



# **LASE measurements during GRIP: A brief overview**

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the LASE Team**

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Data from dropsondes, radiosondes, and MMS were used in the analysis.**

# LASE System and Data Products

- **System Features:**

- DIAL system operating in the 817nm band of H<sub>2</sub>O
- Uses a Ti:sapphire laser (100 mJ at 5 Hz double pulsed)
- 3 line pairs are used to capture the full dynamic range of water vapor in the troposphere

- **Data Products:**

- **Water vapor mixing ratio profiles**

- surface to upper troposphere

- 0.01 to 25 g/kg

- accuracy: 6% or 0.01 g/kg

- resolution (variable)

- vertical: 330 m nadir, 990 m zenith

- horizontal: 42 to 70 km (3 - 5 min)

- **Aerosol/cloud profiles**

- daytime and nighttime

- 0.03 to 25 km

- resolution (nominal)

- vertical: 30 m

- horizontal: 2.1 km

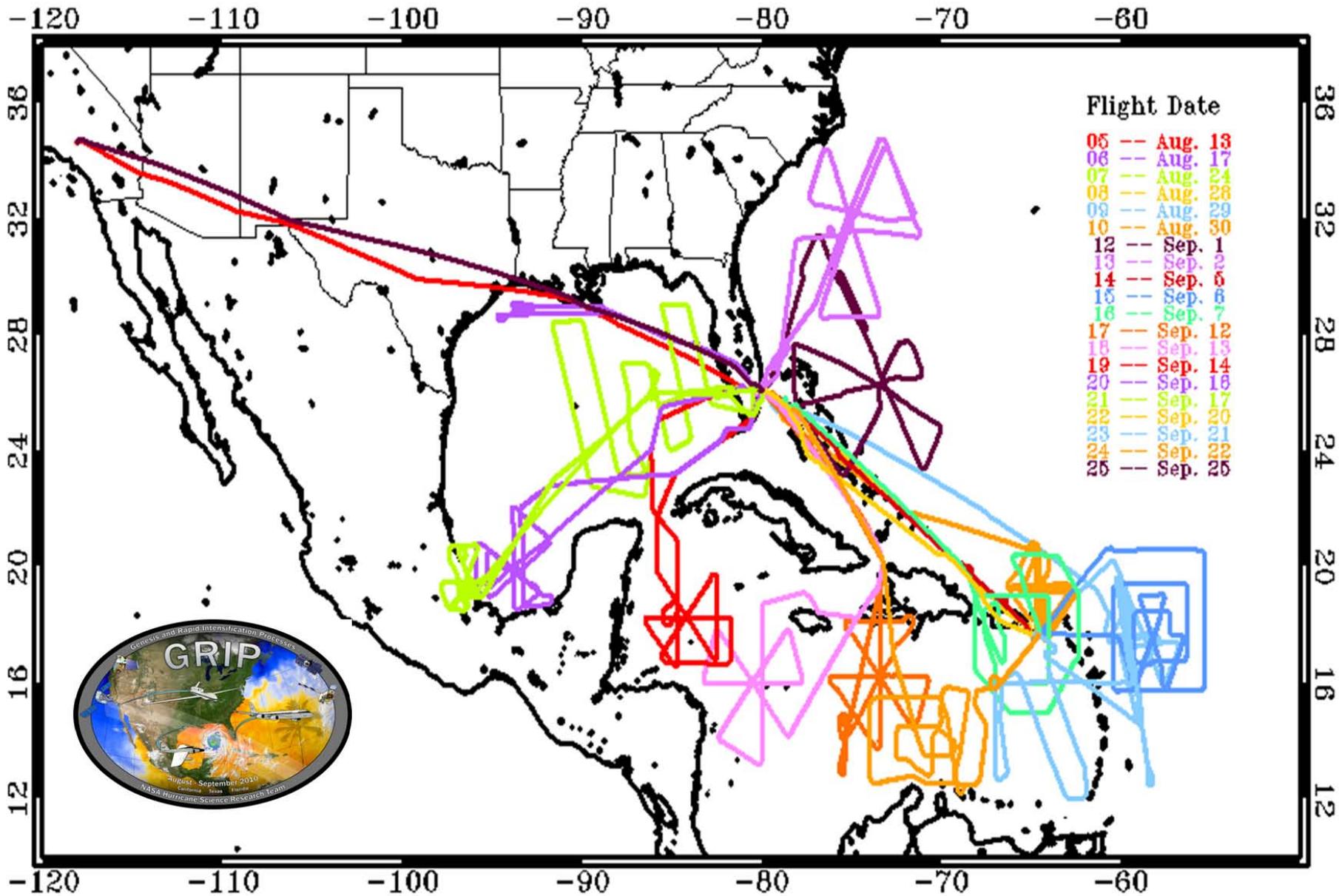
- **Advanced data products:\***

**RH derived from LASE mixing ratio and dropsonde/radiosondes, Total Precipitable Water (TPW), aerosol extinction and scattering coefficient profiles, and aerosol optical depth.**

\*Retrieved on a case by case basis on request

# LASE DC-8 Composite Flight Tracks

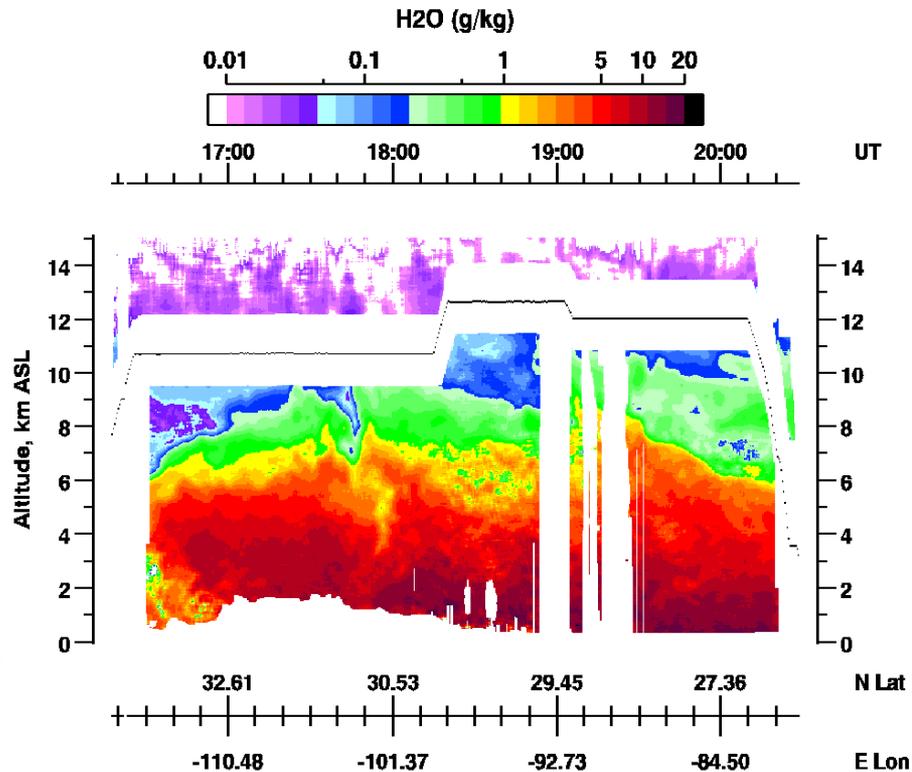
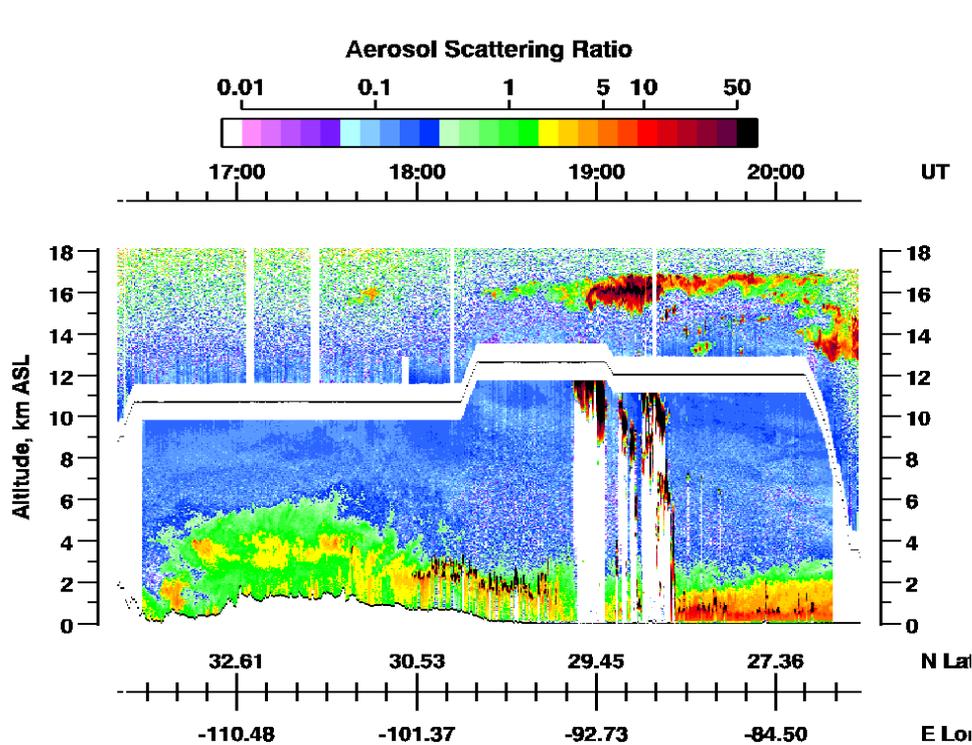
## GRIP: August 13 - September 25



Flight # / Date		Objective	LASE Observations
5	8/13/10	Transit	TD-5 cirrus outflow; increased moisture and aerosols over the Gulf
6	8/17/10	System Tests	AQUA underpass 18:41 UT
7	8/24/10	Frontal Survey	AIRS underpass 19:00 UT; TRIMM overpass
8	8/28/10	Transit to STX	After 15:46 LASE has zenith only
9	8/29/10	Hurricane Earl	SAL below at 16:43; eye not well defined; 22:22 descent into SAL
10	8/30/10	Hurricane Earl	Evolution of eye during rapid intensification; 6 eye crossings; LASE measurements extend down close to surface in the eye
11	8/30/10	Transit to FLL	LASE did not operate
12	9/01/10	Hurricane Earl	Dry air to NW, W, and SW of storm; very moist in and near eye, and SE; Descent into SAL at end (~ 18:30)
13	9/02/10	Hurricane Earl	LASE measures water vapor and aerosols in the eye, water clouds in eye wall, cirrus outflow above the storm; global hawk above
14	9/05/10	Transit to STX	20:00 in situ sampling of SAL
15	9/06/10	Gaston	TS Remnants – intensification questionable
16	9/07/10	Gaston, to FLL	TS Remnants (LASE seeding problems)
17	9/12/10	PGI-44 (Karl)	Not a TD or TS in clouds
18	9/13/10	PGI-44 (Karl)	In clouds, Dry air mass observed near end of flight
19	9/14/10	PGI-44 (Karl)	In clouds
20	9/16/10	PGI-44 (Karl)	In clouds
21	9/17/10	PGI-44 (Karl)	Eye makes landfall over
22	9/20/10	Transit to STX	1 <sup>st</sup> hour is low leg for in situ aerosol
23	9/21/10	PGI-46/CALIPSO/CLOUDSAT	LARGE see Dust on runway before takeoff; Initial low leg for LARGE in Dust; LASE and CALIPSO qualitative agreement of aerosol features; Descent into SAL
24	9/22/10	PGI-46/CALIPSO/CLOUDSAT	Overpass at 18:14:20, 18:14:35 UT; 17:40:40 GV coincidence; dust and dry S of Haiti
25	9/25/10	Transit to Palmdale	A zenith test segment with all energy up

# Flight 5 / Palmdale to Ft. Lauderdale/ August 13, 2010

## Gulf storm outflow



# Transit: Palmdale to Ft. Lauderdale

LASE/GRIP

Flight 5

13 Aug 10

## Relative Humidity (%) (Calc. Over Water)

0 20 40 60 80 100



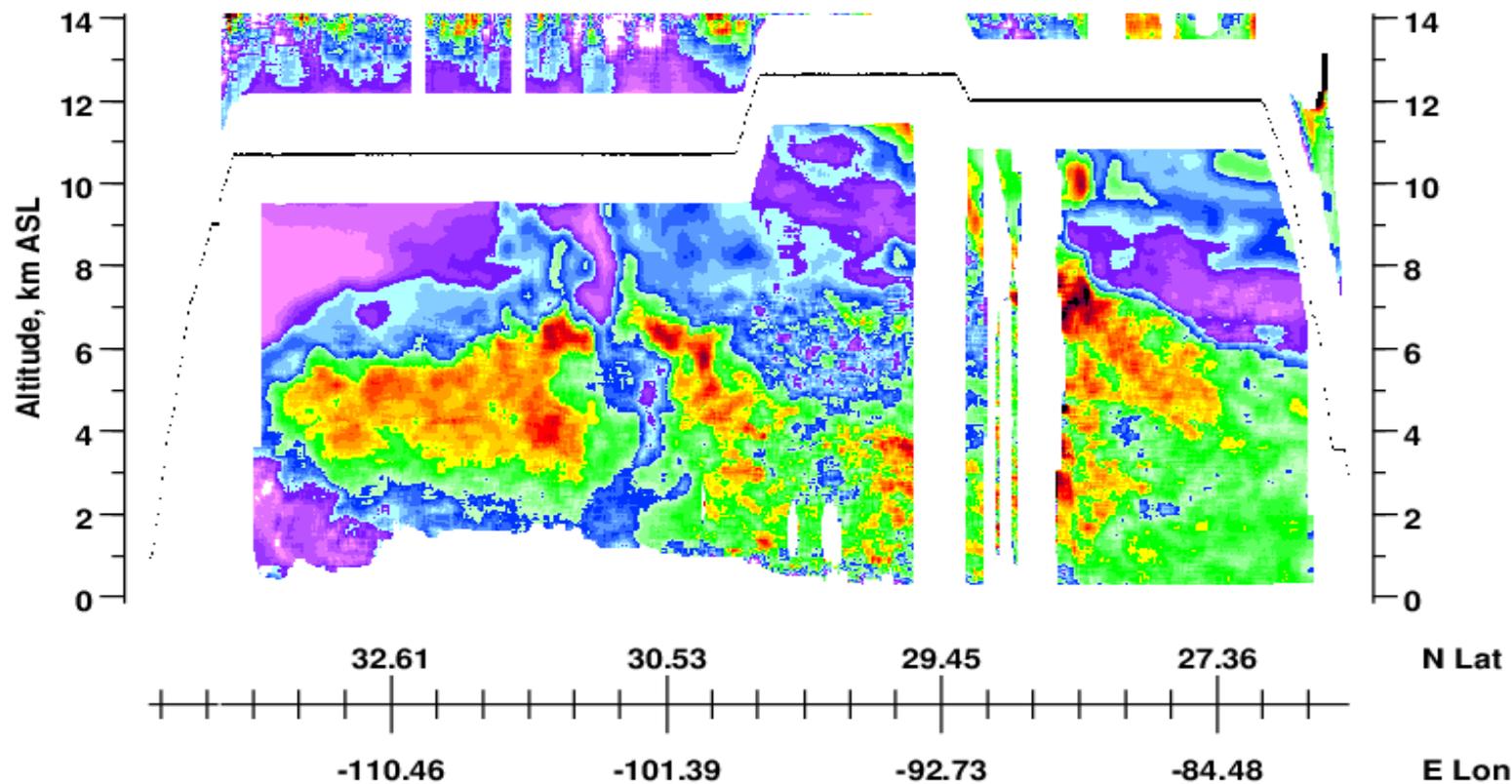
17:00

18:00

19:00

20:00

UT





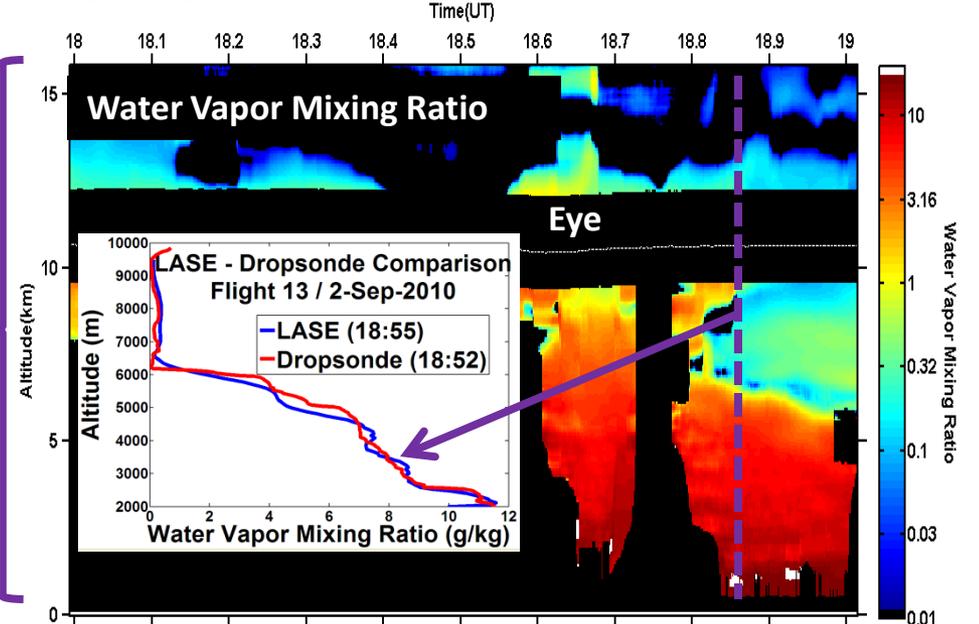
# NASA Langley LASE measurements over Hurricane Earl DC-8 GRIP Flight 13 - September 2, 2010



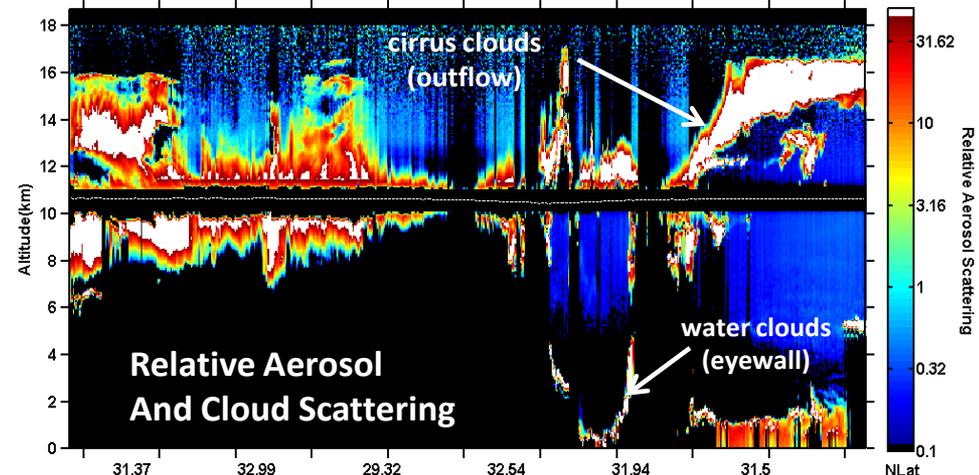
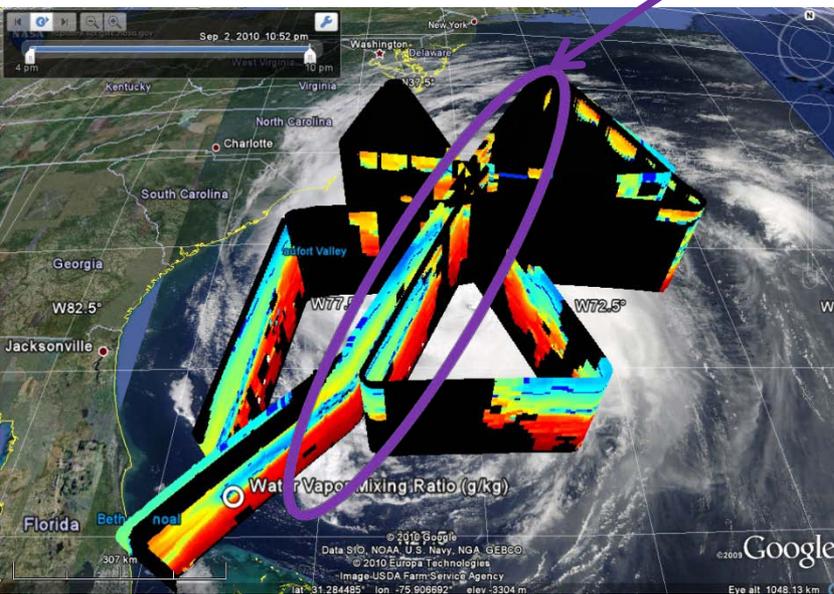
LASE measured water vapor, aerosol, and cloud distributions during flights over Hurricane Earl  
LASE and dropsonde measurements of water vapor just outside eyewall show good agreement



### Flight Segment across Earl between 18 – 19 UT



### Water Vapor Mixing Ratio



# Investigations of interest and use of LASE data from GRIP

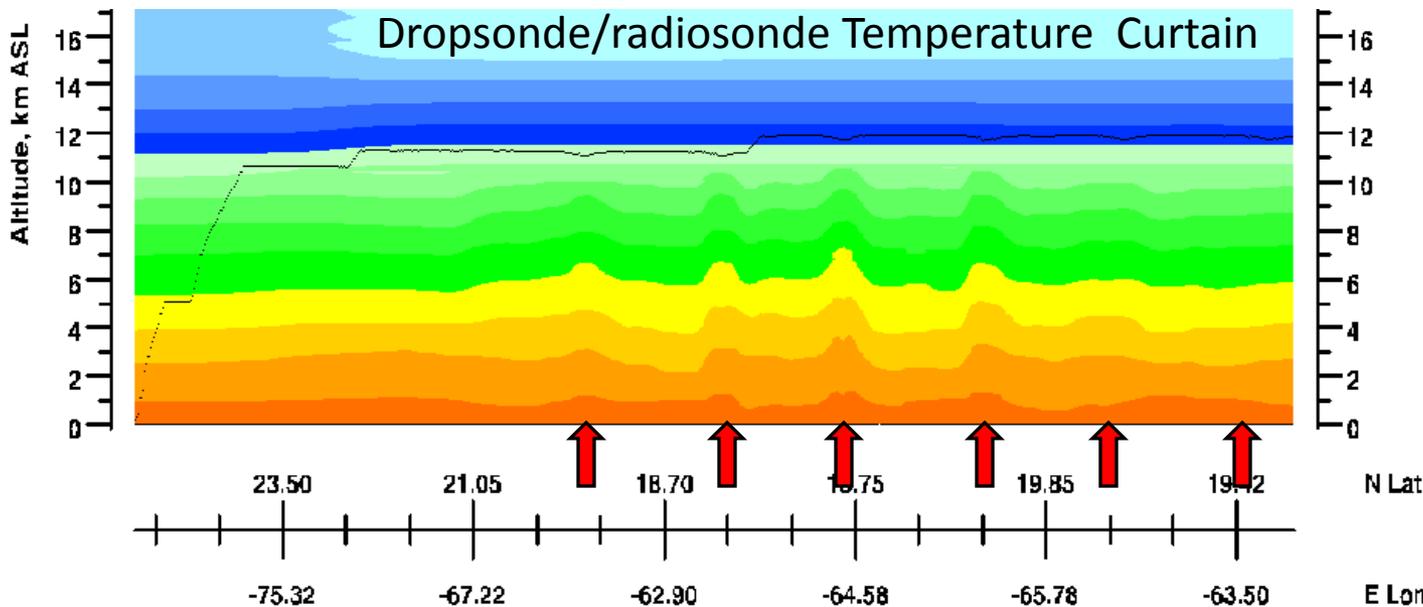
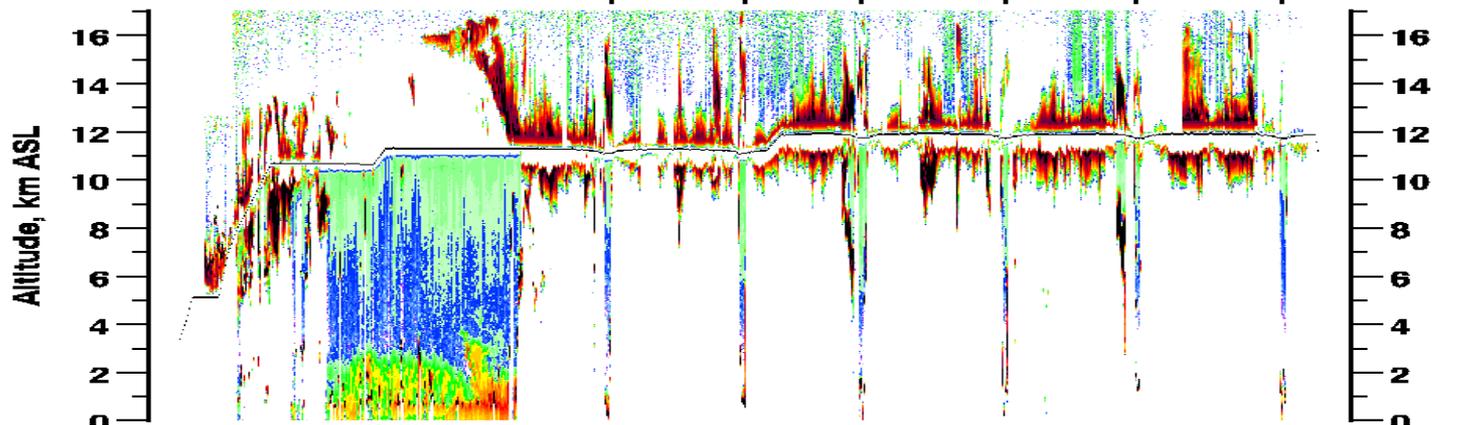
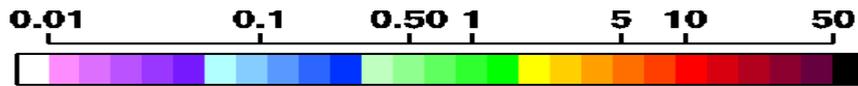
- Morphology and evolution of the eye of Hurricane Earl on Aug 30, 2011
- Data on large scale environment (moisture, and aerosol) to study intensification and storm development process:
  - Dry air intrusions, SAL, convection and outflow, transport, and cloud development
- Comparison with dropsonde measurements
- Comparison with AIRS, CALIPSO, MODIS, and in situ (aerosol) measurements

LASE/GRIP

### Hurricane Earl # 2 Flight 10

30 Aug 10

#### Relative Aerosol Scattering



# # 1 North → South

