RADIOSONDE INTERCOMPARISON

by

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NASA hosted Phase II of the World Meteorological Organization (WMO) International Radiosonde Intercomparison at the Wallops Flight Facility in February-March 1985. Phase I had taken place in June-July 1984 at Bracknell, United Kingdom. The comparison produced the largest amount of material ever collected from a radiosonde comparison. Radiosondes from Australia, Finland, India, and the United States were involved. Data were received from 100 soundings, each of which was a simultaneous in situ test of four different instrument types. A fifth instrument was compared on a limited basis. This was the Graw M60 radiosonde manufactured in the Federal Republic of Germany and used by the United Kingdom.

The simultaneous temperature comparison of participating operational radiosondes in daylight was about 1°C at the 100 hPa level and about 4°C at the 10 hPa level, while the corresponding comparison for geopotential was about 40 meters at 100 hPa and 100 meters at 10 hPa. The uncertainty in the observations made using operational radiosondes is today at the 10 hPa level, in degrees and meters, roughly the same order as it used to be at the 100 hPa level 30 years ago. The main reasons for this achievement are improved sensors, receivers, data evaluation, and, in particular, removal of, or correction for, radiation

errors of some of the instruments.

Estimates of the reproducibility of standard level temperatures are give in table 1. Table 1 also includes results from Phase I. The reproducibility obtained from the in situ comparisons is, in general, slightly better than corresponding results from monitoring measurements in a real-time mode at analysis centers. The Indian radiosonde, however, turned out to be considerably better in the instrument comparison than one might infer from monitoring results.

Conclusions from the intercomparison are many; the following call for particular attention: 1) fully automated radiosonde systems were able to reproduce geopotential measurements better than non-automated systems, mainly due to a decrease in observer mistakes. 2) Observed temperature differences between radiosonde measurements were as large during the night as during the day. 3) Significant inconsistencies still exist between the nighttime and daytime measurements, as well as significant bias errors in the pressure measurements of some radiosonde types.

In addition, the Final Report recommends that manufacturers increase automation in order to minimize errors caused by manual treatment of chart records. Also, the automated systems must be provided with standardized instrumental correction procedures to avoid systematic errors.

Table 1 Estimates of the reproducibility of standard level temperature measurement in °C. The estimates are for one standard deviation (Nash and Schmidlin, 1987).

Pressure Level (hPa)	Link Radiosonde FIN I,II	USA I,II	AUS	FRG	IND	UK	BEUK	GRAW	
1000	0.3	0.8,0.4	0.5	0.3	0.7	0.3	0.4	0.5	
900	0.2	0.4,0.2	0.4	0.2	0.7	0.2	0.3	0.4	
850	0.2	0.3,0.2	0.4	0.2	0.7	0.2	0.4	0.4	
700	0.2	0.3,0.2	0.4	0.3	0.7	0.2	0.3	0.4	
600	0.2	0.3,0.2	0.3	0.3	0.7	0.2	0.3	0.3	
500	0.2	0.3,0.2	0.3	0.3	0.7	0.2	0.4	0.4	
400	0.2	0.3,0.2	0.3	0.4	0.7	0.2	0.4	0.4	
300	0.2	0.3,0.2	0.4	0.4	0.7	0.2	0.5	0.5	
250	0.2	0.3,0.2	0.6	0.4	0.7	0.2	0.6	0.5	
200	0.2	0.3,0.2	0.8	0.4	0.7	0.2	0.7	0.6	(0.5)
150	0.2	0.3,0.2	0.8	0.5	0.6	0.2	0.8	0.8	(0.5)
100	0.2	0.3,0.2	0.8	0.5	0.6	0.2	0.9	1.0	(0.5)
70	0.2	0.3,0.2	1.2	0.5	0.7	0.2	1.0	1.3	(0.7)
50	0.3	0.6,0.3	1.2	0.5	0.8	0.3	1.2	1.5	(1.2)
30	0.4	0.8,0.4	1.4	1.0	1.0	0.4	1.4	2.0	(1.2)
20	0.5	1.0,0.5	1.6	1.5	1.5	0.5	1.6	2.0	(1.2)
15	0.6	1.2,0.7	2.2	2.0	2.0	0.6	1.8	2.5	(1.5)
10	1.0	1.5,1.2	3.0	2.5	2.5	1.0	2.0	4.0	(1.5)

Estimates for the USA and Finland reproducibility differ from Phase I to II as indicated. Bracketed estimates for Graw are for nighttime flights only.