ER-2 breakout session

1. Meteorology constraints
   - Lots of clouds!

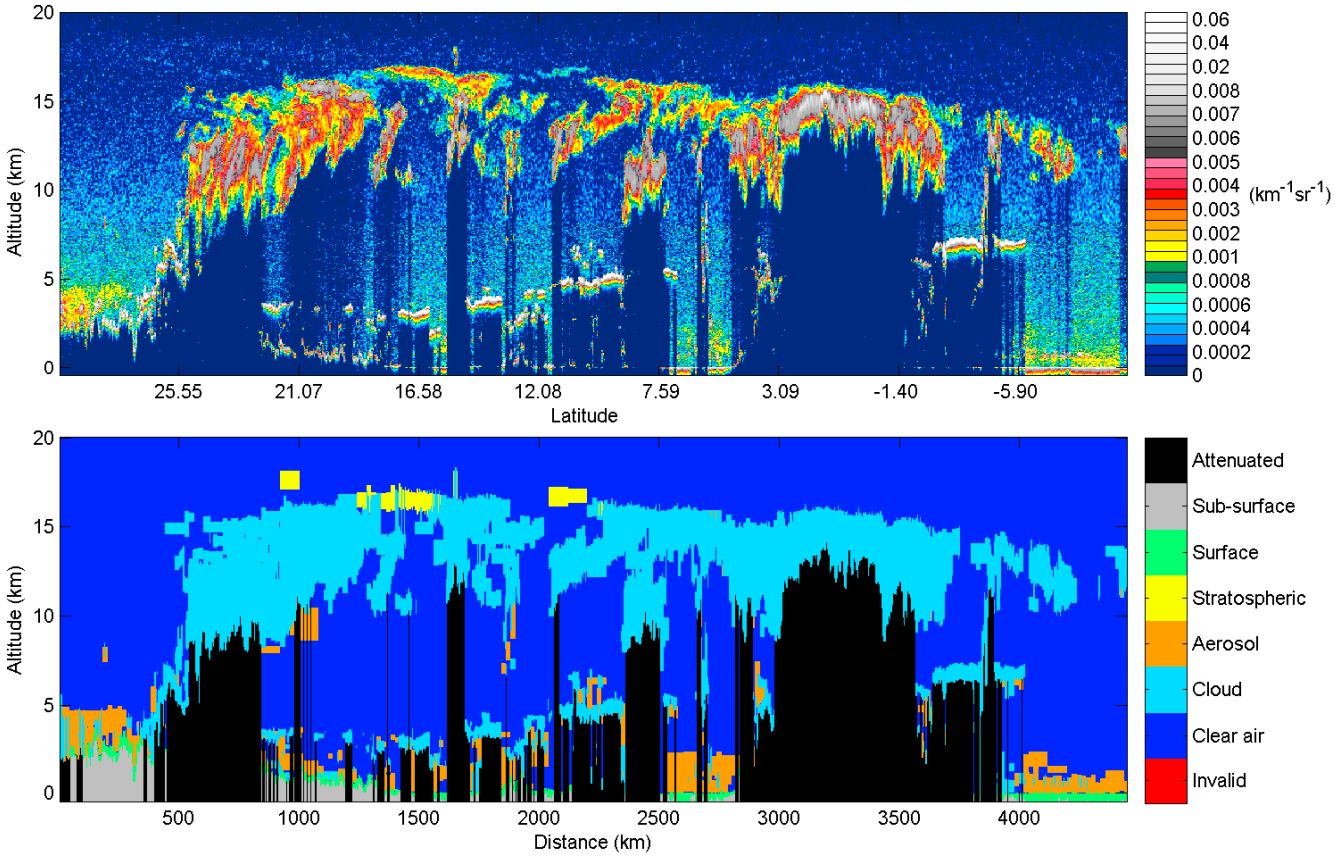
1. Discussion of draft flight modules

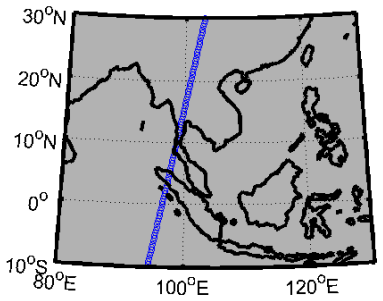
1. Needs/desires of PIs

1. Discussion of transit flights

ER-2 Payload

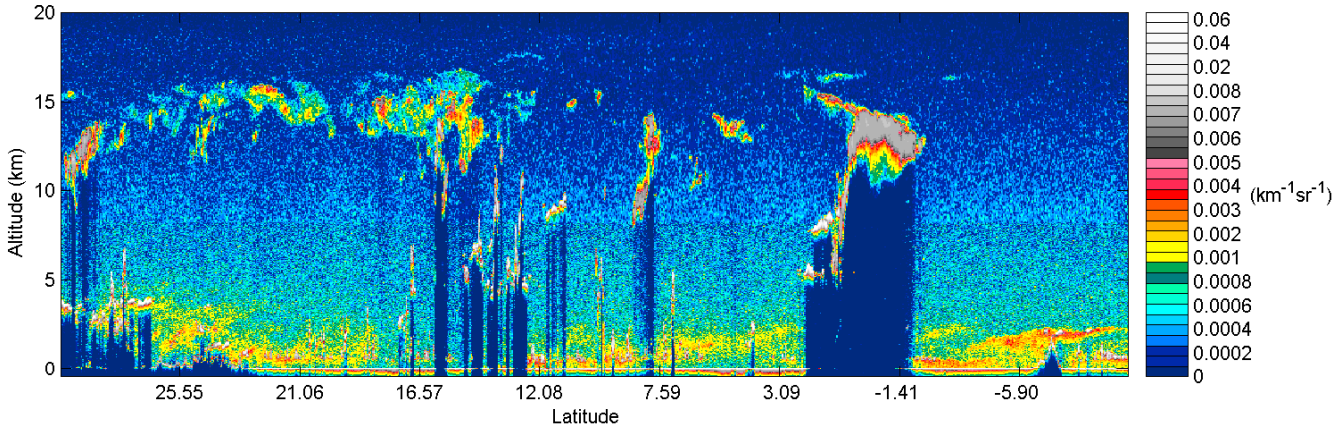
Investigator (Institution)	Acronym	Measurement	Type	Method, sensitivity, resolution
Christensen (JPL)	ALIAS	CO, CH4, N20	In Situ	TDL-spectroscopy, 0.1-0.3 ppb, 1 sec
Wofsy (Harvard)	HUPCRS	CO2, CH4, CO	In Situ	CRDS, (50, 0.2, 7 ppb), 3 sec
Herman (JPL)	JLH	Water vapor	In Situ	TDL-spectroscopy, <1 ppm, 20 Hz
Anderson (Harvard)	HHH	Water Vapor	In Situ	Fluorescence, TDL-spectroscopy, <1 ppm, 1 sec
Gao (NOAA)	UAS Ozone, Water Vapor	Ozone, Water vapor	In Situ	Absorption, ~1 ppb (ozone), 1 sec
Atlas (Miami)	WAS	Trace gases, VOC, OVOC, CFC, etc.	In Situ	Gas chromatography, few ppt, seconds to minutes
Mahoney (JPL)	MTP	Temperature profile	Remote	Passive Microwave radiometer, <1 K, ~20 sec
Bui (Ames)	MMS	P,T	In Situ	0.5 mb, 0.5 K, 20 Hz
Schmidt (Colorado)	SSFR	Spectral Irradiance	Remote	Nadir/Zenith Spectrometers, 350-2150 nm, 1 Hz
Bucholtz (NRL)	BBIR	Solar and IR irradiance	Remote	Nadir/Zenith broad-band radiometers
McGill (GSFC)	CPL	Aerosol/cloud backscatter, depolarization profiles	Remote	Multiwavelength (355, 532, 1064 nm) lidar, 1 sec, 30 m vertical
Platnick (GSFC)	eMAS	Multiwavelength reflectance imagery, cloud retrievals	Remote	Multiwavelength spectrometer
Diner (JPL)	AirMSPI	Polarization and radiance imagery	Remote	Multiwavelength, multiangle polarimeter, 10 m resolution, 11 km swath width
Cairns (GISS)	RSP	Multiwavelength polarized radiances, aerosol and cloud properties	Remote	Multiwavelength, multiangle polarimeter

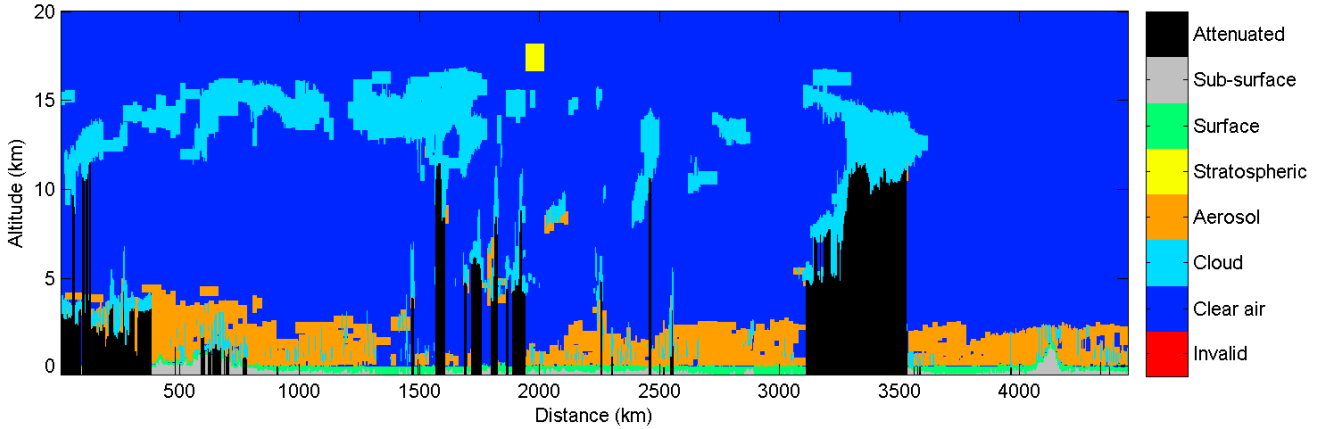


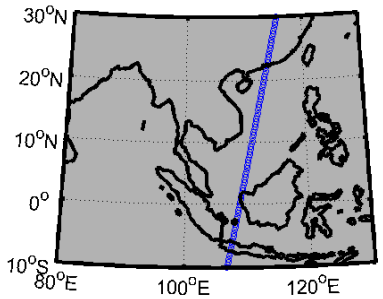


CALIPSO Total Attenuated Backscatter and Vertical Feature Mask

Date: 2011-08-13
Time: 19-00-08 Z, Nightside







CALIPSO Total Attenuated Backscatter and Vertical Feature Mask

Date: 2011-09-06
Time: 18-08-29 Z, Nightside

Types of ER-2 flight modules

1. **TTL profiling** (above ~43 Kft) inside and outside the anticyclone, downwind of extreme convective events, through anomalously cold tropopause regions with thin cirrus, through stratospheric intrusions, etc.

2. **Level flight** segments coordinated with the lower aircraft to provide remote-sensing support for addressing various science objectives.

3. **Level flight** segments over specific scenes (e.g., clear-sky) or coordinated with satellite overpasses, ground measurements, and/or lower aircraft for evaluation of remote-sensing retrievals.

4. **Max altitude (new)** – descent on return to Utapao for in situ measurements and comparisons with balloonsonde CFH, MLS and tracer correlations

- Comments/suggestions?

Discussion

- We will need to make modifications to plans in real-time based on aircraft observations
- Dips and descents will likely be done based on real-time observations
- ER-2 operations below cirrus of not much interest to polarimeters
- CPL operations below cirrus of possible use for CALIPSO – need to find out more
- Polarimeter retrievals through cirrus OD < 0.2-0.3
- Polarimeters interested in cirrus and clouds in general as well as aerosols

Discussion

- Definite need to communicate often among aircraft and ground and communicate flight changes to ER-2 pilot and work out components during flight
  - Clear sky locations, dips and descents, AirMSPI step and stare, how far to stray from balloonsonde site
  - Will need to work out how much and how often to provide guidance to ER-2 pilot
- Many objectives will require coordination among three aircraft
- Multiple modules conducted during flight
- Modules can address multiple objectives
- Patience!

Transit flights

- Three hops each way (e.g., DFRC–>Hawaii, Hawaii–>Guam, Guam–>Utapao)
- Lack of PI support for 2^{cnd} and 3rd flights
- Which instruments will be able to collect data?
- CPL, MTP, (maybe ozone, water vapor, MMS temp?)

Real-time Data Download

Instrument	Data type	Data downlink before?	Why needed?	Does Pi plan to downlink?
CPL	Lidar, clouds and aerosols	Yes, TC4	To detect clouds	Yes
MTP	Temperature profile	Yes, ATTREX	To locate tropopause	Yes
Ozone	ozone	Yes, ATTREX	Locate gradients	Yes
JLH	Water vapor	Yes, ATTREX	Locate gradients	Yes
MMS?	Temperature?			

Carl Sorenson - That's right, I will be integrating the new NASDAT to the ER-2 for SEAC4RS and doing the configuration; also coordinating the ground segment data handling. I'll likely be in the field for the first 3 weeks or so to make sure everything works out. There's a lot of other work going on this year, **so sooner is better than later if PIs want to provide status data to the ground or otherwise use Iridium satcom**. I plan to provide GH-like services on the ER-2 (and eventually on all the platforms).

Flight Parameters and Patterns

- Passive remote sensors (RSP, airMSPI, SSFR, eMAS) need daylight
- Remote sensors (SSFR, BBIR, airMSPI, RSP) generally desire straight and level with pitch, roll within 5 deg
- airMSPI desires minimal pitch variations, ground speed ~ 207 m/s
- airMSPI, RSP (strongly) prefer orientation along principal plane
- airMSPI requires acquisition of discernible land targets for each flight (Utapao airfield would be fine)
- airMSPI wants to avoid complex topography, desires Case 1 waters
- airMSPI wants nose heat
- eMAS – for cloud retrievals avoid sun glint, desire water and dark vegetation
- In situ sensors, and to a lesser degree (BBIR) would like some dips to sample gradients and/or clouds – ascent/descent rates < 2000 ft/min (HU/PCRS)
- Harvard water vapor wants:
  - Multiple vertical samples at different locations
  - Level legs through tropopause, lowest water vapor, lowest temperature
- Harvard water vapor has interest in night flight
- Avoid precipitation during ascent/descent (close RSP door in clouds)
- HU/PCRS desires both north-south and east-west transects of TTL
- NOAA ozone, water vapor desires latitudinal transects (especially to far north)
- So far, all instruments can handle flights up to 8 hours
- On ground RSP needs connection to dry N2
- HU/PCRS wants Q-bay temp < 35 deg C

General Cloud and Aerosol Conditions Desired

- WAS, NOAA Ozone, water vapor desire some in-cloud sampling
- eMAS
  - clear sky, ocean (warm) and anvil (cold) scenes (for IR calibration)
  - avoid multilayer and severely heterogeneous clouds (for cloud retrievals)
  - Moderately thick (for microphysical retrievals)
  - Relatively homogeneous cirrus without low clouds (ice cloud retrieval)
  - Relatively overcast PBL (for water cloud retrievals)
- SSFR
  - Sandwich cloud run with multiple aircraft and/or ER-2 above/below TTL cirrus
- (airMSPI, RSP, SSFR, eMAS) – for aerosol retrieval testing, desire cloud-free skies
- Thin cirrus of interest for many sensors
- Wide variety of aerosol loading conditions and types desired
- NOAA ozone wants to avoid very high aerosol to prevent contamination of instrument

Coincident Data Desired

- DC-8
  - Trace gas, water vapor measurements
  - Radiometers, AATS14, DIAL/HSRL for characterizing radiation, irradiance, surface reflectance, aerosol/cloud amounts
  - In situ aerosol/cloud measurements to provide correlative data for aerosol/cloud retrievals
- GV
  - TOGA, trace gas, water vapor
  - Solar and IR radiometers
  - Aerosol/cloud in situ measurements for correlative data
- Satellites
  - MODIS, MISR, CALIPSO, PARASOL, VIIRS, AURA, AIRS, CrIS, IASI, CLOUDSAT, MLS, MTSAT-2
- Surface
  - AERONET, MPL
  - Ozonesondes, frostpoint sondes for intercomparisons
  - Surface radiation (Singapore, Vietnam)
  - Yokelson mobile FTIR for fire conditions