

Aged Convective Outflow and Tropical Tropopause Layer Sampling Flight

Objectives:

- Sample clouds, aerosols, water vapor, radiative fluxes, and tracers of convection in hours–days old outflow from deep convection using WB–57 and possibly Citation.
- Measure the radiative flux divergence in the tropopause region both in clear sky conditions, and with optically thin clouds using WB–57 and ER–2.
- Sample the water vapor, tracers, aerosols, and clouds in the tropopause region and lowermost stratosphere.
- If possible, coordinate these flights with Aqua or Terra satellite overpasses.
- Compare in situ measurements of cirrus cloud microphysical properties and tropopause layer temperature and humidity with remote sensing measurements, including ER–2 measurements and ground site measurements.

Strategy:

Use tracer forecasts to identify regions with aged convection outflow. Alternatively, use forecasts, ground-based lidar, and MODIS data to identify regions with subvisible cirrus and cold tropopause temperatures (preferably over ground sites). Coordinate with Aqua or Terra overpasses and ground sites if possible.

WB-57:

- Launch and fly to target location
- Fly stacked legs perpendicular to the wind with 20 minute legs separated by about 1000 ft, centered on forecast center of outflow.
- Start below forecast maximum outflow altitude (presumably near 150 mbar) and extend up to WB-57 ceiling.
- After spiral descent, fly 3 20-minute stacked legs along the wind centered on maximum convective outflow (based on CO measurements) or thin cirrus layers (based on ground-based lidar or WB-57 IWC measurements).
- Follow the ER-2 instructions below for TTL radiation budget experiment.

ER-2:

- Launch at same time as WB-57 and fly to target location.
- Fly legs above the WB-57 for remote sensing of clouds and gases .
- TTL radiation experiment:
 - ◆ Fly 15 minute leg downwind at 150 mbar.
 - ◆ Reverse heading and fly back along same path.
 - ◆ Ascend to 80 mbar and fly back and forth along the same leg.
- Launch dropsondes at the beginning, middle, and end of the time on-station (if over water).

Citation:

- If cirrus layers in the target region extend below 44 Kft, then use Citation to sample them.
- Launch 30 min. after WB-57, and fly stacked legs underneath the WB-57.
- The flight leg altitudes should extend from below the cirrus up to the Citation ceiling.

Issues:

- Can we use back-seater readout of CO concentration and/or IWC for flight path adjustment?
- Will instrument uncertainties swamp the TTL flux divergence?
- If we are heading into the deep tropics, the Citation might want to just sample any cirrus over the ground sites instead of coordinating with WB-57 and ER-2.