Evaluating WB-57F and ER-2 MMS measurement confidence

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Abstract

As an evaluation of data integrity, meteorological data from two aircraft during straight and level, wingtip-formation flight are compared for measurements of mean ambient pressure, temperature, and winds.

Intercomparison Details

Coordinated flight leg:

- Data are from the Meteorological Measurement System on the NASA WB57 and ER2
- Average horizontal separation of 100 m near 25°N latitude, 84°W longitude
- Vertical separation of 2-3 m near 16 km altitude and at about 300° heading
- Time duration approximately 600-sec between 64850-65450 utc

Both aircraft have the follow similarities:

- GPS Updated ring-laser Inertial Navigation System
- Satellite coverage of Differential GPS receivers (LandStar from RACAL)
- Temperature compensated quartz digital pressure sensors (ParoScientific)
- Platinum wire temperature probe (Rosemount 102E4AL)
- De-iced pitot probe
- PC104 based data acquisition system (16-bit A/D, 1553B, RS422, 300-Hz)
- NIST traceable calibration of pressure, temperature, and analog measurements

System differences:

- Fuselage mounted 858Y air motion sensing probes are used on the WB-57F.
- The ER-2 air motion sensor is a flush radome differential pressure system (pressure ports in cruciform pattern).
- The WB-57F has a non-standard nose boom for the PALMS instrument.
- The ER-2 has a non-standard Doppler Radar nose cone.
- The ER-2 MMS has dedicated (not shared) static pressure ports
- The WB-57F MMS static pressure source is shared with aircraft avionics and other connections (NAV Recorder, PT instrument, drainage)

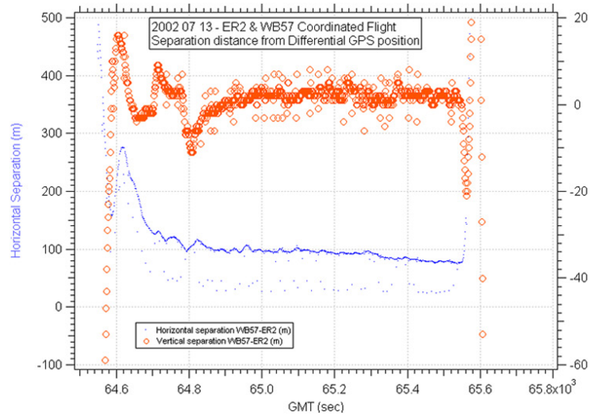
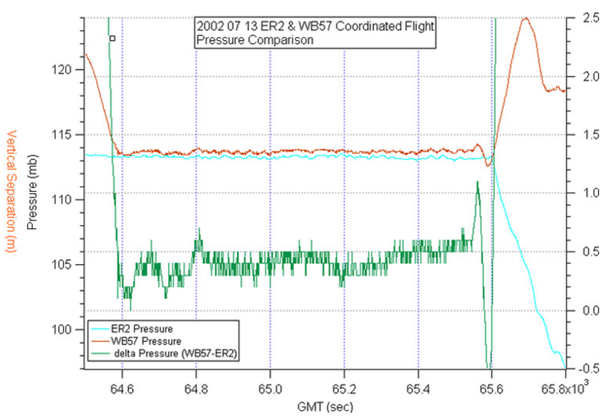
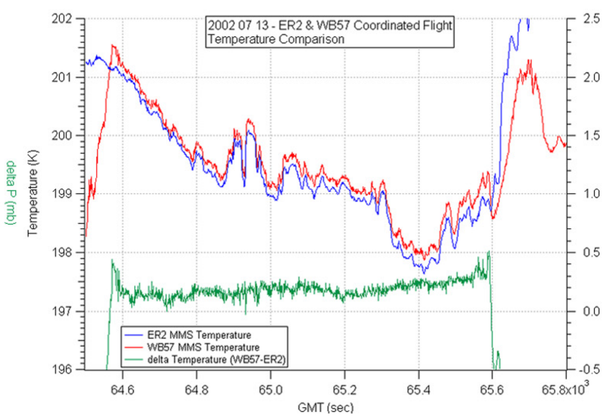
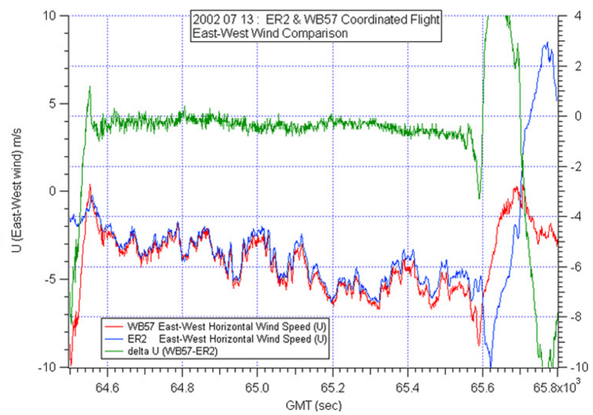
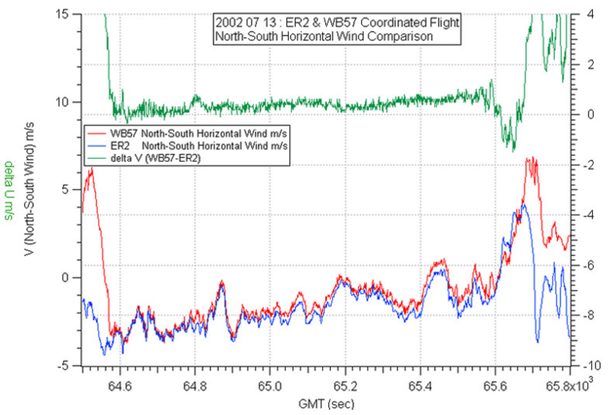
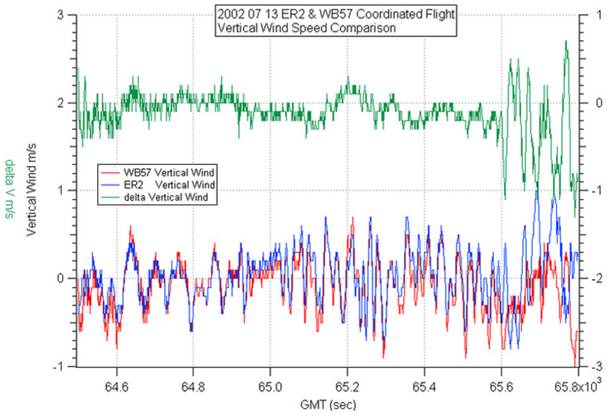
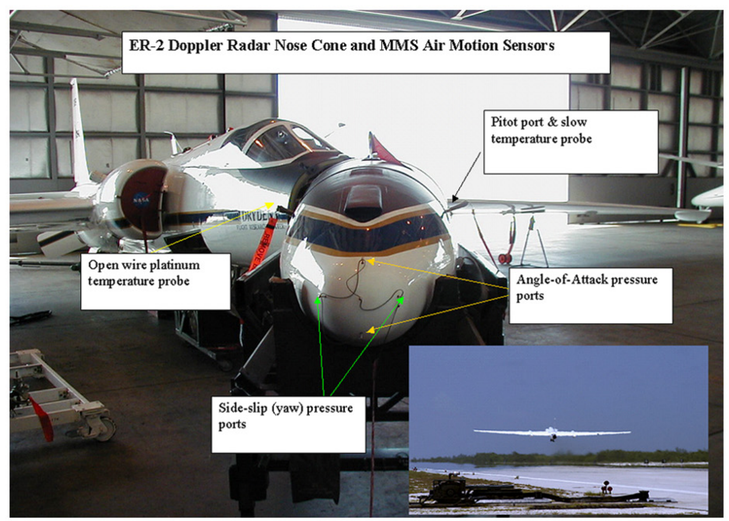
Summary

Meteorological data intercomparison results show good agreement between the two aircraft

Measurement differences are within the instrument uncertainty:

WB57 pressure is higher	0.4 mb
WB57 temperature warmer	0.2 K
Horizontal wind speed	0.5 m/s
Vertical wind speed	± 0.3 m/s and 0.1 m/s precision

Further comparison

Evaluate variances and spectra to determine frequency response
Intercompare cospectra and fluxes
Intercompare with data from balloon sondes and GPS dropsondes

`MMS Web Site: geo.arc.nasa.gov/sgg/mms/index.htm`