

Pulsed Airborne Lidar Measurements of Atmospheric CO₂ Absorption & Line Shapes from 3-13 km altitudes

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Laser Sounder Approach for ASCENDS Mission

2 simultaneous laser measurements

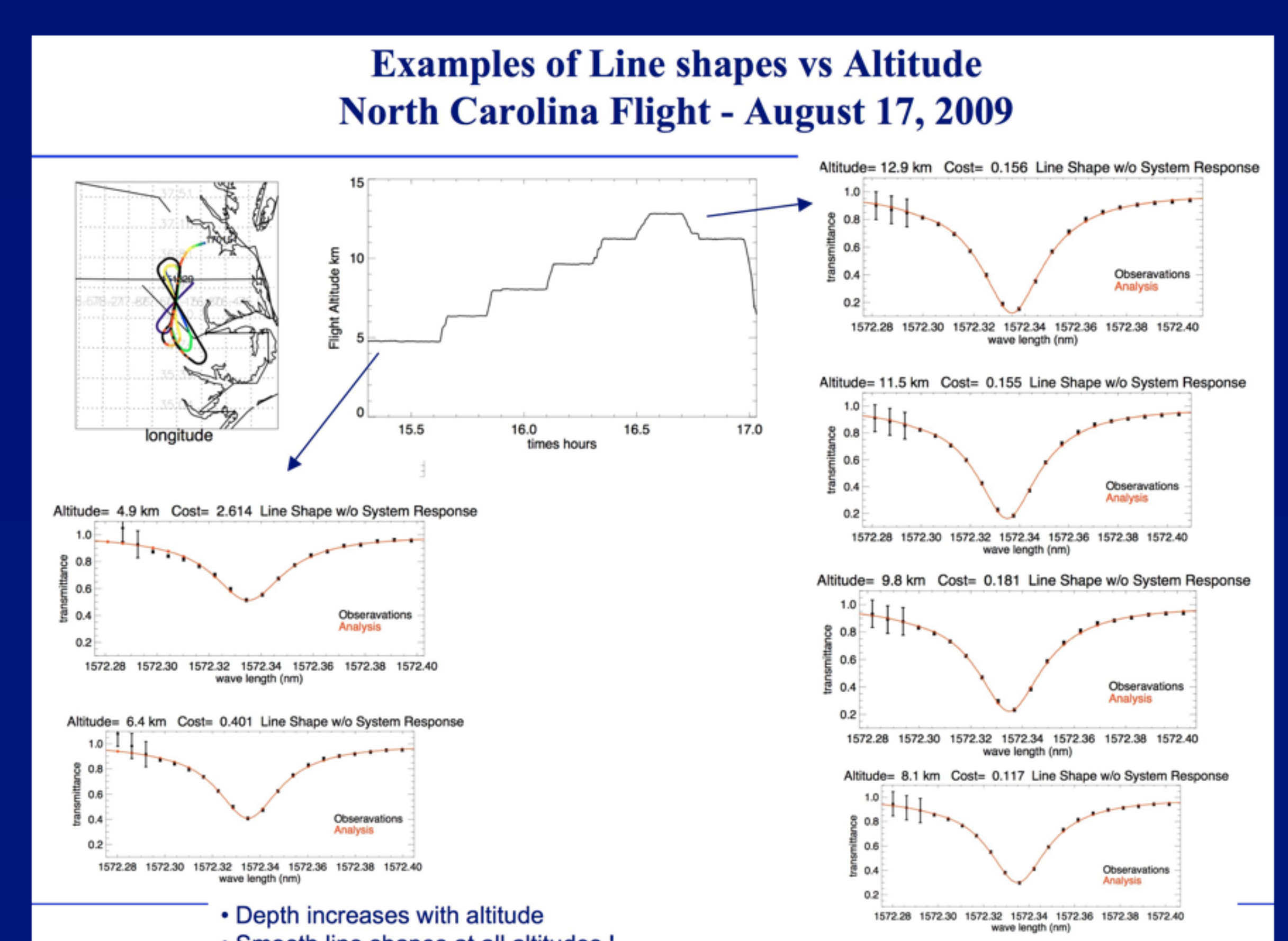
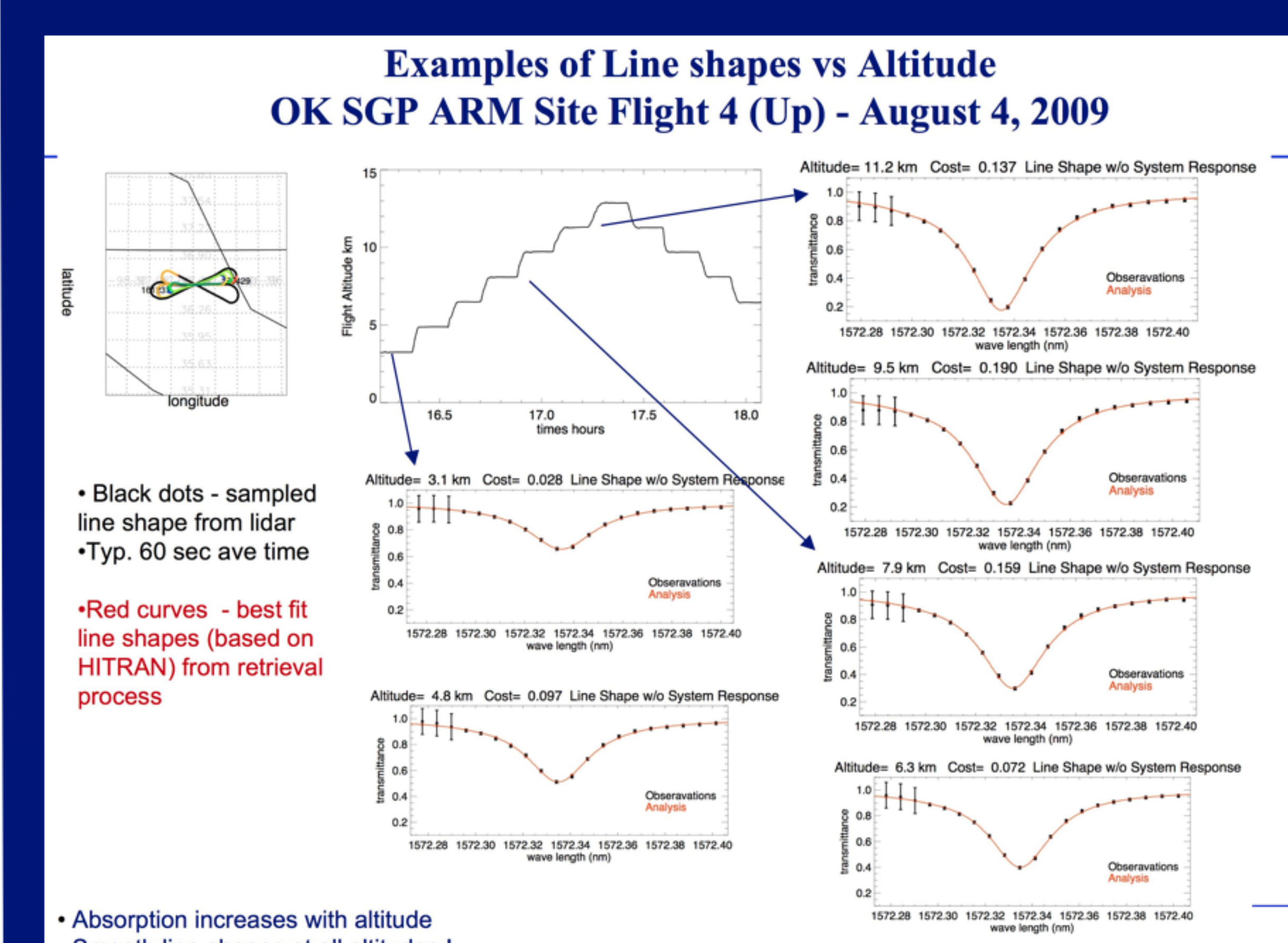
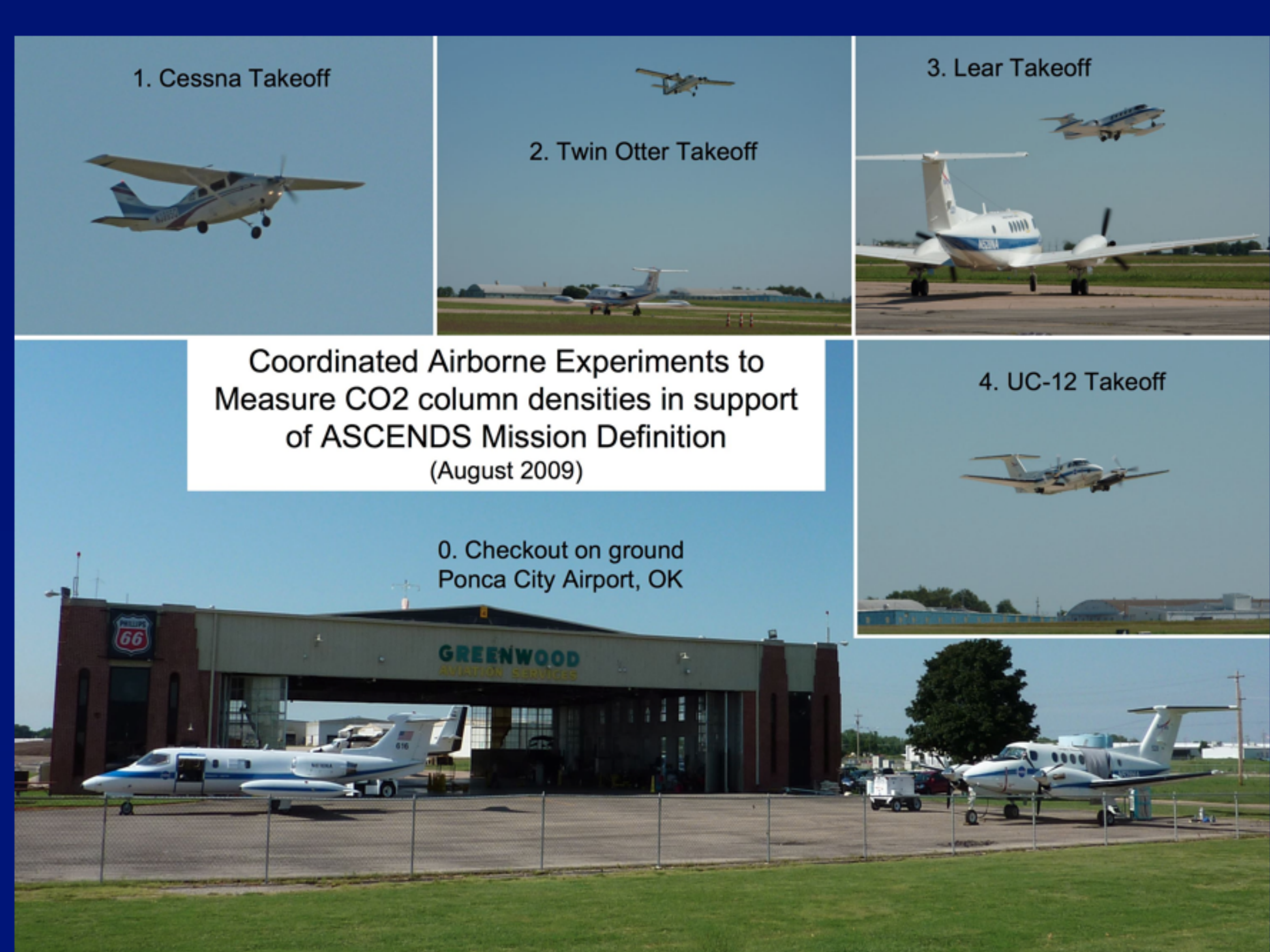
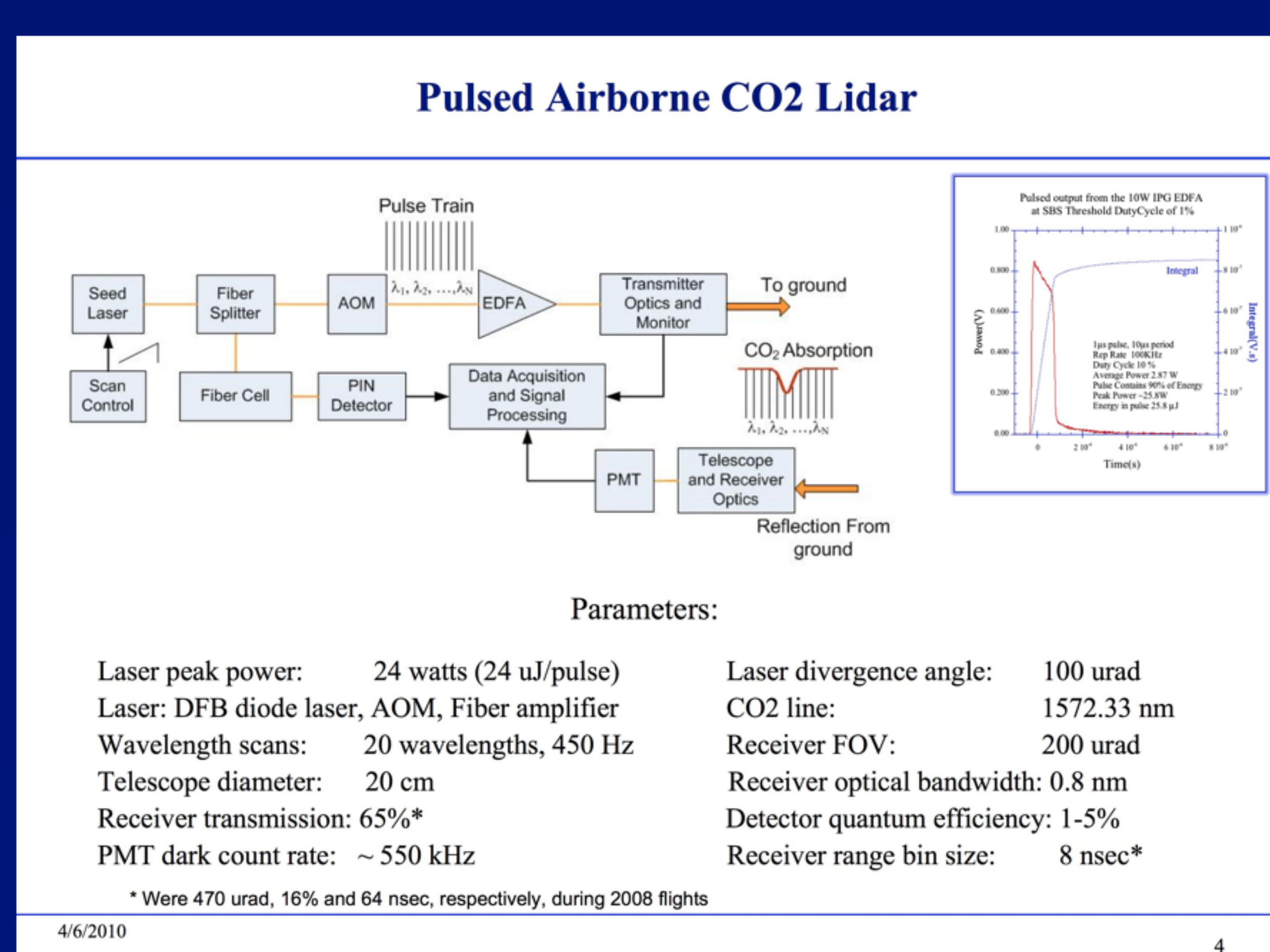
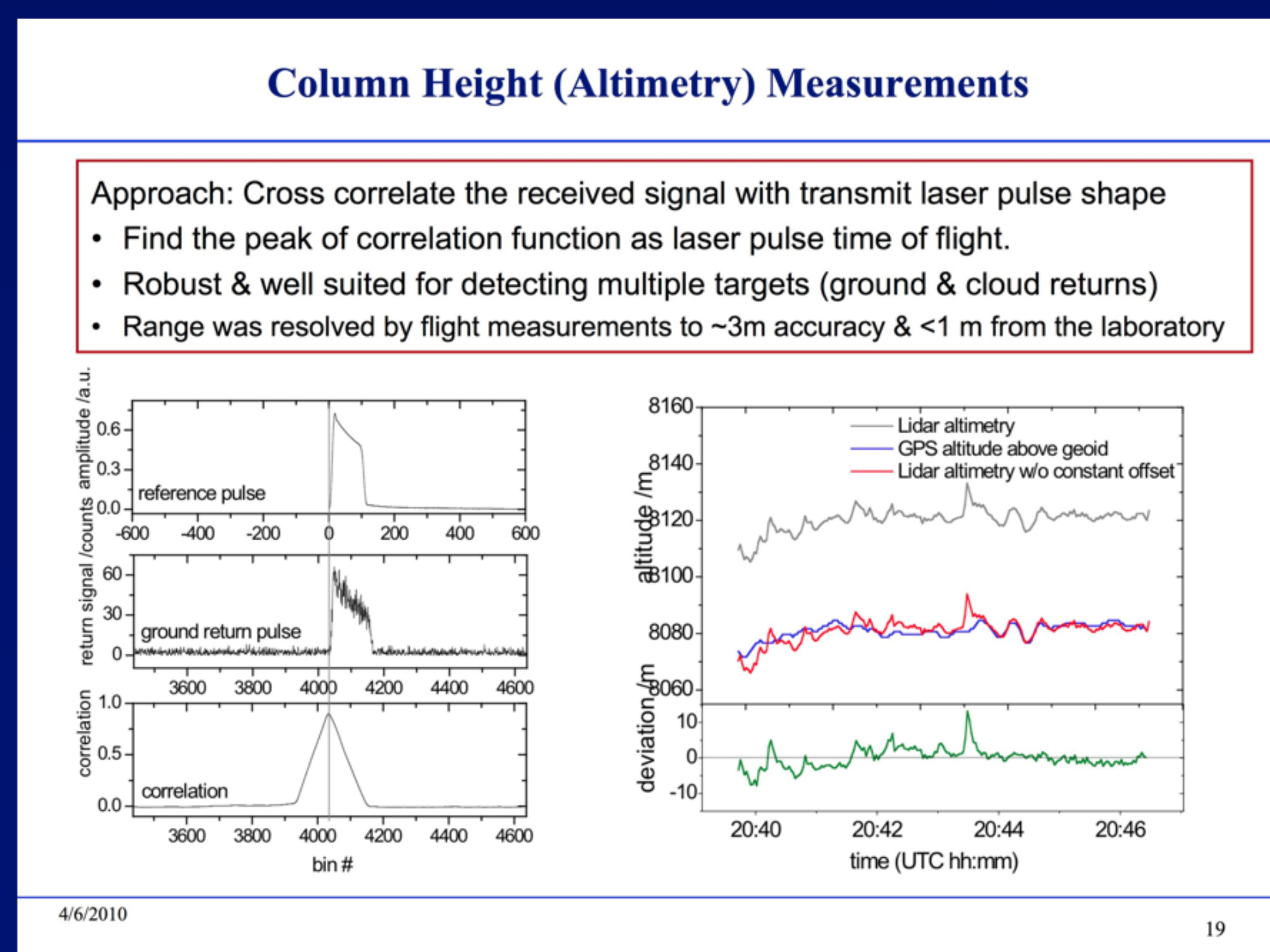
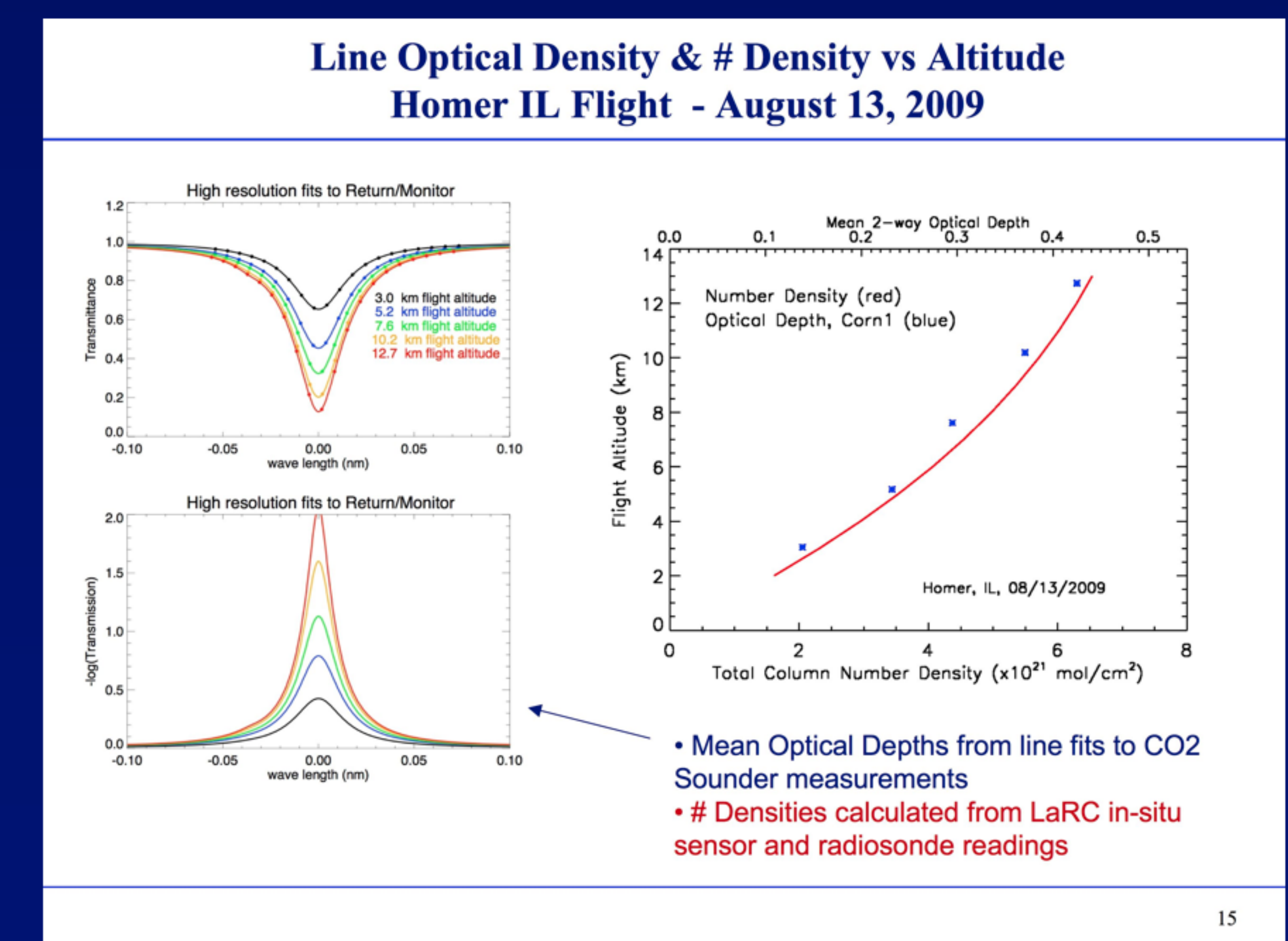
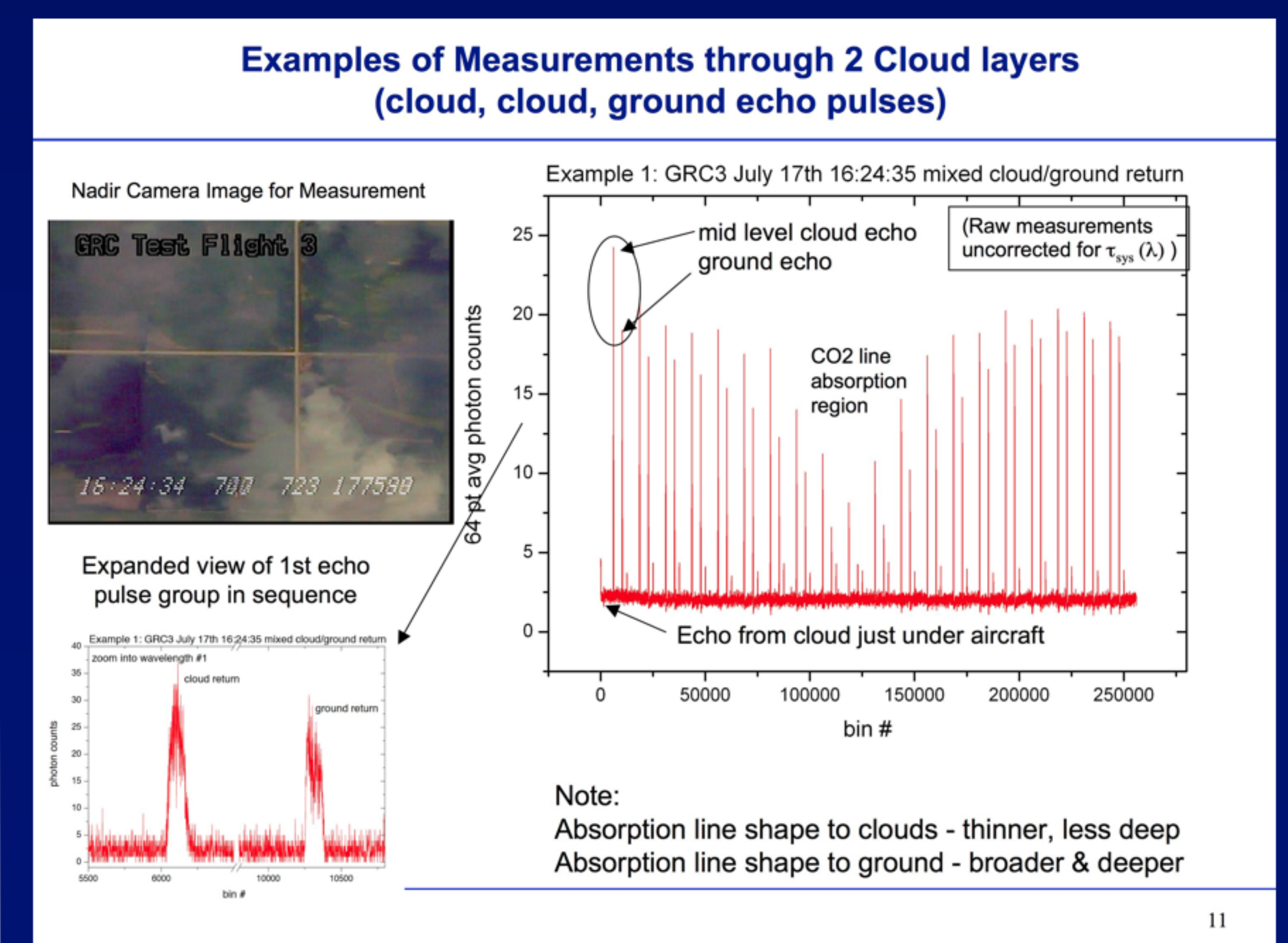
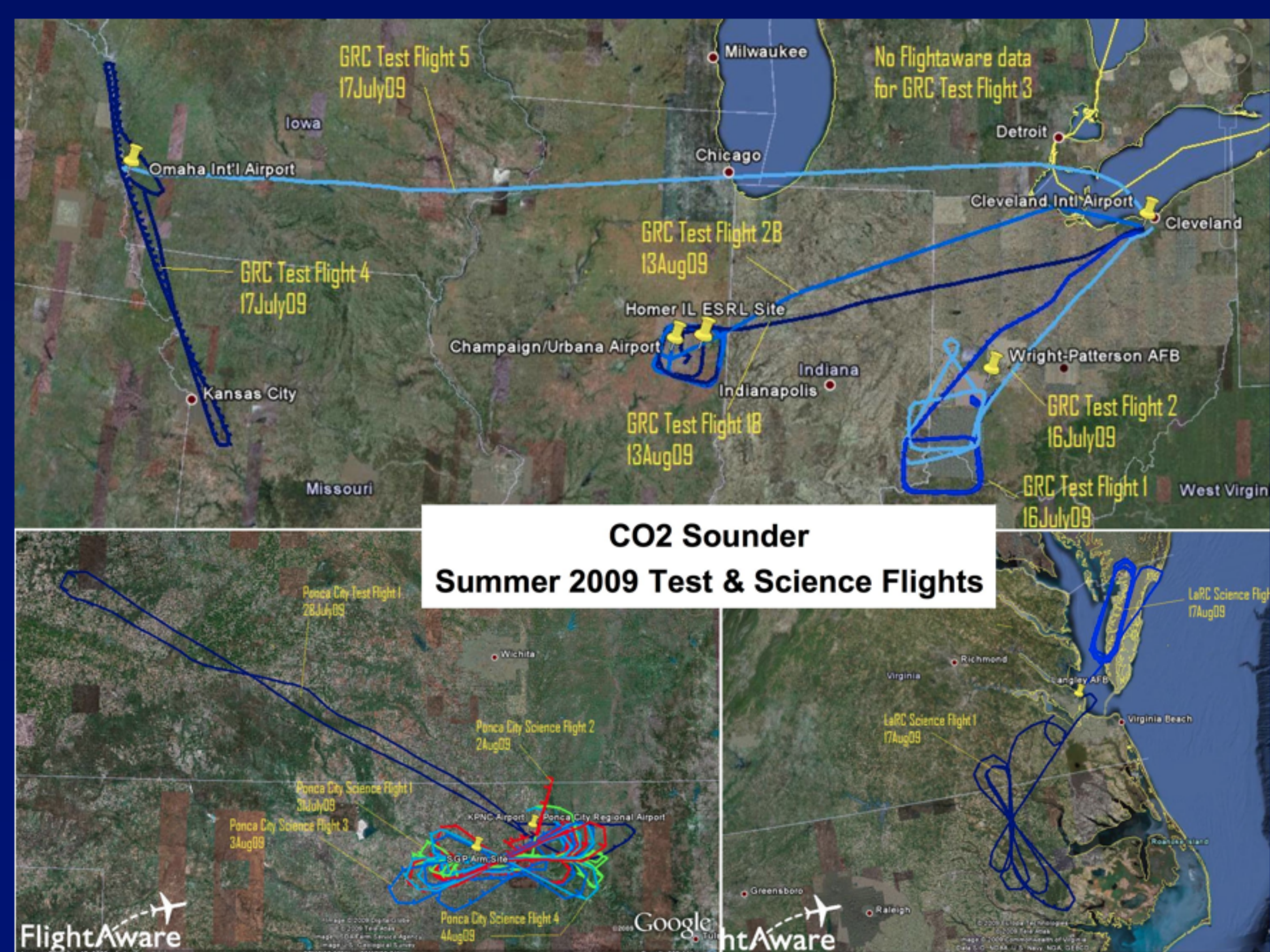
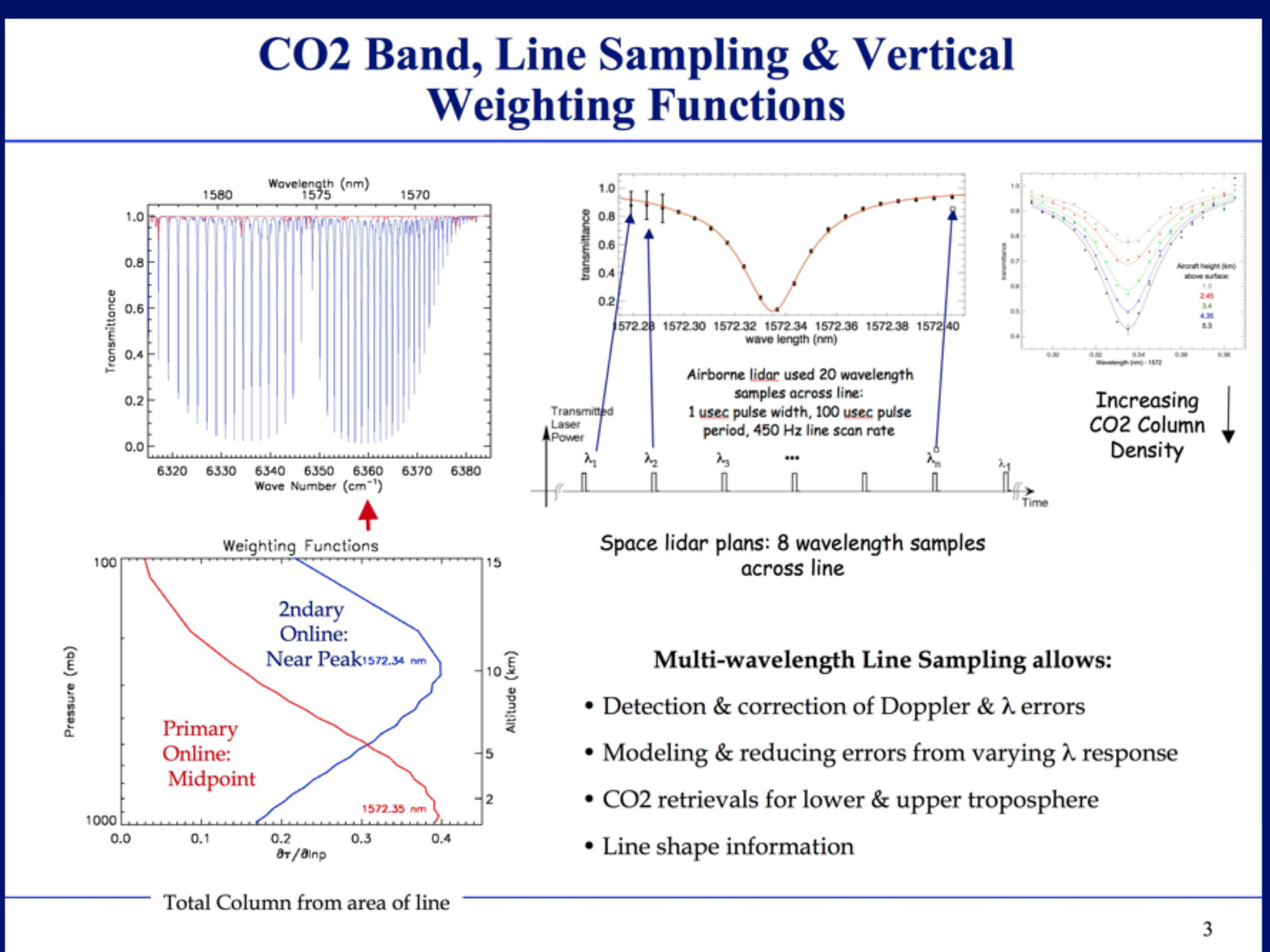
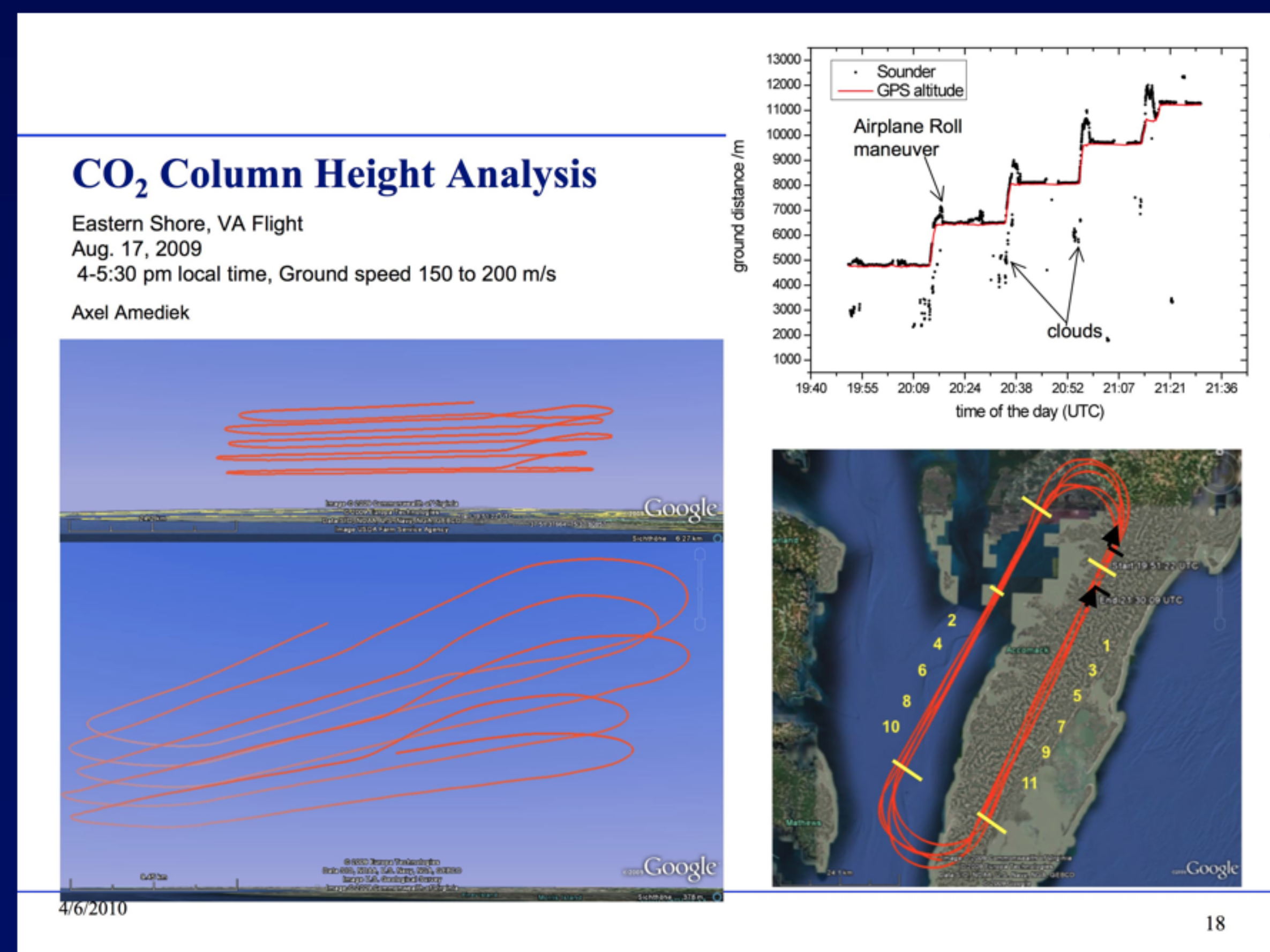
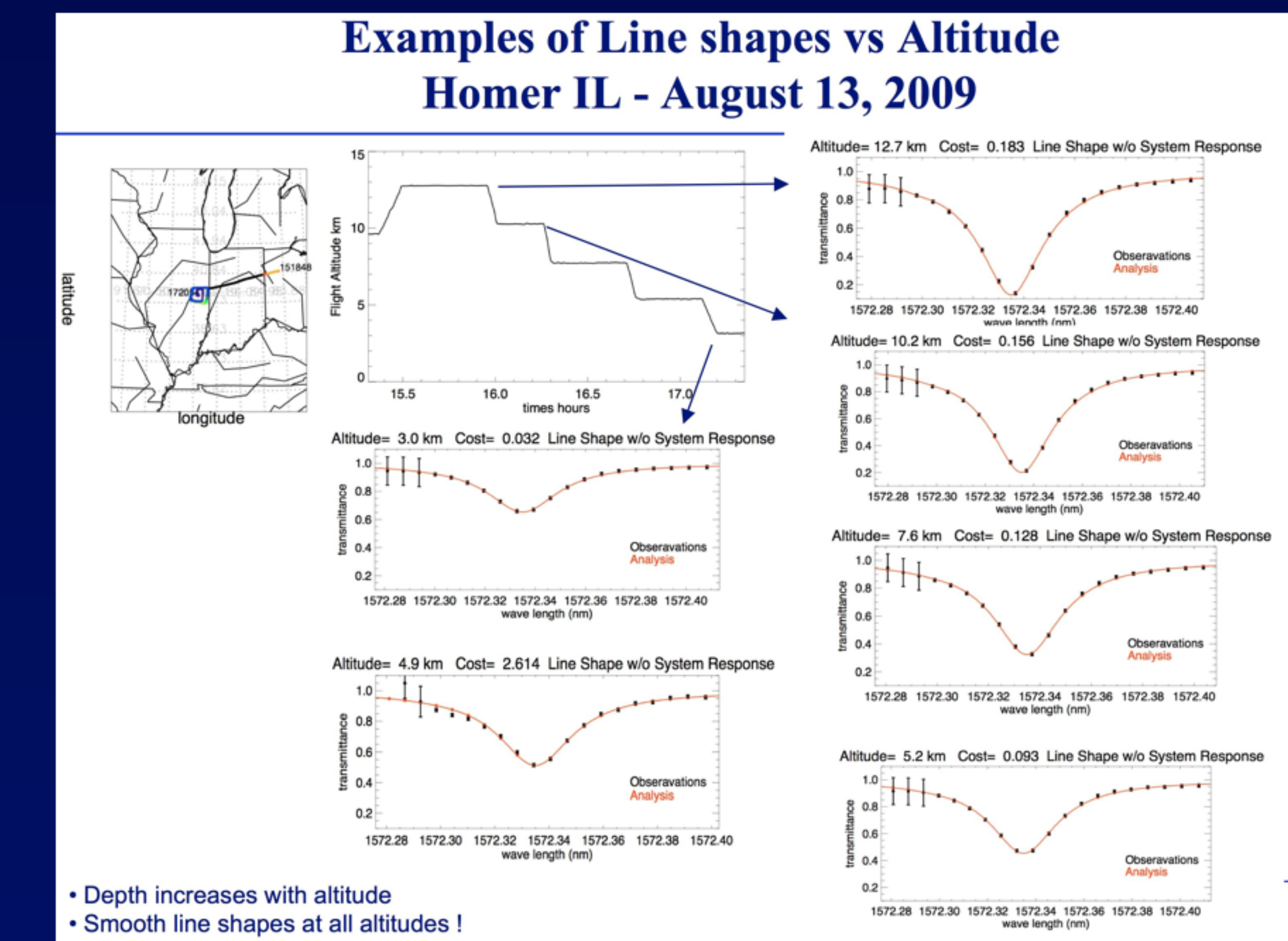
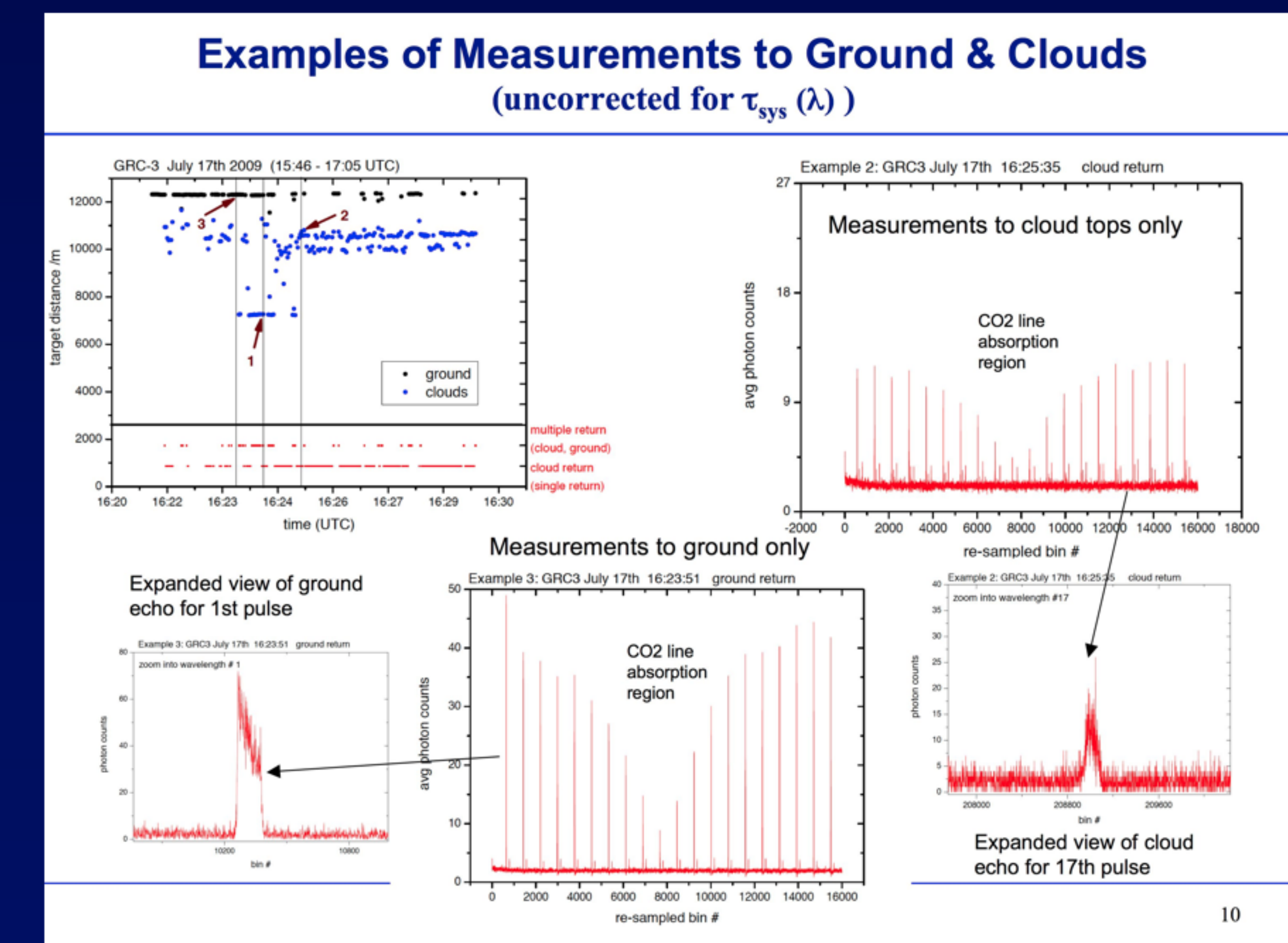
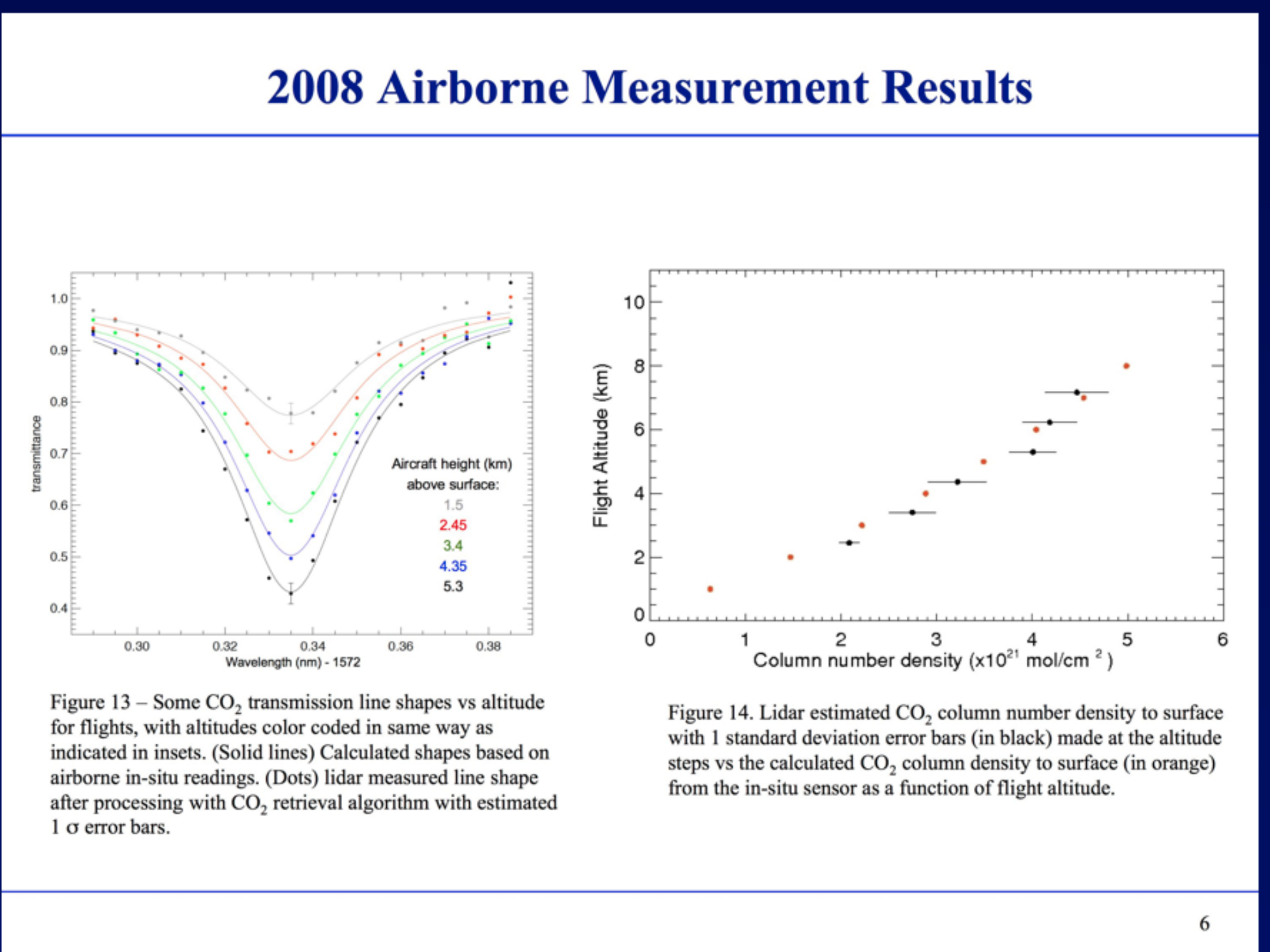
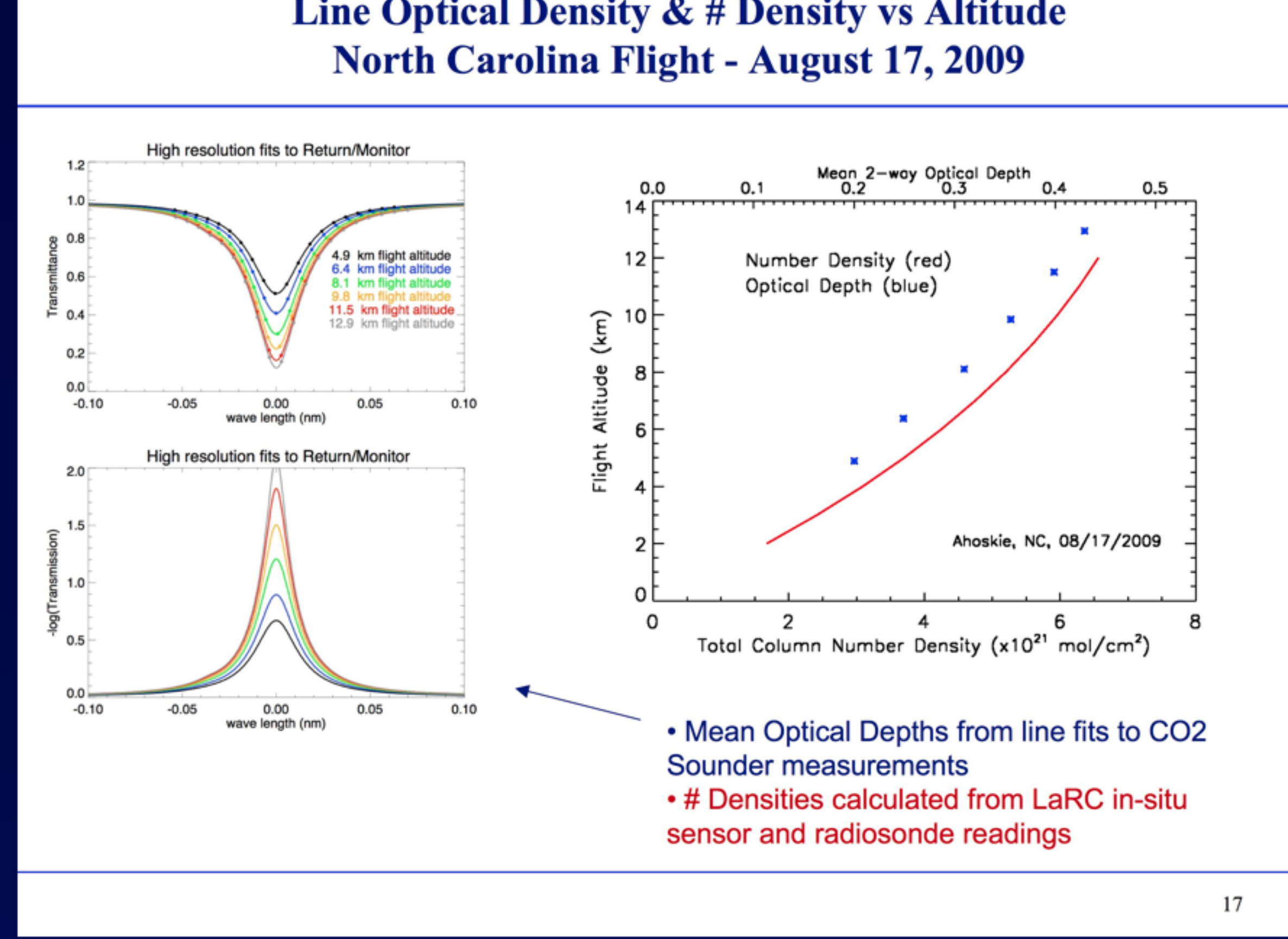
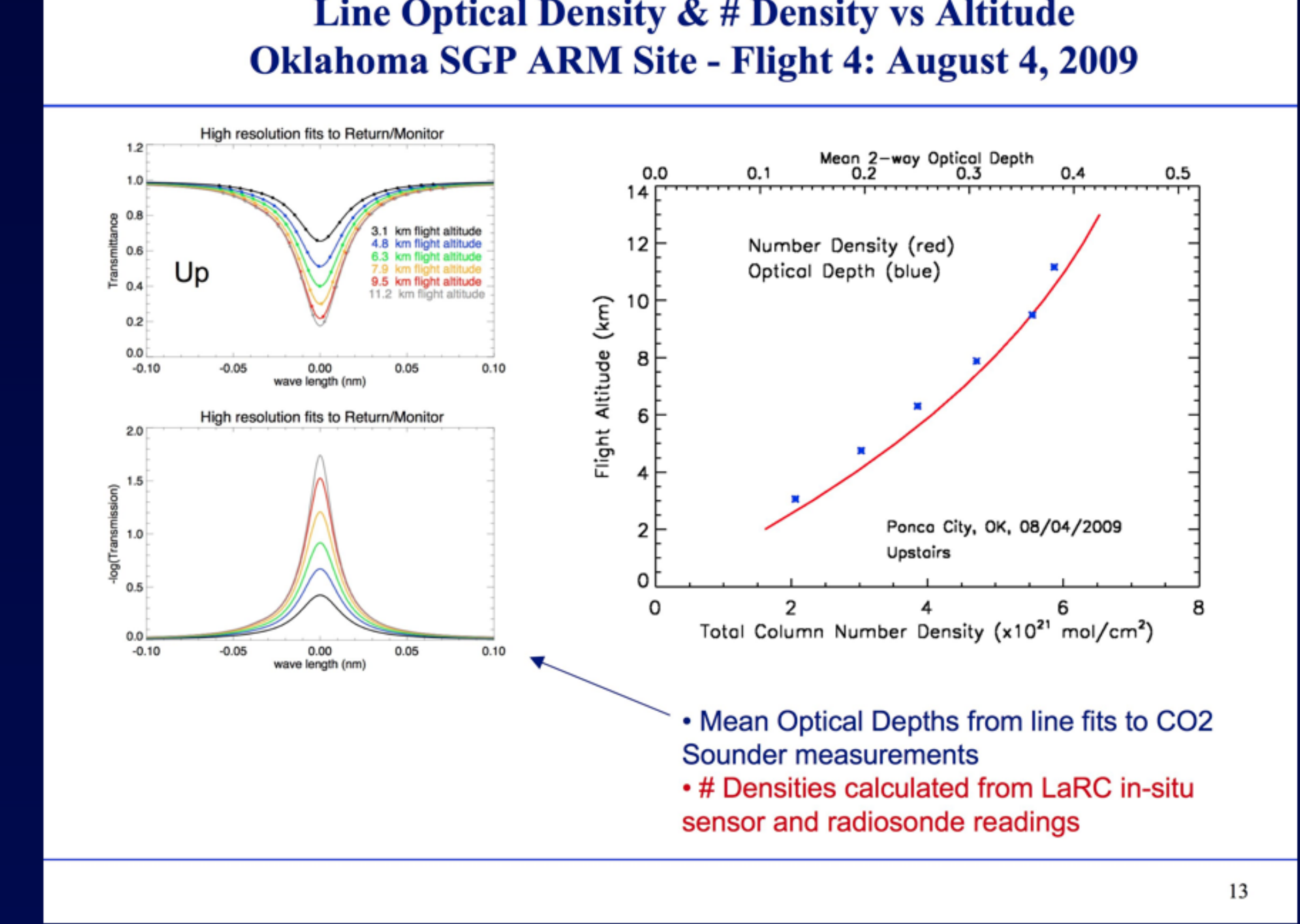
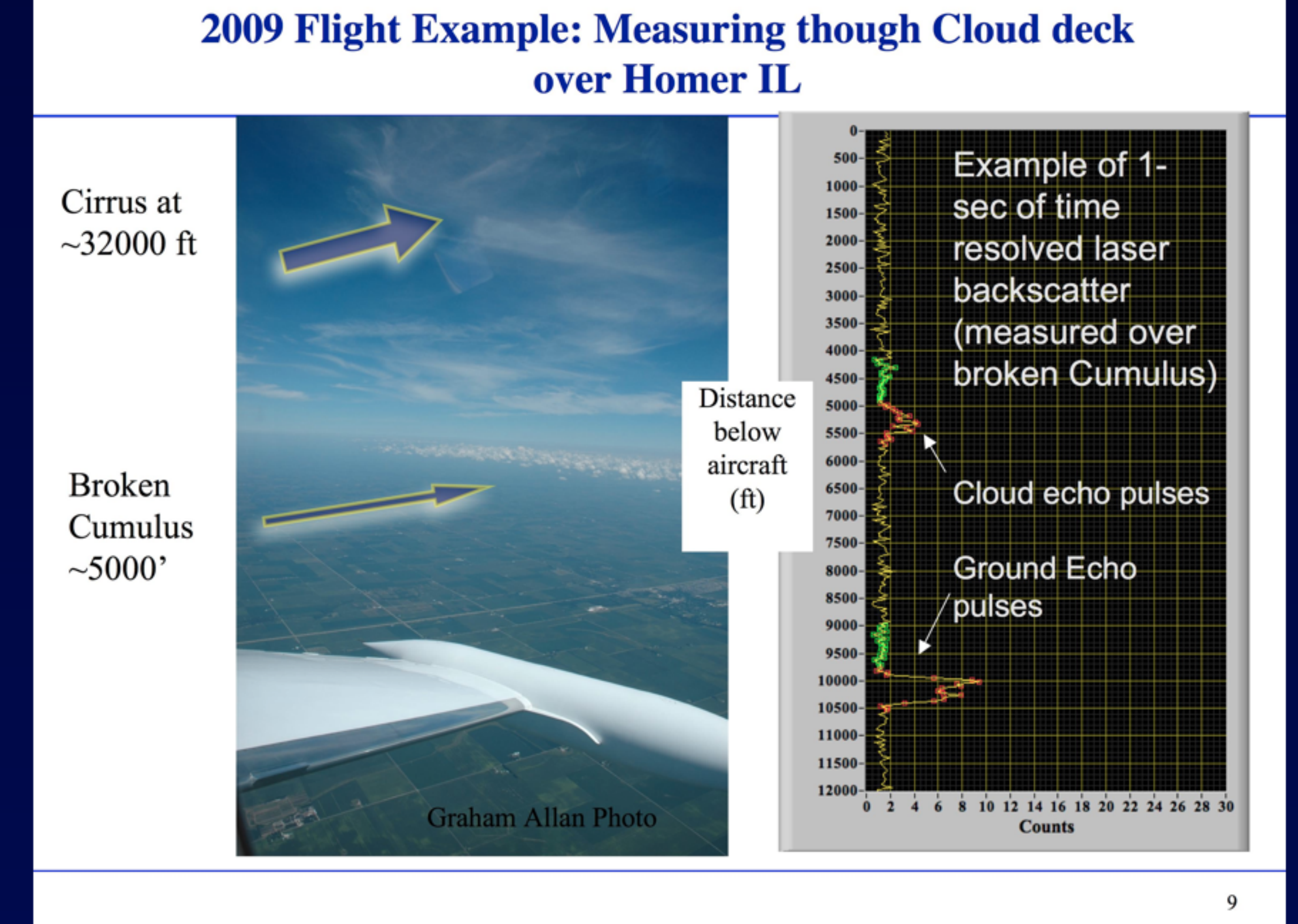
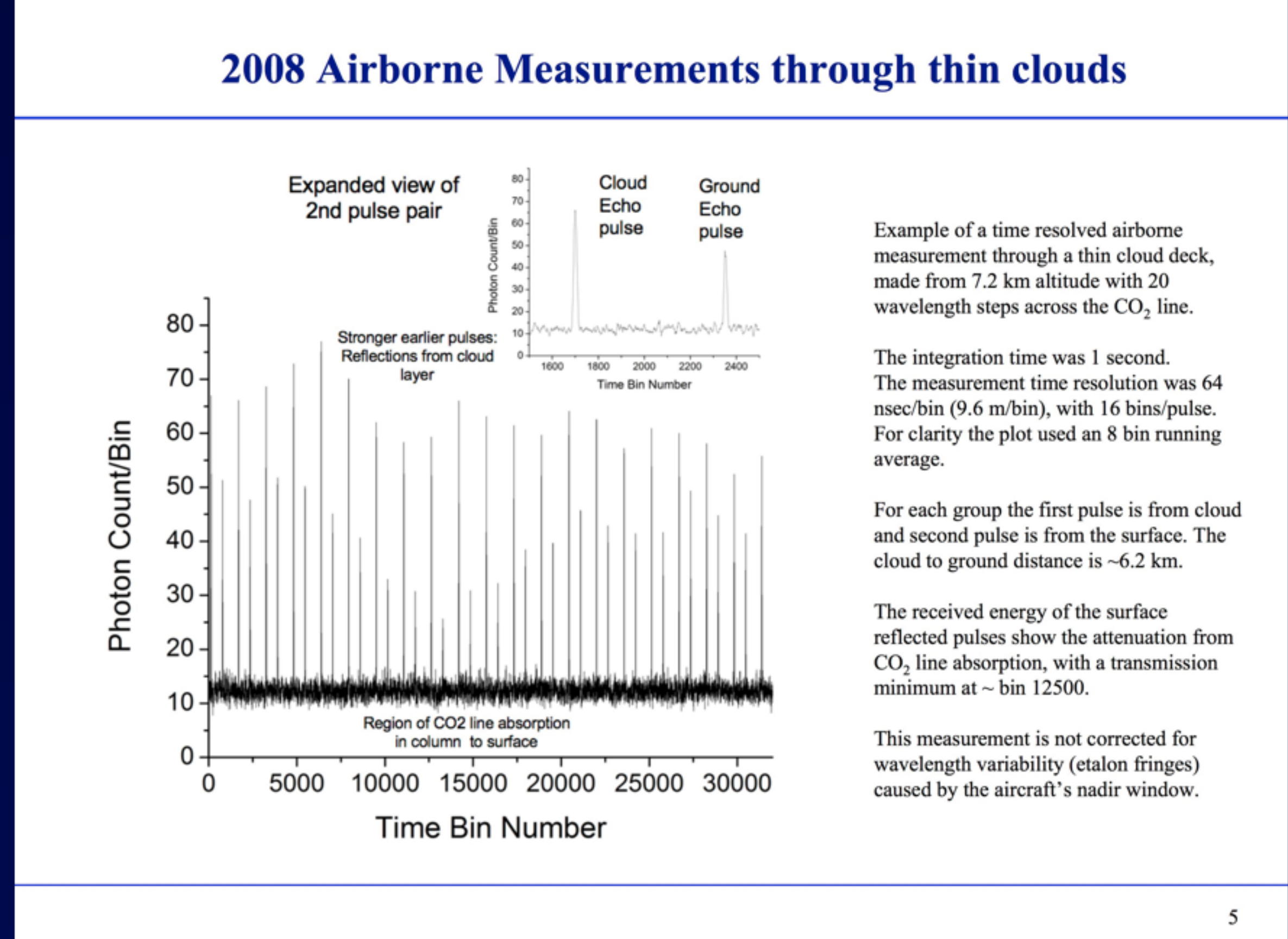
- CO₂ lower tropospheric column: One line near 1572 nm
- O₂ total column: Measure 2 lines near 765 nm
- Altimetry & atmospheric backscatter profile from CO₂ signal: Surface height and atmospheric scattering profile at 1572 nm

Measurements use:

- Pulsed EDFA lasers
- 8-10 KHz pulse rates
- ~8 laser wavelengths/ gas line
- Time gated Photon counting receiver

CO₂ & O₂ column measurements:

- Pulsed (time gated) signals
- Isolates full column signal from surface
- Reduces noise from detector & solar background
- Target: ~1 ppmV in ~100 km along track sample



Summary

- Demonstrated an airborne pulsed lidar for CO₂:
 - 20 samples across line, 450 Hz line scan rate
 - 25 μ /pulse, photon counting PMT receiver
- Fall 08:
 - 1st Airborne measurements of CO₂ line shape:
 - Good SNR & N_{CO2} agreement (A/C window limits)
 - Good line shape & conc. (2.5%) agreements
- Summer 09 - Improved lidar & window:
 - 9 science flights, 6 coordinated with LaRC, JPL
 - Line shapes measured to & though clouds
 - Very good OD agreement with N_{CO2} from in-situ
 - Altimetry heights to ~3 m
 - Calibration & assessments are underway
- We appreciate the NASA LaRC in-situ measurements