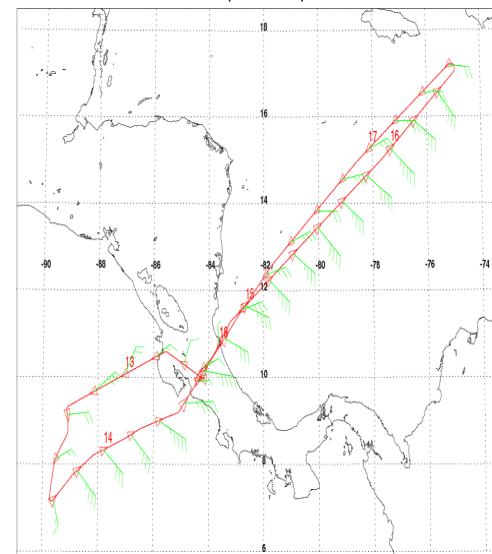


# ER-2 CPL Views of Saharan Dust

## TC4 Flight 07/19/07



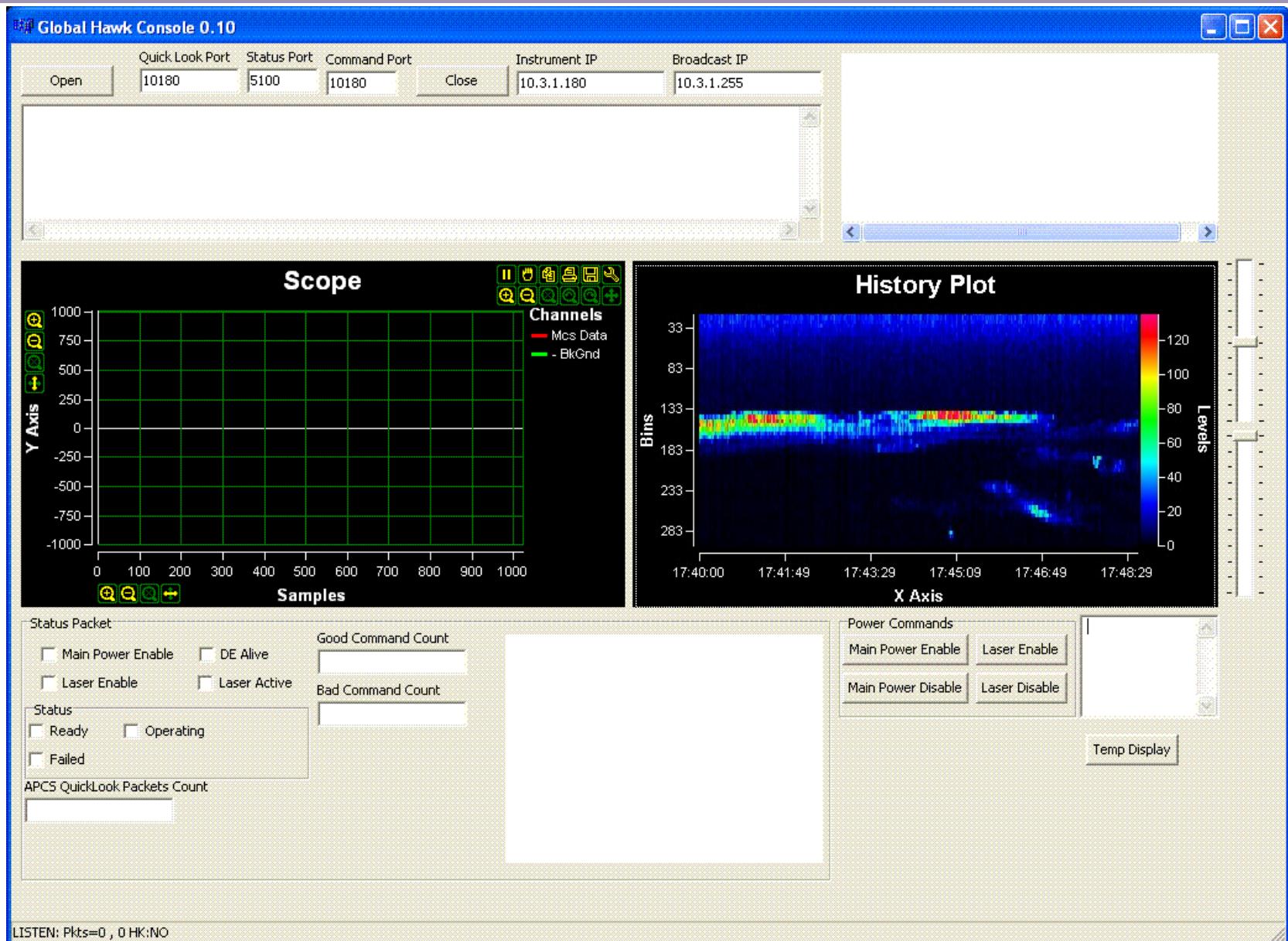
NASA DFRC ER-2 Navigation Recorder Data      Flight Date: Jul 19, 2007    Sortie: 07-9020  
Provided By: AS&M Data Systems



# Global Hawk CPL Issues and Status

- 1. Instrument is in good shape and ready to go.**
- 2. Resolved issue:** The data disk overwrite problem after power disable then laser enable has been resolved. This means if we have to power completely down during flight, we can start laser fire again without losing data.
- 3. CPL ideally calibrates every 5 minutes in a 2 km thick zone starting at 2 km below the plane and above the highest clouds. We can get by with less calibration points and a tighter zone, but this does present problems for us when the plane is below 18km and/or the cirrus is above 15 km.**
- 4. An improved GHOC real time quick look display is being developed with altitude marked instead of # of range bins from aircraft in both the image and the profile.**

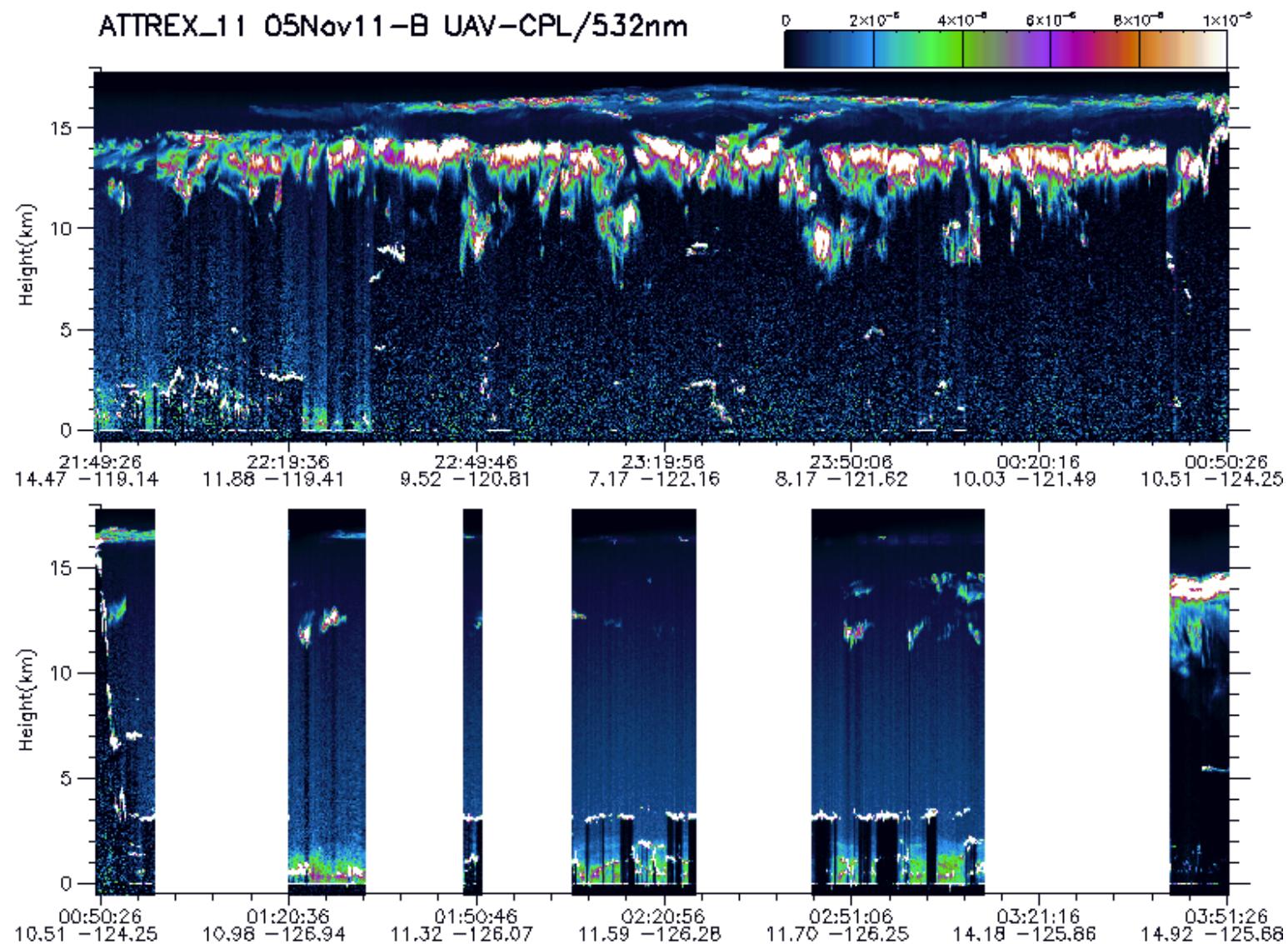
# Global Hawk CPL Issues and Status



# **Global Hawk CPL Questions**

- 1. How soon out of Wallops can the CPL laser be turned on?**
- 2. What will a typical environmental aircraft flight look like as far as CPL “laser on” periods?...Will the Global Hawk climb to (increasing) max altitude and stay there or are there dips planned? What is the status of the COA for CPL operation below 53000 ft?**
- 3. What is the expected Ku band coverage in the regions we will be flying?**

# Global Hawk CPL Questions



# **Global Hawk CPL Extras**

The End

# Global Hawk CPL Extras

## Global Hawk Instrumentation:

Cloud Physics Lidar (CPL)

### ***Publications describing processing algorithms:***

McGill, M.J., D.L. Hlavka, W.D. Hart, E.J. Welton, and J.R. Campbell, "Airborne lidar measurements of aerosol optical properties during SAFARI-2000", *J. Geophys. Res.*, 108, doi: 10.1029/2002JD002370, 2003.

Yorks, J. E., M. McGill, D. Hlavka and W. Hart (2011), Statistics of Cloud Optical Properties from Airborne Lidar Measurements, *J. Atmos. Oceanic Technol.*, 28, 869-883, doi:10.1175/2011JTECHA1507.1.

Yorks, J. E., D. L. Hlavka, M. A. Vaughan, M. J. McGill, W. D. Hart, S. Rodier, and R. Kuehn (2011), Airborne validation of cirrus cloud properties derived from CALIPSO lidar measurements: Spatial properties, *J. Geophys. Res.*, 116, D19207, doi: 10.1029/2011JD015942.

Hlavka, D. L., J. E. Yorks, S. Young, M. A. Vaughan, R. Kuehn, M. J. McGill, and S. Rodier (2012), Airborne validation of cirrus cloud properties derived from CALIPSO lidar measurements: Optical properties, submitted to *J. Geophys. Res.*.

### ***Publications describing data quality:***

McGill, M., D. Hlavka, W. Hart, J. Spinhirne, V. S. Scott, B. Schmid, 2002: The Cloud Physics Lidar: Instrument Description and Initial Measurement Results, *Applied Optics*, 41, No. 18, 3725-3734.

Schmid, B., J. Redemann, P.B. Russell, P.V. Hobbs, D.L. Hlavka, M.J. McGill, B.N. Holben, E.J. Welton, J. Campbell, O. Torres, R. Kahn, D.J. Diner, M.C. Helmlinger, D.A. Chu, C. Robles-Gonzalez, and G. de Leeuw, "Coordinated airborne, spaceborne, and ground-based measurements of massive, thick aerosol layers during the dry season in Southern Africa", *J. Geophys. Res.*, 108, doi: 10.1029/2002JD002297, 2003.

Hlavka, D. L., S. P. Palm, W. D. Hart, J. D. Spinhirne, M. J. McGill, and E. J. Welton (2005), Aerosol and cloud optical depth from GLAS: Results and Verification for an October 2003 California fire smoke case, *Geophys. Res. Lett.*, 32, L22S07, doi: 10.1029/2005GL023413.