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 side-by-side at constant heading flight path are compared for mean measurements of ambient pressure, temperature, and winds.

Intercomparison Details

➢ Coordinated flight leg:

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

➢ Both aircraft have the follow similarities:

1 GPS Updated ring-laser Inertial Navigation System (LN-100G)
2 Satellite coverage of Differential GPS receivers (LandStar from RACAL)
3 Temperature compensated quartz digital pressure sensors (ParoScientific)
4 Platinum wire temperature probe (Rosemount 102E4AL),
5 De-iced pitot probe
6 PC104 based data acquisition system (16-bit A/D conversion, 300-Hz sampling rate)
7 NIST traceable calibration of pressure, temperature, and analog measurements

➢ System differences:

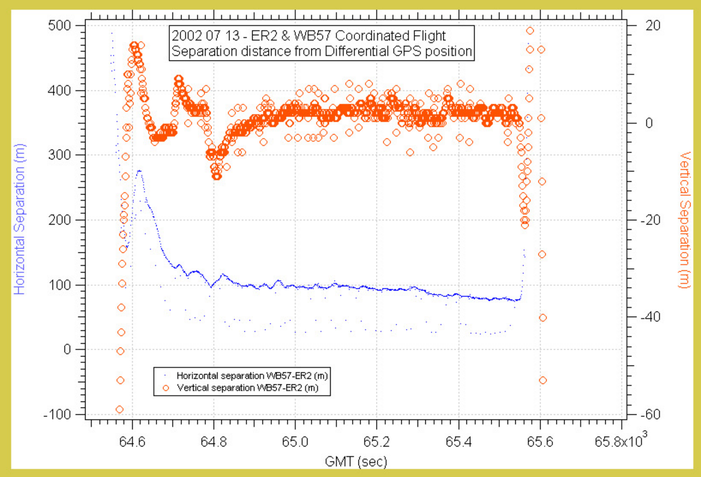
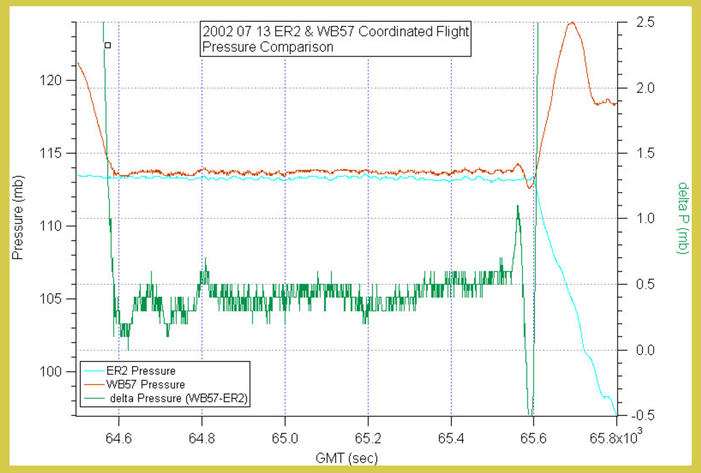
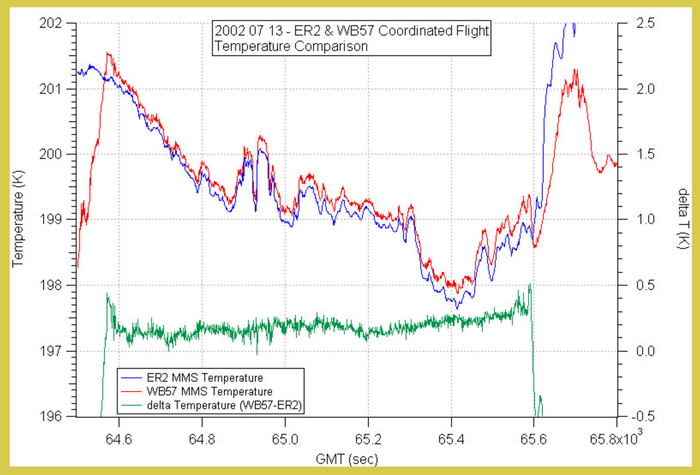
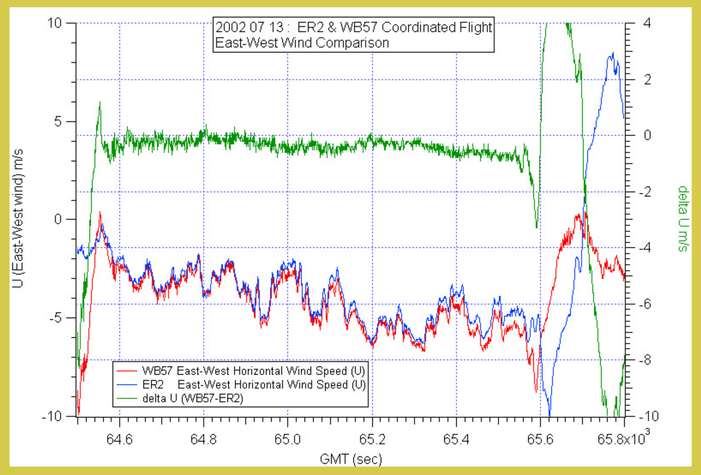
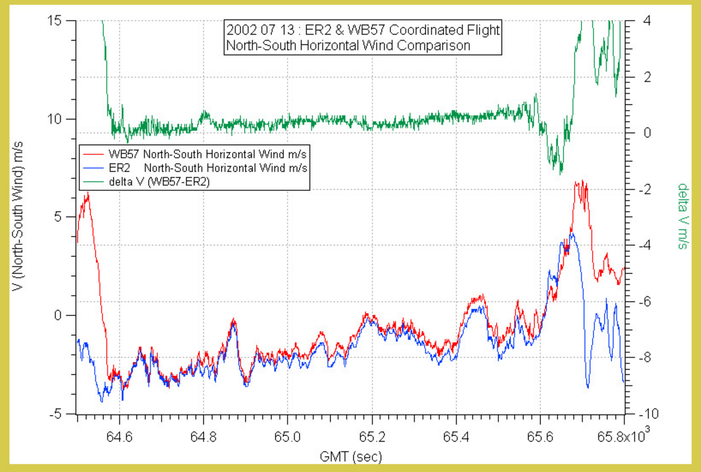
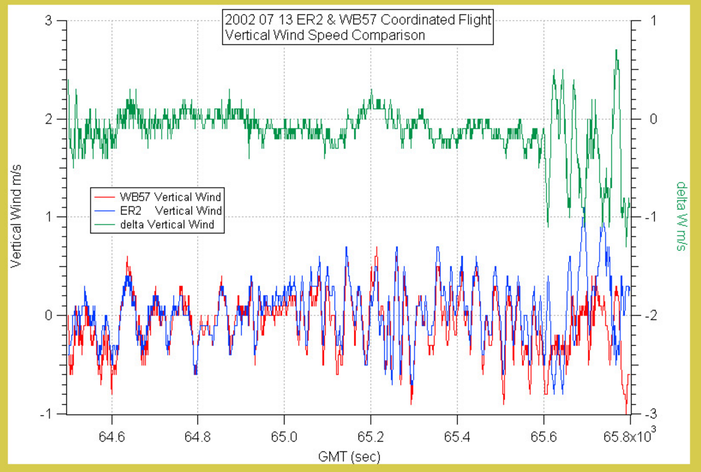
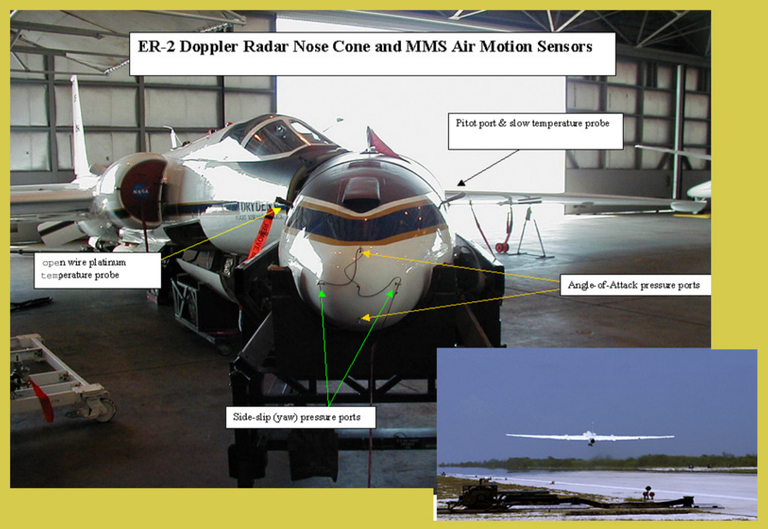
1 Fuselage mounted 858Y air motion sensing probes are used on the WB-57F.
2 The ER-2 air motion sensor is a flush radome differential pressure system (pressure ports in cruciform pattern).
3 The WB-57F has a non-standard nose boom for the PALMS instrument.
4 The ER-2 has a non-standard Doppler Radar nose cone.
5 The ER-2 MMS has dedicated (not shared) static pressure ports
6 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