WORLD METEOROLOGICAL ORGANIZATION

RA VI MEETING OF THE WORKING GROUP ON PLANNING AND IMPLEMENTATION OF WWW CO-ORDINATORS

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INTEGRATED OBSERVING SYSTEM

(Submitted by Mr Keith Groves)

Summary and Purpose of the Document

The document provides information on recent performance of the GOS in Region VI and input on the integrated observing system.

ACTION PROPOSED

The meeting is invited to consider the information on observing systems in Region VI provided in the document

- **Integrated Observing System**
- General

In general, the implementation of the GOS in Region VI has been satisfactory, though with considerable variability in the level of performance across the Region and within the networks. A significant development is the move of EUMETNET Composite Observing System (EUCOS) from an implementation programme to an operational programme. Close co-ordination between Region VI and EUCOS will be required to ensure that benefits are optimized. EUCOS proposals to reduce the number of land based observing systems whilst increasing the number of observations from remote and sensitive areas is aimed at improving the quality of short range numerical weather prediction products over Europe. EUCOS has conducted a number of studies aimed at identifying the optimum network of surface and upper-air observations to maximize the performance of NWP models over Europe in the period 0 to 72 hours ahead. Members of EUCOS will derive savings from the reduction of land based systems, but will need to invest in systems such as AMDAR and ASAP and drifting buoys.

3.2.1 Surface-Based Sub-System

3.2.1.1 The Regional Basic Synoptic Network (RBSN)

The revised list of RBSN stations presented at XIII-RA VI (Geneva,, 2-10 May 2002) showed 759 stations – an increase of 33 in 4 years. Monitoring by the European Centre for Medium-range Weather Forecasts (ECMWF) of RBSN SYNOP reports for Region VI shows a very small increase in the frequency of reception of reports during the 2 years to July 2002. Frequency of reception had been broadly constant at 06, 12 and 18 UTC, but showed a minimum at 00 UTC. Analysis of the results of the October 2002 monitoring period indicated that 93.5% of SYNOP reports had been received. This continues the improvement that has been evident for the past 5 years. However, inevitably there have been changes in stations during inter-sessional periods, and this may create an unduly pessimistic picture. An analysis of observations available in the UK Met Office database from surface RA VI RBSN stations at the beginning of September 2002 had shown 727 stations (95.7%) reporting at that time. However, some of the stations were not reporting a full programme of observations. 32 stations were not reporting at the time of this survey.

The list of upper-air stations presented for revision at XIII-RA VI showed 135 stations, a reduction of 8 stations in 4 years. However, even this list was in need of some revision as changes had occurred since May 2002. There is little evidence of significant change in the past 2 years for the reception of data from upper-air stations, though data monitoring at ECMWF shows a small increase in the frequency of reception of wind observations. The principal area of concern remains the relatively low figure of 73% of TEMP reports received in the 2002 monitoring period, compared to the 91% of reports expected. The main shortfall is evident in the eastern part of Region VI and Members are encouraged to provide assistance to help achieve higher figures for the reception of upper-air data. An analysis of the upper-air observations available in the UK Met Office database at the beginning of September 2002 had indicated that 28 stations (20.7%) were not reporting at that time. In addition, some stations had not been meeting the target of 2 ascents a day.

Vaisala radiosondes (RS80 or RS90) are in use at 75% of stations, 21% use the Russian Federation MARS or MRZ radiosonde with the remaining 4% using VIZ, Graw or ML-SRS radiosondes. In the last 2 years about 40 stations have changed from the Vaisala RS 80 to the RS 90 radiosonde, that offers improved temperature, pressure and humidity sensors.

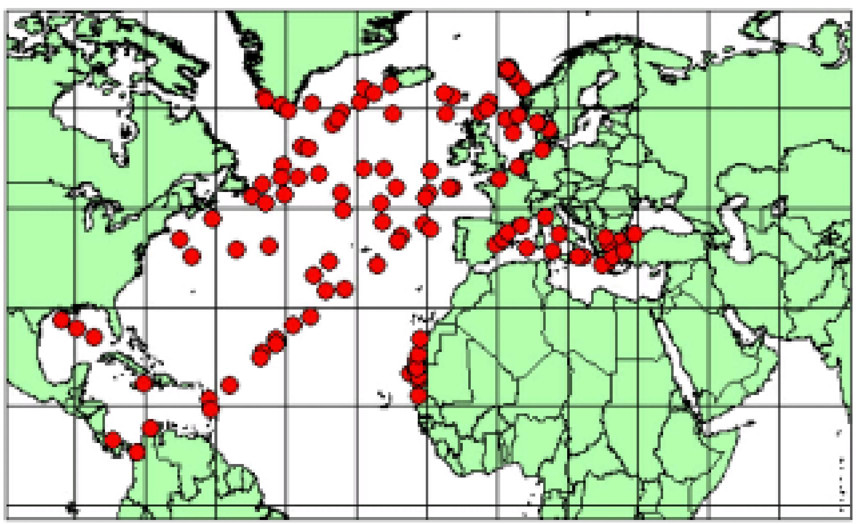
There are 20 remotely controlled autosonde stations in 8 member states in RA VI.

A number of Members have continued to use the LORAN system for wind finding, despite concerns over availability of this system beyond 2005.

Marine Systems

A number of nations in RA VI (about 14) had supported the WMO VOS Programme, though prior to the development of a EUCOS Marine Programme, there was no European forum to co-ordinate the operation of the European VOS. Globally, the number of VOS had been 7036 in 1998. Although no confirmed figures were available for later years, it was expected that the global number would be near to 6000 in Aug 2002. Some of this reduction has occurred through the removal of ships of poor quality. However, the Composite Observing System for the North Atlantic (COSNA) consolidated monitoring report for 2002 indicates that there has been little significant trend evident in either the global or North Atlantic numbers of SYNOP reports from manual and/or automatic ships in the past 4 years. The list of suspect ships within the North Atlantic, maintained by ECMWF, had shown a significant increase in the number of ships reporting suspect SYNOPs. The number had increased from about 13 in 1998 to about 40 in 2002. The JCOMM Ship Observing Team had noted the importance of maintaining a network of Port Met Officers to liaise with ships and improve the volume and quality of data. A continuing concern with the VOS Programme is that a small number of Members bear a significant proportion of the communications costs for the Programme.

A number of Members had supported the ASAP programme. ASAP route coverage for Feb 2003 is shown below:



Within the COSNA area, there were 14 mobile ASAP units aboard ships and a further 12 units outside the COSNA area. Within the COSNA area, the number of TEMP soundings had increased in recent years, reaching 3880 soundings in 2001. However, the COSNA consolidated monitoring report had shown that the number of soundings available at ECMWF varies considerably from ship to ship, and that there are continuing problems over corrupted call signs. The number of TEMP SHIP observations available at ECMWF at 00 and 12 UTC had shown a decline in recent years, whilst the number available at 06 and 18 UTC had shown an increase in 2001. This had been the result of an increased number of automatic systems on board ships, allowing more frequent ascents. Once again the benefits of collaboration had been shown by the continued support by 6 Members of the ASAP unit on the Ekosfisk oil platform in the North Sea.

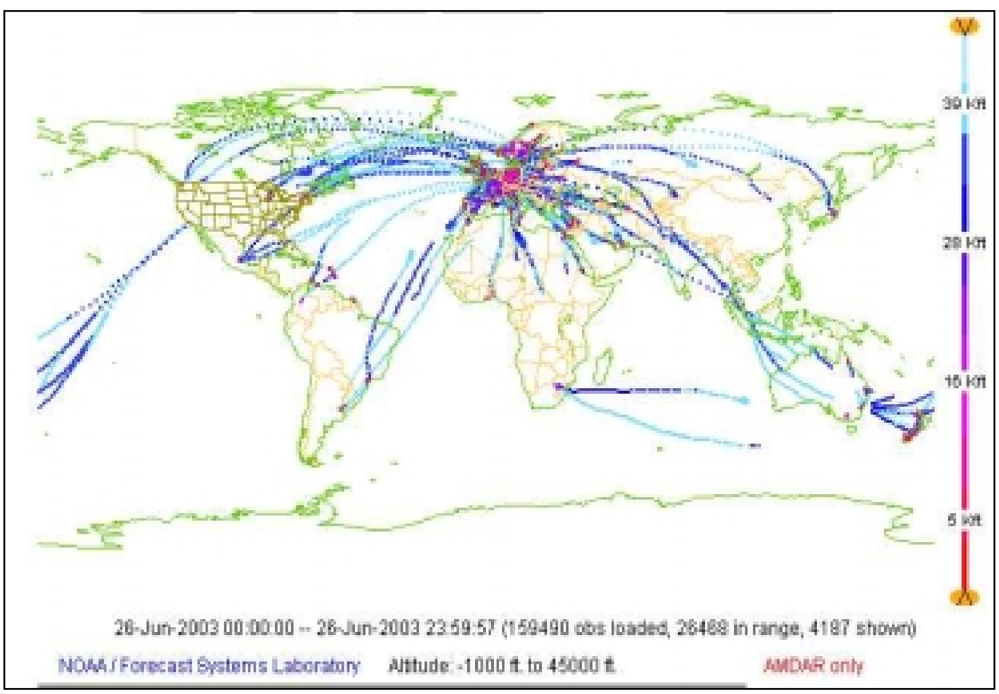
The number of drifting buoys in the North Atlantic Ocean operating within the European Group on Ocean Stations (EGOS) programme had reached a monthly average of 49 in 2000, but fallen to 43 in 2001. At 31 July 2002, the figure was 42, with a further 22 buoys expected to be deployed in the next 6 months. The average lifetime of the buoys has increased significantly, being close to 400 days during 2001. The number of buoy deployments fell from 71 in 1999 to 57 in 2000 and to 41 in 2001. Budgetary constraints had been the main reason for the decline, though increased reliability had been an enabling factor.

The network of moored buoys maintained by the UK, France and Ireland has continued to operate. In the UK, there have been a number of operational difficulties caused by interference from trawlers, and in Aug 2003, one buoy is adrift in the N Atlantic and another has been recovered and will be re-deployed later. Both UK buoys in the North Sea are adrift. The network has been augmented by the deployment of an additional buoy by Ireland, with 2 more to be deployed later. The benefits of international collaboration had been evident in this area as well, as the UK and France had maintained buoys in the Bay of Biscay, and the UK and Ireland are collaborating to improve the design of Buoys.

Aircraft Observations

The number of AMDAR units and reports had continued to increase in the past 2 years, and although there had been a decline in the number of reports after 11 September 2001, reports had since recovered to pre-September 2001 levels. In April 2002, there had been over 500 units within the EUMETNET E-AMDAR project, with over 50% of these fully operational. 95% of reports had been available within 1 hour. There had still been some national airlines that do not participate in AMDAR. This may be a consequence of the lack of appropriately equipped aircraft, or that the NMS has not convinced the airline of the mutual benefits to be derived from participation in the programme. It should be noted that the EUCOS Implementation Report indicates that continued investment in the E-AMDAR project will allow for more efficient use of observing resources over national territories.

A typical day's coverage is shown below:



The first EUCOS high frequency AMDAR trial ended in Apr 2003. Some data thinning was necessary in the early days of the trial, but a significant increase in the number of reports was obtained during the trail period. The second phase commenced on 20 Aug 2003.

Other Systems

There had been a small increase in the number of tropospheric wind profiling stations in the region, and an increase in the number of weather radars measuring upper winds, though these were mostly in Scandinavian countries. These systems had the advantage of producing a continuous record of upper level winds, and providing a valuable source of information for numerical weather prediction models.

3.2.1.2 The Regional Basic Climatological Network (RBCN)

Based on recommendations of EC and CBS, XIII-RA VI (May 2002) had agreed to the concept of defining a separate RBCN for the Region. Furthermore, Members were urged to spare no efforts in implementing the revised RBCN. The new network now comprises 520 (714) CLIMAT stations and 91 (142) CLIMAT TEMP stations (previous numbers are given in parenthesis).

The results of the July 2002 monitoring period had indicated that 72% of CLIMAT and 64% of CLIMAT TEMP reports had been received at MTN centres during the monitoring period. Members are urged to take appropriate action to address the reasons for low availability of RBCN reports in their area of responsibility.

3.2.2 Space-based Sub-System

Operational Satellites

Members in RA-VI had been well supported by the EUMETSAT geostationary satellites Meteosat-7 and Meteosat-5, and by the LEO systems provided by NOAA/NESDIS, the Russian Federation and by China. The launch of the first MSG geostationary satellite on 28 August 2002 promised to bring the benefits of advanced imaging and sounding from geostationary orbit to the NMHSs in the RA VI and RA I areas. MSG routine operations are expected to commence by the end of 2003.

Research Satellites

Member states, especially those with NWP capability, climate models, and ocean forecasting models had been making substantial and increasing use of data from research satellites. In particular, scatterometer data providing surface wind vectors were having a positive impact upon forecast skill. Within the UK Met Office Hadley Centre Along Track Scanning Radiometer (ATSR) and Advanced Along Track Scanning Radiometer (AATSR) data were having a significant impact upon sea surface temperature analyses, and in the study of the radiative properties of cirrus clouds. The assimilation of UARS data had led to improve analysis and understanding of stratospheric temperature and ozone. Products derived from MODIS data were being examined with the intention of using them in global and regional NWP models, in site specific models and in climate studies.

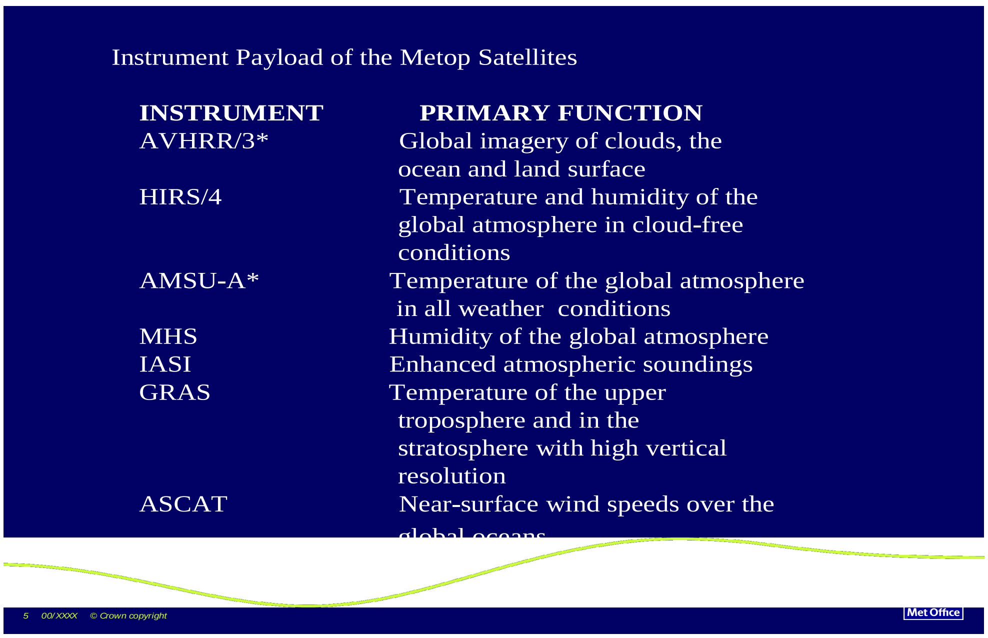
Ground Systems

RA VI had 36 out of 49 Members equipped with low-resolution LEO receivers (APT) and 21 out of 49 Members equipped with high-resolution LEO receivers (HRPT). The Region had 44 out of 49 Members equipped with at least one LEO receiver, which was an increase of five from the previous report. Most of RA VI had been adequately covered for reception of HRPT except Eastern Europe, and some Members are supported by receiving equipment located in another member state.

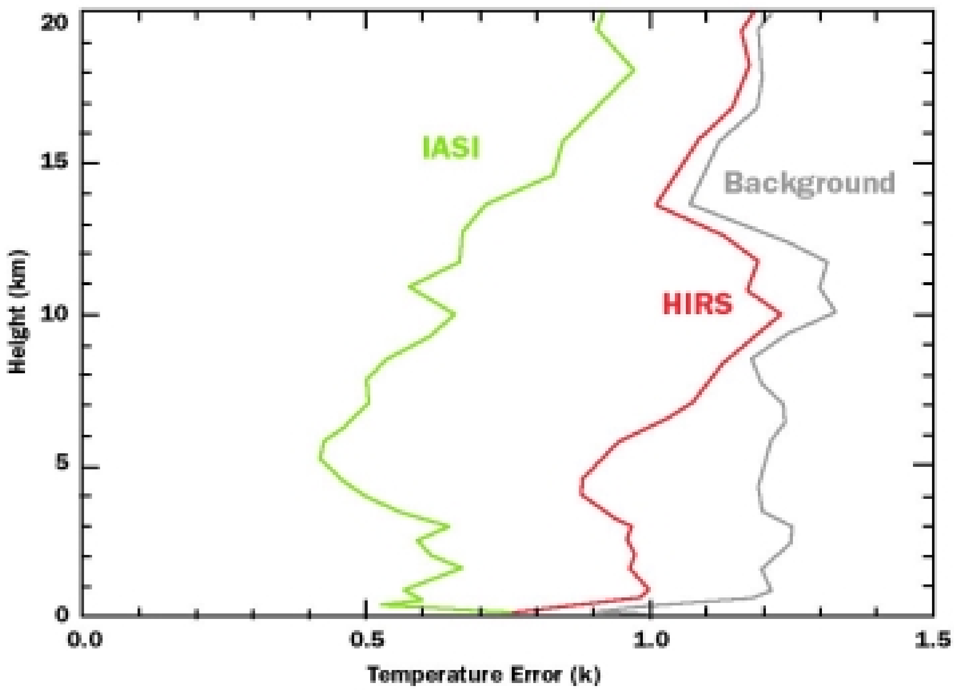
The situation was similar for GEO satellite receivers. Out of 49 Members, 40 had low-resolution WEFAX receivers and 27 had high-resolution receivers. Forty-four out of 47 Members had at least one GEO receiver, which was an increase of five since the last survey. One should note the large number (286) of low-resolution WEFAX GEO receivers reported by RA VI. Forty-three out of 49 Members had at least one LEO receiver and one GEO receiver.

Integrated Observing System (IOS)

The significant increase in quality and resolution expected from spaced-based meteorological observations in the next 5 to 10 years will result in some NMHSs looking closely at the requirement for surface-based observing systems. The Metop payload is given below:



The following diagram demonstrates the expected increase in capability to be provided by the IASI instrument on Metop. It compares temperatures errors for model background fields, HIRS and IASI and clearly demonstrates the significant improvement expected when IASI is operational (mid 2006?):

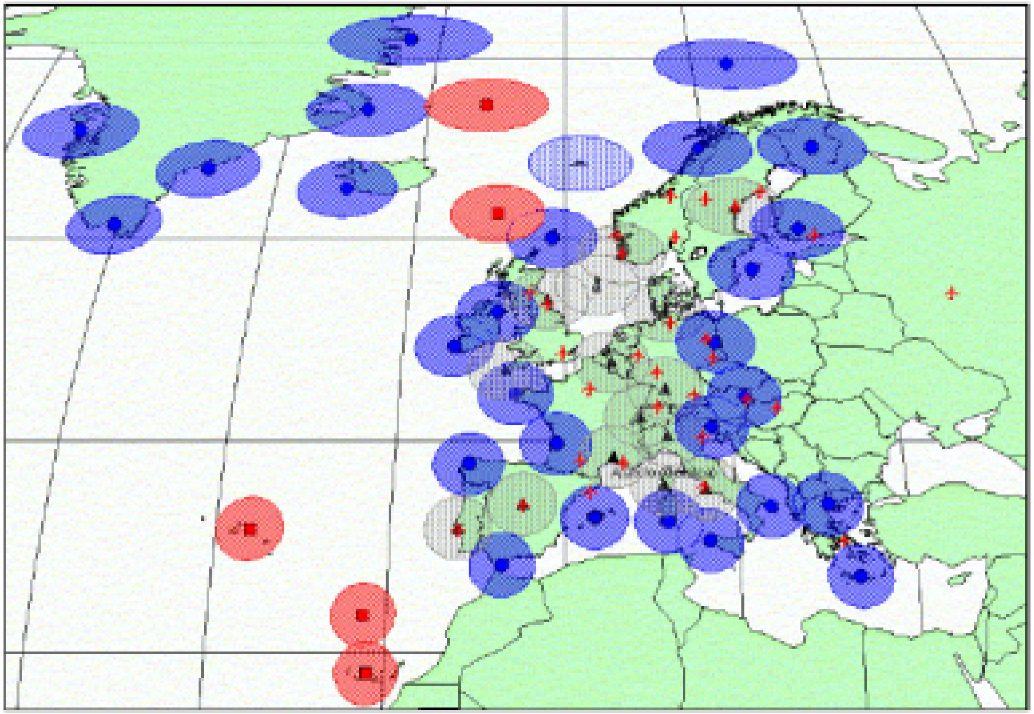


Given that the space component of the integrated observing system is fixed, it is likely that NHMSs will seek efficiencies in the surface-based programmes with the aim of delivering value for money whilst retaining quality. It is likely that the surface-based systems will be designed to complement the observations available from space. This will require a focus upon observations in the lower atmosphere where the performance of satellite systems is likely to be less effective.

3.2.4.2 Increased resolution in nwp models and improved analysis in the boundary layer, combined with full utilisation of observing systems will allow some NMHs to produced 'virtual' observations for any location. These observations will be aimed at meeting the needs of many users of metreorological information. It is likely therefore that the parameters measured at the surface will be those largely to meet the needs of nwp. There will be a continuing need to measure certain parameters to meet the needs of some users, especially climate. Clearly, users will need to ensure that such virtual observations meet their quality aspirations.

3.2.4.3 When considering the future design of an IOS, we will need to examine requirements on global, regional and local scale. These will differ as the meteorological products delivered on these scales vary significantly. WMO will need to take a lead on a global scale. Within Region VI, EUCOS has already made proposals for surface and upper-air observing networks, though these may not be designed with full consideration of the observational data that will be available from satellites in the 5 to 10 year time frame. The local scale will largely be the responsibility of NMHSs, though some international co-operation will be required on this scale.

The EUCOS Upper-Air Design is shown below:



- The 5 stations that have already been identified as strategically important and are subject to limited cost sharing are plotted as red squares. These have all been assigned an observing frequency of 4 launches per day.
- Stations situated along the edge of the network, or those located in remote data sparse regions, have also been given an observing frequency of 4 launches per day and are plotted as blue circles
- Stations within central Europe where regular AMDAR profiles are generated have been assigned an observing frequency of 2 launches per day and are shown as black triangles.
- Airports providing regular 3-hourly AMDAR profiles (during the daytime) are plotted as the red aircraft symbol.

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3.2.4.4 The EUCOS Surface Marine Programme has the following aims:

- provide design principles for co-ordinating the future development of the surface-marine observational structure for VOS, moored and drifting buoys in order to meet EUCOS requirements ;
- develop appropriate funding mechanisms and provide suitable management to ensure that programme objectives are met in an efficient and timely manner ;
- optimise surface-marine observations from VOS, moored and drifting buoys taking full account of EUCOS observational requirements in data-sensitive areas ;
- maximise the efficiency of operating VOS, moored and drifting buoys for EUMETNET/EUCOS participants by reducing duplication and implementing requirements in the most cost-efficient manner ;
- develop proposals for the future integration of the existing voluntary observing fleets and buoy networks operated by EUMETNET Member countries.

It is likely that the balance of marine meteorological observing systems will change in future years, with a greater dependence on drifting buoys and automated ships observations.

3.2.4.5 The performance of nwp models has continued to improve in recent years. This is the result of a number of factors, including improved modeling and assimilation techniques, increased resolution, but also improvements in data availability and quality. Improved use of information from satellites and data from new observing techniques are also factors. However, there is still much scope for improvements in our ability to forecast parameters that impact upon the boundary layer, e.g. low cloud, visibility, convective precipitation and low level wind. The IOS, especially on a local scale, must be developed in consideration of the need to improve the quality of forecasts in the boundary layer using both automated and traditional forecasting methods.

3.2.4.6 A number of observing system experiments will be required to determine the optimum IOS on these various scales, and further experiments will be required as surface-based systems develop.