

WB-57 Breakout discussion

Instrument updates:

- Weinheimer wants to only measure NO/NO_y rather than switching to particulate NO_y.

- Maycomm laser hygrometer will be added by PANTHER group and downlinked via REVEAL.

- comparisons with DC-8 measurements of aerosols and trace gases at maximum possible altitude are highly desirable.

- spirals through clouds within 30 min of Terra/MODIS overpass requested.

- Harvard water will have second detection axis to compare with old/new configuration.

- CloudSat wants to sample in clouds with high ice water content (few hundred mg/m³).

Candidate mission profiles, clouds and aerosols:

- **Cloud outflow missions –**

Goals: understand microphysical processes and transports and entrainment of air in tropical marine Cbs.

- **Cirrus characterization --**

Goals: Sample a diverse array of cirrus clouds, determine which arise from remnant blow-off, versus in situ formation; life cycle, radiative and chemical properties.

Characterize of ice crystal size distributions in maritime anvil cirrus. Flight patterns would include spirals and stairsteps back up, coordination with both **ER-2 and DC-8**.

- **Remote sensing validation --**

The WB-57 is not well suited for direct validation of most satellite sensors. The WB57 is to fly coordinated missions with the DC-8 and ER-2 and validate the remote sensing observations from these platforms, which will then be used in direct satellite validation flights. Note OMI needs clear pixel vertical profiles, joint DC-8 an WB-57.

The missions above have not been discussed by the team. A WB-57 telecon to discuss them will take place Wednesday.

Candidate mission profiles, composition:

TTL missions --

Goals: Sample air of diverse ages, origins; quantitatively characterize the TTL; understand better the origin, characteristics, and fate of condensed phase water that we see.

WB57 and ER-2 fly together to points distant from CR, one mission each towards E, W, and to Galapagos [*Starr*]. The WB-57 does porpoising and/or stairs with gentle ramps. We choose a cold phase of the mixed Rossby/Kelvin wave in order to combine combination of TTL cirrus sampling and tracer measurements, and to use the opportunity to validate ER-2 cirrus and cloud products [*Jensen*]. *Includes a stratospheric profile; utilizes [Pfister] forecasts of convective influence to maximize air mass types.*

Chemical source inflow/outflow missions-

Goals: Determine the trace gas chemical composition of the TTL and of the air entering the stratosphere, and delineate the controls on composition via convective inputs.

WB-57 and DC-8 must sample together from the PBL to the lower stratosphere. Can be combined with cloud-related objectives [*Wennberg*].

o TTL cirrus characterization missions (Jensen)

Goals: Measure the microphysical properties, relative humidities, and tracers (to understand origins) in thin TTL cirrus.

Coordination with ER-2 and/or DC-8 is desirable for providing lidar measurements of cloud structure.

WB-57 flight patterns: Hopefully, the lidar measurements from the other aircraft will give us an initial estimate of the cloud boundary heights. Slowly porpoise through the entire vertical extent of the cloud layers using CAPS display as a guide.

These missions should be conducted during the cold phase of the mixed mixed Rossby-gravity waves to maximize probability of TTL cirrus occurrence. Presumably, TTL cirrus sampling would be combined with TTL tracer and chemistry measurements to cover multiple objectives.

o Anvil evolution missions (Jensen)

Goals: Understand processes leading to anvil dissipation or evolution into self-maintaining cirrus.

Requires coordinated flights with ER-2 and DC-8. ER-2 remote-sensing measurements (particularly CPL and CRS) will provide information about the cloud structure evolution and provide context for the WB-57 in situ measurements.

WB-57 flight patterns: cross-wind (or along-wind) racetracks. Start at cloud top and step down on subsequent racetracks. Shift the racetrack pattern downwind with the mean wind. When cloud base is reached, spiral back up to cloud top. The DC-8 should use similar approaches to sample cloud base.

o Cirrus characterization missions (small particles in cirrus)

Goals: Characterize the number concentration of small (less than 100 microns) ice crystals in anvil cirrus and in situ cirrus.

Ideally, we would want coordinated ER-2 and WB-57, and DC-8 flights, permitting comparison of quantities such as extinction from the lidar and radiation measurements with extinction derived from the in situ measurements. We would also like to coordinate with the Terra nadir track for comparison with MODIS measurements.

WB-57 flight patterns: Level legs or porpoising through relatively uniform cloud decks with ER-2 and DC-8 flying (to the extent possible) directly above or below. For thicker clouds, spiral up or down through the clouds with ER-2 and DC-8 doing short legs above and below the spiral. Note: thin cirrus near the tropopause won't help with this objective because they lack large crystals that might shatter.

Issues

We expect a number of scrubs due to weather forecasts, which may place excessive stress on the team given the hours of operation.

The intercomparison with the DC-8 will be very challenging to carry out so as to obtain statistically robust information.

Convective mixing and source characterization using multiple tracers [*Schoeberl*]. (Obtain Schoeberl talk about the “flowing processor”.)

The clear sky and transport studies, joint *in situ* and satellite science studies have priority over straight cal/val.

Vertical profiles of CO, H₂O, CO₂ for scanning HIS etc.