

WORLD METEOROLOGICAL ORGANIZATION

Distr.: RESTRICTED  
CBS/OPAG-IOS (ODRRGOS-4)/Doc. 9/Add.1  
(24.I.2002)

COMMISSION FOR BASIC SYSTEMS  
OPEN PROGRAMME AREA GROUP  
ON INTEGRATED OBSERVING SYSTEMS

ITEM: 8

Original: ENGLISH

EXPERT TEAM ON OBSERVATIONAL DATA REQUIREMENTS  
AND REDESIGN OF THE GLOBAL OBSERVING SYSTEM

FOURTH SESSION

GENEVA, SWITZERLAND, 28 JANUARY-1 FEBRUARY 2002

### **OSE Studies carried out by ECMWF in 2001**

*(Submitted by Horst Böttger, ECMWF)*

---

#### **Summary and Purpose of Document**

The results from the OSEs carried out by ECMWF in 2001 in response to the proposals made by the Expert Team in April 2001 are summarized in the Appendix to this document.

---

#### **ACTION PROPOSED**

The meeting is invited to take into consideration the results of OSEs carried out by ECMWF.

**Appendix:** OSE studies carried out by ECMWF in 2001

## **OSE studies carried out by ECMWF in 2001**

### **1. Background**

The OPAG-IOS Expert Team on data requirements and the re-design of the global observing system (ET-ODRRGOS) in April 2001 suggested seven OSEs for consideration by NWP centres. ECMWF proposed

- (i) to study the impact of hourly SYNOP observations with a high resolution T511/T159 12 hour 4D-Var assimilation system (OSE 1);
- (ii) to study the impact of observations taken during ascent and descent with a high resolution T511/T159 12 hour 4D-Var assimilation system (OSE 4);
- (iii) to study the increments in the ERA-40 observing system through several OSEs done as part of the scientific programme.

This document provides a summary of the work done at ECMWF since the last meeting of the ET/ODRRGOS. The results were presented by Erik Andersson at the Eighth ECMWF Workshop on Meteorological Operational Systems, 12-16 November 2001.

### **2. Recent data impact studies at ECMWF**

The OSEs were undertaken with the most recent configuration of the operational forecasting system. The data impact was studied through the denial of observations received operationally from the WMO GTS. Any demonstrated impact will be the incremental effect of the observations denied in the experiments. All other data sets which are used in the operational system entered the data assimilation as usual.

#### **2.1 Denial of hourly surface data from SYNOP, SHIP and DRIBU**

The impact of hourly surface pressure and also wind observations has been evaluated in the context of ECMWF's operational 4D-Var data assimilation system. It is known from earlier experimentation (Järvinen, Andersson, and Bouttier, Tellus 51A, 1999, pp 469-488) that the temporal information in time-series of observational data can correct the intensification rate of developing cyclones, when used in 4D-Var. This has now been re-investigated as the operational system recently was enhanced with a longer time window (12-hourly cycling) and higher analysis resolution: the main forecast model at T511 and the analysis increments at T159 spectral resolution. These enhancements were expected to be particularly beneficial with respect to high density and high frequency data.

The study period was 1-31 May 2001. The globally available observations from the main synoptic hours at 00, 06, 12 and 18 UTC were used in the experiments. Only the data from the intermediate hours were excluded. ECMWF receives such observations mainly from the European-Atlantic region, from moored buoys in the American coastal waters, from Australia and from the drifting buoys in the southern oceans. The impact from the hourly data can be detected in the analysis increment fields and in the 48-hour forecast error of 500 and 1000 hPa geopotential. However, the signal is weak and, considering the relatively short period of the experiment, is largely statistically insignificant.

Nevertheless, the results of the study confirm that hourly surface observations have a positive impact when used in the operational 4D-Var assimilation system. The positive impact in the short-range forecast is seen in those areas where such data are available, i.e. the North Atlantic and the southern oceans, and which are otherwise relatively data sparse with respect to in situ surface observations. The global exchange of all hourly surface observations for use in a 4D-Var system appears to be beneficial for NWP.

## 2.2 Denial of vertical profile data from aircrafts

The experiments were carried out for the period 1-31 January 2001. All aircraft data (T, u, v) between the ground and 350 hPa were excluded over North America (25-60N, 120-75W) and over Europe (35-75N, 12.5W-42.5E).

The impact of the wind and temperature profiles from the aircraft observations taken during ascent and descent can be detected in the increment field of geopotential height in the free atmosphere. Forecast errors are reduced over North America, the North Atlantic and Europe. The signal propagates eastward with forecast time and is clearly visible out to D5 of the forecast and beyond.

Even with the caveat of a relatively short experimentation period the study indicates that the atmospheric profiles from aircrafts have a significant impact on the 4D-Var data assimilation resulting in improvements of the short and medium range forecast over North America, the North Atlantic and Europe. The results support the expansion of the coverage of aircraft observations including the observations taken during ascent and descent from other parts of the globe.

## 2.3 ERA-40 observing system studies

The operational production of the ERA-40 is progressing. At this stage only some preliminary data studies have been undertaken mainly in support of the production activity. Observing system experiments and studies as part of the scientific programme will follow at a later stage in the project.