

Squawk List for Flight 1846
Thursday, 4 January 2001,
1907 to 2138 UTC

Project IMPROVE research flight 1

(Instruments not mentioned as having a problem are believed to have worked satisfactorily)

FLIGHT CONDITIONS

Flight over the coastal waters near Warning Areas 237 B and A and about 25-100 nm offshore in corridor west-southwest of HQM AP. Multi-layered rainband clouds sampled enroute to coast and in the coastal waters. Considerable rain and snow were encountered. Rather high droplet concentrations ($>200 \text{ cm}^{-3}$) in lowest stratus fractus clouds embedded in the offshore (southeasterly) flow near the surface (100-200 m ASL). Above this surface layer, droplet concentrations in the several weakly developed liquid layers were "maritime", i.e., 10s cm^{-3} . Precip fell through these layers.

Tops of multi-layered stratiform clouds with precip about 15-16 kft, temps about -10°C or so; good example of "upside down" precip process, namely, liquid altocu/stratocu-like cloud tops with snow fallout underneath, and also of ice multiplication in stratiform clouds.

This day probably would have made an excellent case study for precip formation due to the warm cloud tops and the lack of riming/splintering or other secondary mechanisms of precip formation in models.

OVERALL SCIENTIFIC ASSESSMENT

- Generally quite good agreement in all LWCs with the exception when noise spikes impacted readings. This is the best these LWCs have looked so far in my opinion.
- Serious imaging probe problems: CPI not installed due to problems; 2-DC also did not image particles, with the exception of a rare "blip" every few minutes or so. HVPS had a considerable amount of noise and particles did not look like precip particles, but were rather "north-south" slivers instead providing no reliable spectra data. (Probably caused by probe imaging particles in non-standard, horizontal configuration.
- The 35 GHz radar's signal, while strong, did not appear to detect the substantial precipitation that reached the ground below the aircraft that we flew through.

- Due to these problems, it is not possible to tell what you are flying through (heavy rain/snow vs. light snow, fallstreaks, etc.) except by eyeball on the pilot's window!
- We were not able to reliably measure any of the precipitation spectrum.

HIGHLIGHTS

- Quite good LWC measurements in all probes; rather few noise spikes impacted those measurements.
- HUGE REDUCTION in noise spikes; virtually non-existent in state parameters!

PARTICULARS ON INSTRUMENT PROBLEMS

1. GPS /WINDS/TURBULENCE/AIRSPEED GROUP

GPS tans-vector system. Data OK; apparently a characteristic of a low resolution part of this system is to report a new lat-long every 3-15 seconds.

Winds: A substantial improvement in our wind calculations has occurred under the aegis of Grant. The Shadin and our own winds are in good agreement and looked reliable most of the flight. However, there were a number of unreliable winds that appear to have occurred during turns and climbs, i. e., other than straight leg flying, though this was not ALWAYS the case.

BAT: Not working yet.

2. STATE PARAMETERS

Huge reduction in noise in all state parameters!

Rosemount temperature sensor: The Rosemount-derived static temperature continues 5-15° C higher than either the reverse flow temperature (tstatr) and the Shadin Air Computer static temperature (shadin_stemp). It has been suggested that this is due to a problem with the wiring and/or the Rosemount sensing head.

Reverse Flow Temperature: NO noise spikes! Appears to be OK.

Chilled Mirror Dewpoint Temperature: Noise on previous flight did not recur. Appears to be OK.

3. CLOUD PHYSICS

FSSP-100: OK.

PVM-100: Noise spikes in the LWC trace were rather few on this flight. Quite good agreement in LWC with the FSSP-100 derived LWC. (However, they were about as numerous as previously in the effective radius channel.) The noise spikes do not affect all three PVM “channels” simultaneously.

Johnson-Williams hot wire: Quite good agreement with the FSSP-100 LWC.

DMT hot wire: Still noisy in and out of cloud, though not as much as on previous flights. LWCs are in quite good agreement with the FSSP-100.

2-D cloud probe: Not working properly. Very few images ($\ll 1\%$ of those possible) acquired in a flight with nearly continuous precipitation for most of the 2.5 h flight time.

1-D cloud probe: No improvement. Several channels record particles and adjacent size channels record very few making holes in the 1-DC spectrum.

CPI: Not installed. Still being worked on at the bench.

35 GHz Radar: Very strong ground signal. However, precipitation did not seem to be detected below the aircraft when it should have. No data being recorded as yet; waiting for digitizer card.