Further development of the EUMETNET Composite Observing System (EUCOS)

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Abstract

EUCOS, which stands for EUMETNET Composite Observing System, is a EUMETNET programme whose main objective is a central management of surface based operational observations on a European-wide scale serving the needs of regional scale NWP. EUMETNET is a consortium of currently 24 national meteorological services in Europe that provides a framework for different operational and developmental co-operative programmes between the services.
The work content of the EUCOS Programme includes the management of the operational observing networks, through the E-AMDAR, E-ASAP, E-SURFMAR and WINPROF programmes. The coordination of NMSs owned territorial networks (e.g. radiosonde stations and synoptic stations), data quality monitoring, fault reporting and recovery, a studies programme for the evolution of the observing networks and liaison with other organisations like WMO are among the tasks of the programme.

The current period of the EUCOS programme has a five year duration (2007-2011) and a two stage approach was proposed in the programme definition. During the transition phase 2007-2008 no new programmatic objectives had been set because amongst others the Space-Terrestrial Study which investigated the relative contributions of selected space based and ground based observing systems to the forecast skill of global and regional NWP models had to be finalised first. On the consolidated results of these studies new programmatic objectives will be developed by EUCOS and revised by the relevant bodies of the EUCOS management structure during 2008. However, for the current programme phase it is envisaged to redesign the EUCOS upper-air network, whose configuration and setting should be based on scientific analyses rather than on a simple merging of historically grown national networks. Therefore the results and specific recommendations from the aforementioned Space-Terrestrial Study are taken into account.
Throughout the second phase of the programme (2009-2011) the revised EUCOS design will be implemented and the EUCOS operational system will be steadily improved.

Further tasks for EUCOS will be the proposal and implementation of a new E-programme responsible for running a central data hub and centralised monitoring, accompanying and support of research on targeted observations, setting of new objectives for the programme components E-ASAP, E-AMDAR, E-SURFMAR and WINPROF, and an extension of quality monitoring activities. An example for new programme objectives is the introduction of a humidity sensor on commercial aircraft within the E-AMDAR programme.

1. About EUMETNET and EUCOS

EUMETNET is a network grouping of 24 European National Meteorological Services. EUMETNET provides a framework to organise co-operative programmes between the Members in the various fields of basic meteorological activities such as observing systems, data processing, basic forecasting products, research and development, training. Through EUMETNET Programmes, the Members intend to develop their collective capability to serve environment management and climate monitoring and to bring all European users the best available quality of meteorological information. They will use EUMETNET to make more efficient the management of their collective resources.

The EUCOS Operational Programme aims to establish and operate a truly European observing network under the auspices of EUMETNET, to deliver increased efficiency, leading to better quality numerical and general forecasts, initially on a European scale. The EUCOS management team works under the guidance of the programme board for observations (PB-OBS). The EUMETNET Co-ordination office monitors EUCOS on behalf of EUMETNET Council and PB-OBS.

During the last programme phase (2002-2006) the EUMETNET Composite Observing System (EUCOS) was being developed from the planning phase to an operational programme as an integrated terrestrial observing system for Europe serving the needs of regional numerical weather prediction. EUCOS has evolved rapidly by the active co-operation and support of all the members of EUMETNET. In the coming years additional ground based observing systems will be integrated into the programme, and the terrestrial observing system will continue to be coordinated with the space based observing system.

The objectives of the EUCOS Programme are to:

1. Design and coordinate the evolution of the ground based EUMETNET composite observing system to be optimised at European scale with a view to improve short range forecast over Europe without increasing the overall cost, in line with the EUCOS strategy defined by the Council,
2. Monitor and control EUCOS performance,
3. Ensure integrated management for agreed components such as E-ASAP, E-AMDAR and E-SURFMAR,
4. Support the evolution of EUCOS through a studies programme.

2. Current status of the EUCOS programme

The EUMETNET Council decided in December 2006 to place the responsibility for the programme management of the EUCOS Operational Programme on the Deutscher Wetterdienst.
The Programme has five year duration (2007-2011) and a two stage approach was proposed in the programme definition. During the Transition Phase 2007-2008 no new programmatic objectives had been set because amongst others the Space-Terrestrial Study had to be finalised first in 2007. On the consolidated results of these studies new programmatic objectives would be developed by the EUCOS Team and revised by the relevant bodies of the EUCOS management structure during 2008.
Throughout the second phase of the Programme 2009-2011 the revised EUCOS design will be implemented and the EUCOS operational system will be steadily improved. The work undertaken during the first year of DWD's responsibility for the EUCOS Operational Programme has focused on the further development of the website and the quality monitoring system, to present conclusions from the S-T studies and initiate an upper-air network redesign. Work has started to integrate WINPROF into EUCOS. As a first step the measures for the managerial and financial integration of WINPROF into EUCOS have been taken. The proposal to continue WINPROF as an integrated programme component of EUCOS has been prepared, and has been discussed at PB-OBS before being presented to EUMETNET Council. A drafting group for a centralised data hub

has resumed work.
EUCOS continued to be represented in international organisations and related programmes at GEO, GMES and WMO.

2.1. 2007 EUCOS Network

The EUCOS network design has broadly been fully implemented during the 2002-2006 operational phase. In 2007 no major changes have been made.

Table 1 summarises the 2007 EUCOS Network. The radiosonde station Zagreb of the new member Croatia and the radiosonde station De Bilt have been added to the station list. The surface station list has been updated and 209 stations instead of 195 stations (in 2006) were monitored by the EUCOS team. All other networks had no increases in station number. A preoperational test of observation targeting started in 2008 (PREVIEW DTS trial).

EUCOS 2007		
Oceanic segment	Ocean platforms	OWS "M" (4 RW/day) and Ekofisk oil rig (2 RW/day) 2,028 TEMPs in 2007
	ASAP units	16 units operated by E-ASAP producing 4,032 TEMPSHIPs in 2007
	Data Buoys	89 Drifting Buoys operated by E-SURFMAR
	Moored Buoys	4 moored buoys operated primarily for satellite calibration purposes by E-SURFMAR
	Ships	On average 408 conventional VOS ships providing 301 daily observations and 69 automated VOS providing 799 daily observations operated by E-SURFMAR
Aeronautic segment	AMDAR units	12,750,000 AMDAR observations. On average 753 daily profiles from 112 European Airports and 389 aircraft.
Territorial segment (under revision)	Radiosonde stations	52 stations selected based on a 500 km spacing, providing 2 RW/day 34,967 TEMP in 2007
	Surface stations	209 surface synoptic stations selected according to a 250 km spacing, providing hourly or 3 hourly reports 1,329,069 SYNOPs in 2007
Observation Targeting	ASAP, AMDAR	Season and area variable deployment and activation
	Other systems	To be defined according to the results from the studies programme

Table 1: 2007 EUCOS network.

2.2. 2007 Network Performance

A summary of the network performance during 2007 compared with the EUCOS performance targets is provided in Table 2.

2007 Network	Data availability	Timeliness HH+50 *	Timeliness HH+100*	Achieving 100 hPa	Achieving 50 hPa	Individual targets subprograms
Surface stations	**Target: 95% 93%**	**Target: 90% 97%**	**Target: 95% 100%**	---	---	---
Radiosonde stations	**Target: 95% 91%**	**Target: 50% 72%**	**Target: 95% 90%**	**Target: 97% 97%**	**Target: 95% 89%**	---
ASAP units	---	**Target: 50% 65%**	**Target: 95% 84%**	**Target: 90% 82%**	**Target: 75% 75%**	**Loss rate Target: max. 20% 23%**
Ocean platforms Average	**Target: 95% 91%**	**Target: 50% 93%**	**Target: 95% 95%**	**Target: 95% 96%**	**Target: 90% 89%**	---
OWS M	96%	96%	98%	99%	95%	
Ekofisk	86%	89%	91%	93%	83%	
E-AMDAR	**Annual target: 12 Mio. obs 12,750,000**	**Target: 90% HH+60: 95% HH+50: 94%**	**Target: 95% 97%**	---	---	***Profile distribution*** **daily profiles Target: 760 753 daily airports obs. Target: 130 112**
Moored buoys	**Target: 90% 94%**	**Target: 90% 100%**	**Target: 95% 100%**	---	---	---
Drifting buoys	**Target: 88% 97%**	**Target: 90% 34%**	**Target: 95% 69%**	---	---	---
VOS ships Average	**Target: 95% 32%**	**Target: 90% 85%**	**Target: 95% 95%**	---	---	---
Conventional (4 obs per day)	17%	79%	94%			
Automated (24 obs per day)	46%	90%	96%			

target achieved
<10% below target
=>10% below target

*: Upper-air data HH+60 and HH+120 January till June 2007, AMDAR data timeliness HH+50 average August till December 2007

Table 2: EUCOS network performance summary 2007. Since 2007 tighter targets exist.

While most components performed well, other components required improvements. Detailed plans to recover targets were agreed; however some highlights for each network component are described in the following subchapters.

2.2.1. E-ASAP

Key figures of the availability and quality in 2007 are:

1. Target of 4640 soundings on the GTS HH+100 from 16 units.
2. 5235 launches on board of the ships (according to the ships' log books).
3. 4032 soundings received on the GTS.
4. 77% efficiency (soundings on the GTS / launches).
5. Mean timeliness < HH+100.
6. Median burst height < 50 hPa.

Figure 1 shows the distribution of bulletins (TEMP A, B, C, and D) in 2007 on a 2°x2° grid without interpolation.

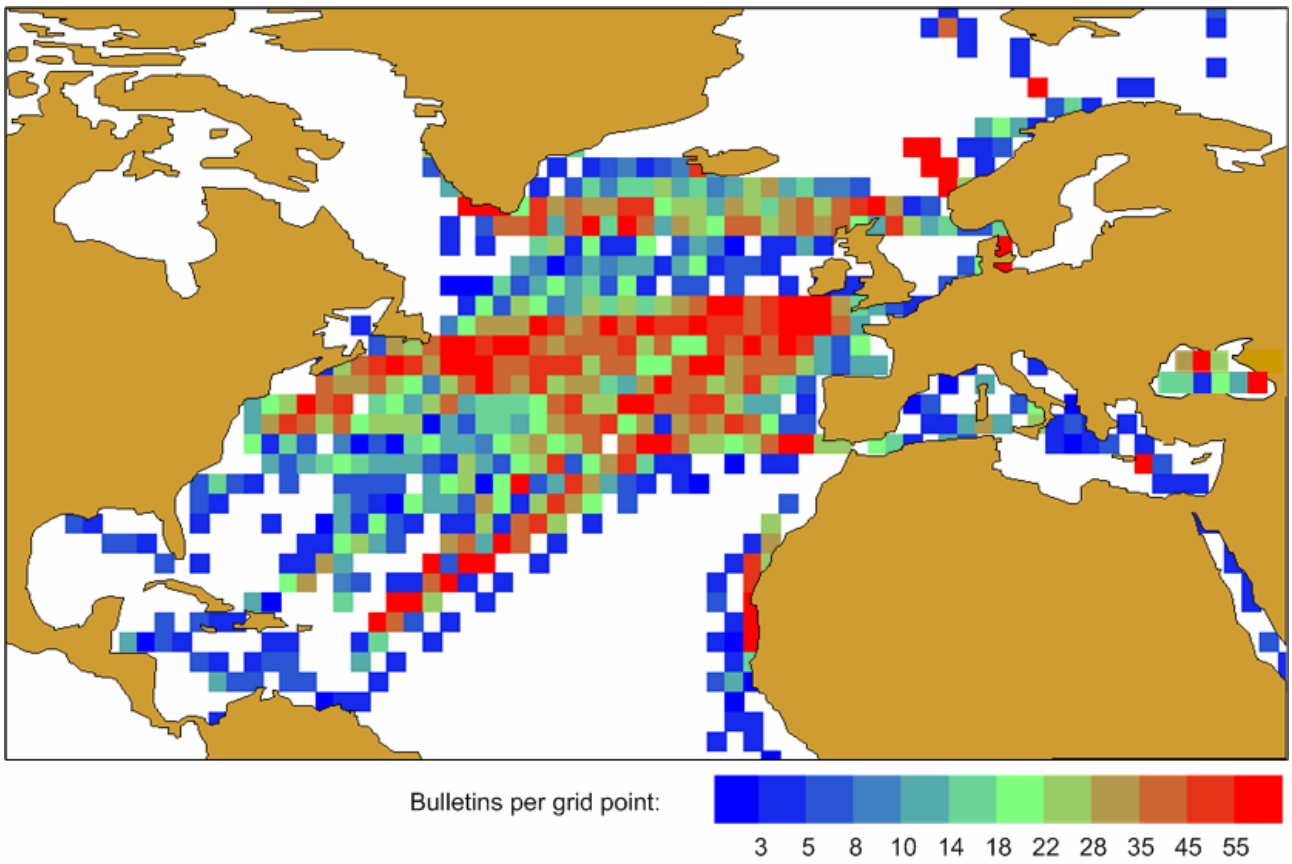

Figure 1: Distribution of ASAP soundings for Jan-Dec 2007.

2.2.2. E-AMDAR

As could be seen from Figure 2, the network continues to grow in terms of number of participating aircraft. Also the number of observations continues to grow. The decrease towards the end of 2007 is the effect of a forced reduction in observations due to a funding problem. In the meantime this problem has been resolved.

The E-AMDAR Programme fulfilled, or exceeded, the targets for timeliness, total number of observations as well as the amount of observation over 'sensitive' EUCOS areas. The targets for total number of daily profiles within the EUCOS area and contribution to WWW were closely met. The targets for number of airports in EUCOS area visited daily and the number of 3-hourly observed airports was not fully met.

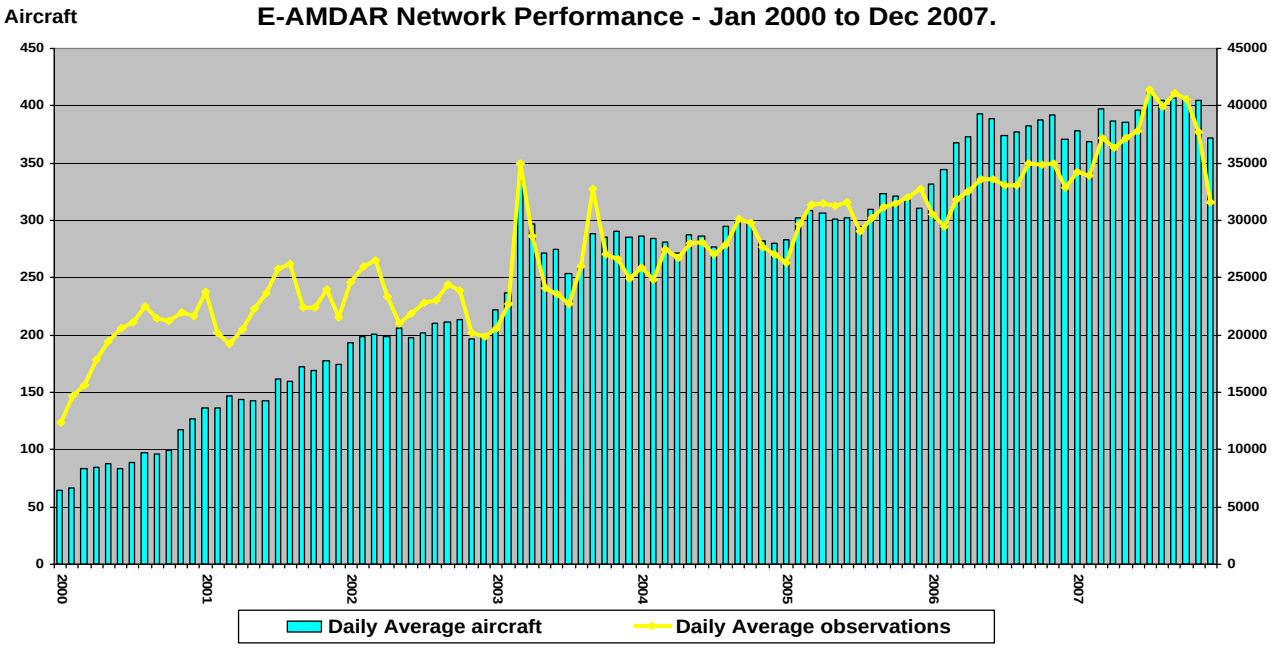

Figure 2: E-AMDAR network performance Jan 2000 to Dec 2007.

2.2.3. E-SURFMAR

Voluntary Observing Ships

The number of 'manual' observations reported by Voluntary Observing Ships (VOS) continued to decrease in 2007. In last December, an average number of 240 observations per day were received from conventional "EUMETNET ships" sailing into the EUCOS area, against 310 ones year before (-23%). This decline is mainly linked to the decrease of port meteorological activities at different NMSs.

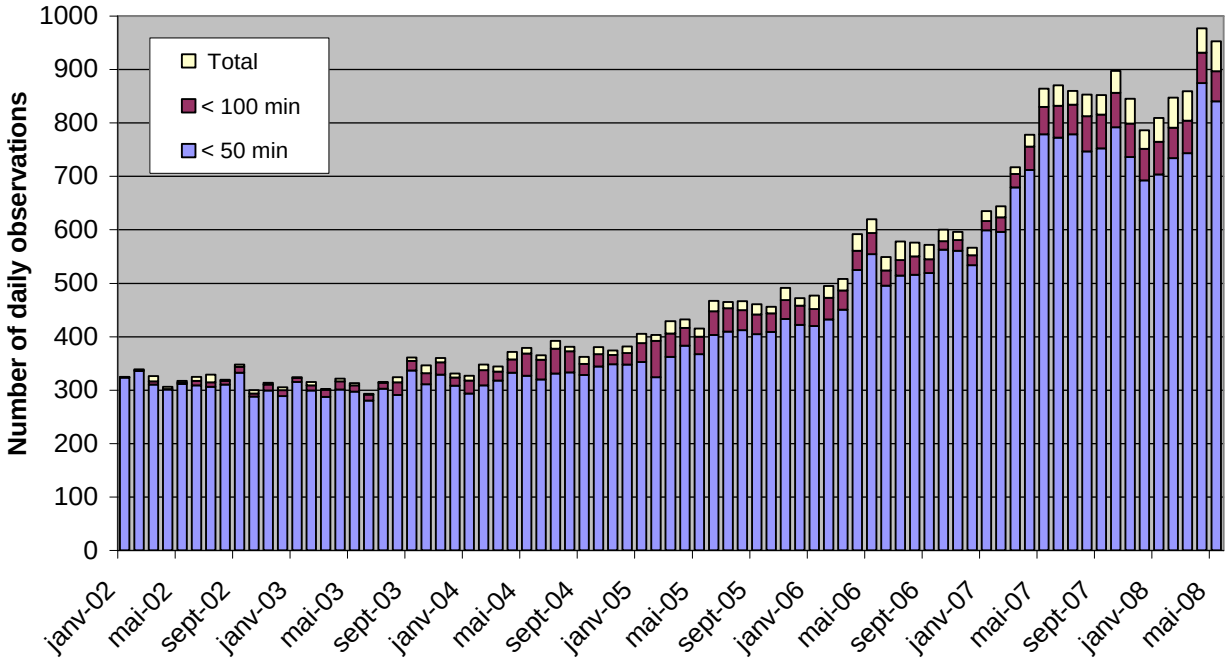

Figure 3: EUMETNET automated VOS, data availability and timeliness, average number of observations per day.

During the same time, the number of automated weather observations increased significantly (+39% - 785 observations per day in December 2007 - see Figure 3). This is partly due to more simple Automated Weather Stations (AWS) installed aboard ships. These stations correctly meet EUCOS requirements but they do not satisfy all other demands e.g. such from climatology and nowcasting.

Drifting buoys

Drifting buoys are the main component of E-SURFMAR to provide sea level pressure measurements. During 2007, 76 drifting buoys were deployed in the North Atlantic.

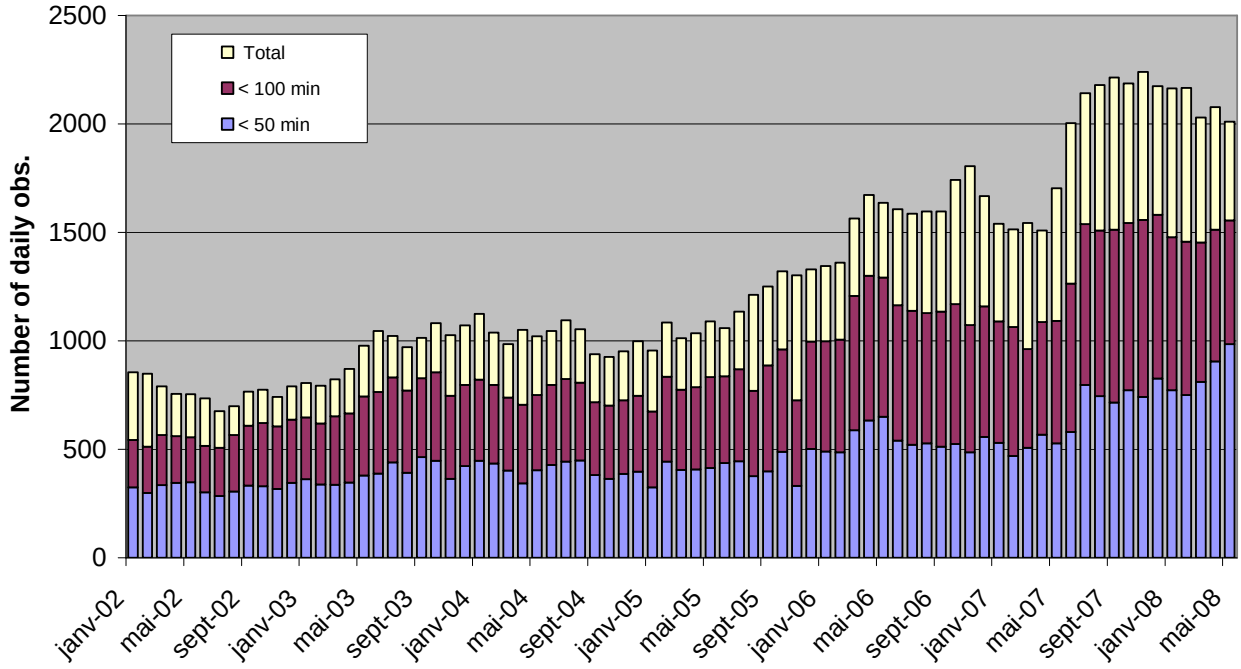

Figure 4: EGOS then EUCOS drifting buoys, data availability and timeliness, average number of hourly observations per day.

In 2007, an average number of 80 drifting buoys were in operation. They delivered about 1900 observations per day (more than 2000 during the second half of the year - see Figure 4). The network was extended north-eastwards through some deployments from Ocean Weather Station Mike. The mean lifetime for the buoys which ceased to operate in 2007, was approximately 12 months.

The timeliness of drifting buoy data was still worse than that of other observational data. Due to the use of the ARGOS system, only one third of the reports were delivered within 50 minutes and another third within the next 50 minutes. This will change with the use of Iridium transmissions: 45 Iridium drifting buoys were ordered to be deployed in 2008.

Moored buoys

The four EUCOS moored buoys correctly worked in 2007, reporting about 33,700 observations at all. The three K-pattern buoys (K5, M6 and Lion) report FM13-SHIP messages whilst Cabo Silleiro reports through BUFR. The replacement of K5 by a buoy providing directional wave spectra was postponed.

2.3. EUCOS website and Quality monitoring

The EUCOS website (www.eucos.net, see Figure 5) contains public accessible general information about EUCOS, describing the EUCOS programme and its structure as well as the different networks and integrated programmes. Information concerning quality monitoring, meetings, documents and protocols is password protected. Related activities, such as quality monitoring of

RA VI observation networks is also accessible via the EUCOS web page but secured by a different password.

Figure 5: Screenshot of EUCOS website.

The EUCOS Quality Monitoring Portal and the RA VI Quality Monitoring Portal, established in August 2007, display monitoring results for surface land stations, radiosonde stations, ASAP units and ocean platforms on a daily and monthly basis. For E-AMDAR statistics of comparisons between AMDAR observations and NWP model output of the COSMO-EU model are delivered. But monitoring results for surface marine observations as well as comparisons between observations and NWP model output for all EUCOS network components are not included until now. The terms and conditions for the EUCOS Quality Monitoring are described in “EUCOS Operational Programme, Performance Standards, Monitoring and Change Control Procedures”.
However, a complete EUCOS Quality Monitoring Portal including monitoring results for all EUCOS networks regarding

- data availability,
- timeliness and
- comparison of observations against NWP model output of COSMO-EU

has been developed during 2008 and will be set live and accessible in autumn 2008. Figure 6 shows a screenshot of a test version of this new quality monitoring web portal.

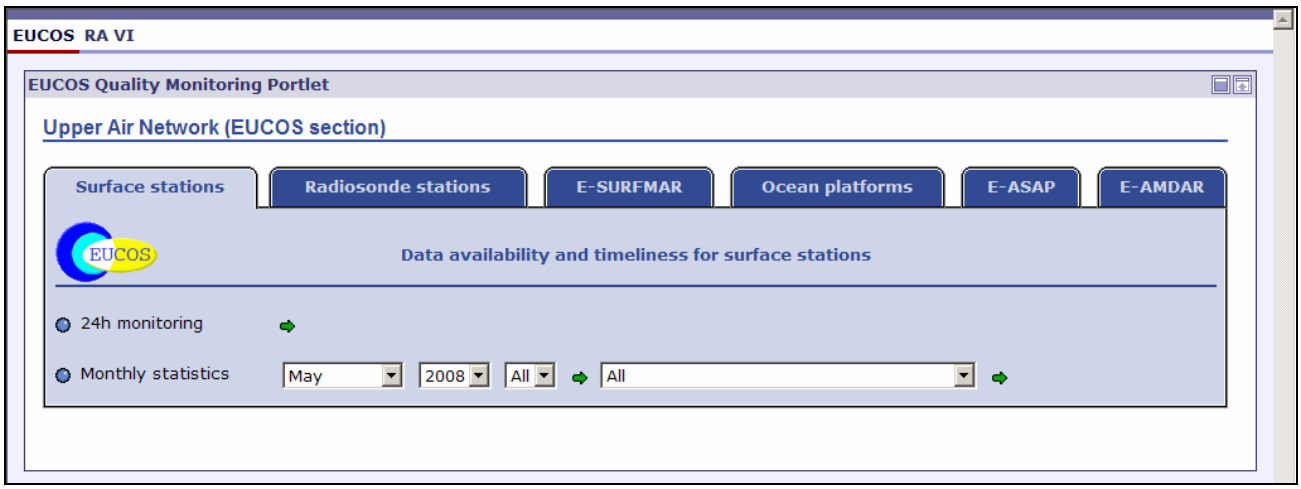

Figure 6: Test version of the new EUCOS/RA VI QM portal.

The information provided in the new portal will be based on the same data as the current EUCOS QM Portal but will present more monitoring results than before. Until the end of 2008 it is planned to present comparisons of observations against ECMWF global model first guess fields.
It is envisaged to provide EUCOS members with monitoring results, which then can be directly downloaded from the QM portal as csv files. Furthermore an extension of the monitoring, covering also the pure 'domestic', i.e. non-EUCOS observation sites of all members, is currently being considered.

With respect to the planned integration of WINPROF into EUCOS as of 2009 the WINPROF Advisory Committee supported the EUCOS proposal to integrate WINPROF monitoring information into the EUCOS QM Portal. Such monitoring results will be made available by the time WINPROF will be integrated into EUCOS at the latest.

2.4. Further programme activities

PREVIEW Data Targeting System

The objective of this activity is to further develop EUCOS data targeting facilities. EUCOS involvement within PREVIEW focuses on automating many aspects of the data targeting process by means of a pilot project, providing the tools and facilities necessary to streamline the decision making process required to support operational adaptive observing. The Met Office is leading the DTS project, partnering with ECMWF, which developed the web-based solution and currently is hosting the system on its website. Experience from the Atlantic THORPEX Regional Campaign (A-TReC) strongly influenced the design of this system. The project is 50%/50% funded by the EUCOS Studies Programme and the EU, through the GMES Programme. The prototype development and a corresponding trial had been finalised in 2007. During 2008 an 11 months trial runs from February until December.
The project is progressing according to schedule. The prototype trial demonstrated that the DTS is a very straightforward and user-friendly tool. There is a good level of participation from EUCOS members, 18 European Met. Services have agreed to provide targeted observations. In addition MoUs with Bermuda and Canada have been signed. The USA agreed in principle to deliver targeted observations. Observations which can be targeted or activated are additional radiosondes (usually 06 and 18 UTC) from land-based sites, E-ASAP radiosoundings and sub-3-hourly E-AMDAR data.
From 4th February until 22nd April 2007 102 cases have been proposed, whereof 99 have been accepted.

Extra observations were requested in the above mentioned time period from 42 cases,

- 201 observations requested (including AMDAR)
- 155 observations requested (excluding AMDAR)
- 110 extra observations deployed (excluding AMDAR)

THORPEX and related activities
The EUCOS Programme Manager continues to provide the link between EUMETNET and THORPEX activities through the International Core Steering Committee (ICSC). The interest in additional observations to be conducted by EUCOS Members for special campaigns like COPS, ETReC 2007 and T-PARC is co-ordinated through this contact.
During the summer months June to August 2007 the COPS field phase and the ETReC 2007 campaign took place. Targets of COPS were, to get a deeper insight in the processes connected with convective precipitation events, to try out new observation instruments and to test and to evaluate especially for the convective/kilometre-scale developed numerical weather prediction models and their assimilation systems. ETReC 2007 was a regional campaign of THORPEX, which aimed at a more thorough investigation of targeted observations. EUCOS organised the support for these two international experiments. This support consisted of about 500 additional radiosoundings, which have been carried out by DWD, KNMI, Meteo-France, MeteoSwiss, and the Met Office. Furthermore, E-AMDAR provided additional hourly aircraft measurements at a number of airports located in the COPS and ETReC 2007 areas of interest.

MEDEX
MEDEX is a Mediterranean project focused on cyclogeneses and high impact weather in and around the Mediterranean area. Regarding its scientific objectives MEDEX looks like regional application of THORPEX. The EUCOS Programme Manager is a member of the MEDEX Core Steering Committee (CSC) and the CSC reports to WMO through THORPEX. In the short and medium term some low intensity campaigns are envisaged during the autumn and winter seasons where EUCOS is requested to deliver extra radiosonde and maybe also aircraft observations e.g. during the winter 2008/2009. During these campaigns, the preoperational PREVIEW Data Targeting System could be used as an operational tool to aid research. In the long term, it is envisaged that the MEDEX Phase 2 activities would culminate in a major Mediterranean campaign in 2010 or 2011.

WMO
EUCOS contributed to the “International Polar Year” by delivering additional observations. The programme manager of E-ASAP and the EUCOS Operations Manager have organised additional land-based radiosonde, dropsonde as well as ASAP-measurements during the Greenland Flow Distortion Experiment (GFDex) from 19th February until 10th March 2007. The E-SURFMAR PM organised the deployment of additional ice buoys in the Arctic during IPY.

Furthermore, the EUCOS Programme Manager is a member of the CBS IOS Expert Team on the Evolution of the Global Observing System and is chairman of the RA VI Working Group on the Planning and Implementation of WWW.

3. EUCOS Studies Programme

3.1. Motivation for impact studies

In order to fulfil the EUCOS objective to design and coordinate the evolution of the ground based EUMETNET composite observing system a periodic review of user requirements and external drivers and developments becomes necessary. As an external driver can be considered the fact that the different observing networks evolve differently (e.g. regarding availability, accuracy, cost, etc.). Another external development is the ongoing improvement of data assimilation algorithms, which can make use of more and more observational data. A potential outcome of the review process could be that a modification of the meteorological observing network becomes necessary.
When aiming for changes in the observing network EUCOS needs approval from PB-OBS and EUMETNET Council respectively. In order to get the 24 Members convinced of such changes it was decided to base them on scientific analyses. A favourite means is to run observation system experiments (OSE) or impact studies and to derive general design principles from the outcomes of these experiments.

3.2. Space-Terrestrial Study and recommendations derived from it

During the EUCOS programme phase 2002-2006 the EUCOS management proposed to run a so-called Space-Terrestrial Study. The motivation was to assess and clarify several findings and conclusions like the fact that historically the planning of the space and terrestrial components of the composite observing system had proceeded largely independently and that the timescales for implementation of these programmes vary enormously ranging from decades for the space component to months or even a few weeks for some elements of the terrestrial component. Furthermore there was the feeling that there is a need to better understand the relative contribution of both components so that the total system may be progressively optimised and that there was also a need in particular to define the impact of the additional data from the EUCOS Programme at that point of implementation in 2005.

When setting-up the study the approach taken had been to seek co-ordinated studies sponsored by both EUMETSAT and EUMETNET (EUCOS) in order to achieve a comprehensive set of results. Both EUMETNET and EUMETSAT Councils had approved the programme of work and the associated initial funding. EUMETSAT was funding ECWMF to consider the space contribution and EUCOS was funding ECMWF, Met Office, DMI, met.no and OMSZ to study the terrestrial components. Thereby the varying assimilation schemes models etc were regarded as strength. The differing approaches reflected the need to understand the contribution of the elements of the space component when added progressively to the total terrestrial component and vice versa. Finally, it was hoped that most of the results would be available during 2006 to guide the further evolution of EUCOS in the timescale 2007-2011 and space programmes in the longer term.

The five NWP centres: ECMWF, Met Office, DMI, met.no and OMSZ, which carried out the S-T study, agreed on common OSE scenarios, time periods, verification procedures and presentation styles.
The experimental set-up for the OSEs was as follows. Two periods were selected: Winter, 14th December 2004 to 27th January 2005 (44 days) and Summer: 15th July 2005 to 15th September 2005 (63 days). Forecast runs were started at 00UTC and 12UTC. The following scenarios were defined:

- Baseline: all current satellite observations used in NWP (radiances, cloud-drift winds, scatt winds) + GUAN radiosonde network + hourly GSN surface land data + hourly buoys (no ship data);
- Control: full combined observing system;
- And different additions to the Baseline (radiosondes, wind profiler, aircraft measurements).

After a presentation of results a discussion within the EUCOS Scientific Advisory Team (E-SAT) in May 2007 lead to the following general recommendations, thereby keeping in mind that the individual results vary depending on season (winter or summer), type of assimilation scheme and numerical model:

- Compared to Baseline all additional ground based observing systems have a positive impact on the forecast skill. On top of the additional available satellite data further improvements of the ground based observing system are important.
- The radiosonde network is still the most important component of the ground based upper-air observing network. Any further reductions of the current radiosonde network should be evaluated by an OSE.
- NMSs are encouraged to move to BUFR for Radiosonde messages and make full use of increased vertical resolution profile data.
- E-ASAP shows a positive impact on the forecast. A compilation of studies made 10 years ago showed that a minimum of 10-15 systems are needed in the Atlantic Ocean to show any significant impact in NWP. E-SAT proposes reactivating of the existing 2 French and 1 Danish units.

- The 6 remote island radiosonde stations (Heraklion (Crete), Lajes (Azores), Funchal (Madeira), Tenerife, Jan Mayen and Torshavn (Faroe Islands)) are seen as important part of the EUCOS radiosonde network, as long as no 3-hourly aircraft measurements are available at those locations.
- The impact of aircraft measurements is significant and second largest. The E-AMDAR optimisation systems should be developed further to get a more homogenous distribution of profiles in space and time. More airlines should be incorporated to get 3-hourly observations from more European airports.
- AMDAR humidity is seen as a high priority project.
- Having now more than 15 wind profiler systems being assimilated in NWP models the impact on regional forecast models should be evaluated again.
- Weather Radar Wind Profiles are available from more than 80 sites. NWP centres are encouraged to monitor the data and work towards operational assimilation.

3.3. EUCOS upper-air network redesign

The original EUCOS upper-air network design was prepared in 2000 in order to define a set of stations serving the common general NWP requirement. Additional considerations were to make it possible to supply a common set of performance standards across the territory of EUMETNET Members and to ensure that the radiosonde network interleaved with AMDAR airports.

The EUCOS upper-air network now requires a redesign because of several reasons. There is a need to take into account the significant evolution of the AMDAR network. Member states were not able to install the proposed EUCOS radiosonde network design with 4 ascents per day at most of the sites. The results from the Space-Terrestrial Study are available with recommendations for the network design. Data assimilation of NWP models has improved significantly with advanced capability to make use of high time resolution data. A subset of the wind profiler network has achieved operational status and the data are used operationally in the different NWP models. Wind measurements from Doppler weather radars are available which are used in the data assimilation of the Met Office numerical model, and monitored at other NWP centers. Water vapour measurements from the GPS networks are available.

The main objective for the proposed study is the definition of a European-wide network of ground-based upper-air observing systems whose configuration and setting is based on scientific analyses rather than on a simple merging of historically grown national networks. The S-T study has shown that despite of all the additional new satellite observations, the degrading of the current terrestrial observing system to a basic (GUAN+GSN) network would have a significant negative impact on the forecast skill.

The expected result from the envisaged OSE is to find an optimum setting of upper-air measurements in space and time which maintains forecast skill. The WMO user requirements for regional NWP are a good basis to start from. Thus, a natural idea could be to configure a set of different networks (in different wording: scenarios), each realising a specific setting of horizontal and/or vertical spacings of observations.

Furthermore, when setting-up the different OSE scenarios the following constraints have to be considered. The experimental set-up should start with the baseline, as specified in the Space-Terrestrial Study to have the connection with this study. The control run should be the full combined operational system. The S-T study has shown that the radiosonde network is still the most important component of the ground based upper-air observing network. In addition the study demonstrated that the impact of aircraft measurements is significant and second largest. Therefore, at sites where 3-hourly AMDAR profile measurements are available with a collocated radiosonde (having a spacing less than 20 km), the radiosonde station will not be included in the upper-air design. The 6 remote island radiosonde stations (Heraklion (Crete), Lajes (Azores),

Funchal (Madeira), Tenerife, Jan Mayen and Torshavn (Faroe Islands)) are seen as important part of the EUCOS upper-air network, as long as no 3-hourly aircraft measurements are available at those locations. The marine upper-air observing network is below or near the threshold to show an impact on the forecast skill. Therefore all ASAP measurements together with the radiosonde profiles from weather ship Mike and the Ekofisk platform will be included in all experiments. The main application of Doppler weather radar is in the area of nowcasting for the management and issuing of warnings. The wind profiles are a by-product delivering a contribution to the upper-air network. It can be seen as an enhancement of observations in high impact weather situations.

The following OSE scenarios are agreed:

Scenario no 1: Baseline:
All current satellite observations used in NWP (radiances, cloud-drift winds, scatt winds) + GUAN radiosonde network + GSN + hourly buoys (no ship data);

Scenario no 2: Control run:
All currently available data in the EUCOS area.

Scenario no 3a:
Experiment with horizontal spacing of 100 km for profiles.
Baseline + terrestrial RaSo stations with 100 km horizontal spacing, thereby excluding RaSo stations if 3 hourly AMDAR measurements are available at those locations + AMDAR data with 100 km horizontal spacing, SHIP, BUOY, ASAP, WRWP, WP data

Scenario no 3b:
The same as for 3a but keeping 0 UTC radiosonde ascents at those sites which are excluded in scenario 3a because of the vicinity to an airport

Scenario no 4:
Experiment with horizontal spacing of 250 km for profiles from radiosondes and aircraft.

Scenario no 5:
Experiment with horizontal spacing of 500 km for profiles from radiosondes and aircraft.

Several NWP centres assured their participation in the proposed study and they agreed again on common time periods, verification procedures and presentation styles.

As agreed with the EUCOS - Scientific Advisory Team (E-SAT), the upper-air network redesign OSE will be conducted until end of June 2009 and the proposals for a revised EUCOS upper-air network will be co-ordinated with relevant bodies before being recommended for implementation.

3.4. Future plans for OSEs

EUCOS currently plans to run further OSEs during the current programme phase 2007-2011. These are an E-SURFMAR network design study (to be run in 2008/2009), an evaluation of the EUCOS/PREVIEW Data Targeting System Trial Phase by running data denial studies (to be carried out in 2009) and a second Space-Terrestrial Study investigating the benefit of the additional satellite data from METOP (to be conducted in 2009-2010).

4. Programme Outlook

4.1. EUCOS

The EUCOS Management Team will continue to manage and co-ordinate the delivery of the EUCOS Programme in close collaboration with the managers of the integrated programmes. The development of the integrated programme components will be supported, e.g. the addition of humidity measurements to E-AMDAR observations and the complete integration of WINPROF into EUCOS are of high importance. Furthermore, an operational Data Targeting System to be continued after the trial phase and a EUMETNET Centralised Monitoring and Production Programme, integrated as DCPC in the future WMO Information System, will be proposed to the EUMETNET Council in autumn 2008. The EUCOS team will continue to contribute to the PB-OBS Working Group on Observations Strategy and will continue developing new programmatic objectives in consideration of the strategies developed for EUMETNET and PB-OBS.
The EUCOS Programme Manager was nominated by Council to represent EUMETNET in the work of the GMES ISOWG Support Group. The Support Group should advise the Implementation Groups of the GMES fast track services and the atmosphere pilot project on the practicability of their proposals.
The Quality Monitoring Portal will be further developed to include a monitoring of WINPROF observing systems and to deliver comparisons of observations with the ECMWF model.
The EUCOS Programme Management Team will continue to manage the Studies Programme to ensure that:

- The upper-air network redesign OSE will be conducted until spring 2009;
- Proposals for a revised EUCOS upper-air network will be co-ordinated with the “EUMETNET Working Group on EUCOS Radiosonde Network”;
- Further requested OSEs on the wind profiler and the surface marine network are coordinated with E-SAT;
- The PREVIEW DTS trial will be evaluated.

4.2. E-ASAP

The current fleet of 15 ships will be extended by two French, one Danish, and one Icelandic ship. Satellite communication will be switched to Iridium which allows transmitting a BUFR message at the same price as a TEMP message (25 Kbyte BUFR file compared to 3 Kbyte TEMP file).

4.3. E-AMDAR

Negotiating with airlines in order to fill the data scarce areas and refinement of the flight selection system are means to get a more even data distribution. The Humidity trial continues by installing the re-engineered version of the WVSS-II sensor in Lufthansa aircraft during summer 2008. Assuming that the sensor will perform to our satisfaction preparations for a first operational phase have to be initiated.

4.4. E-SURFMAR

VOS ships: Twelve simple AWS stations (Baros) will be built by Meteo-France in 2008 and installed aboard E-ASAP ships as a matter of priority. A Task Team on AWS was set up in March 2008. The main purpose is to define and agree on specifications which can be used in calls for tender for the procurement of AWS for use on observing ships recruited by E-SURFMAR participants.
A VOS metadata database has been developed by E-SURFMAR. Available on the Web, it will allow VOS operators to enter the metadata of their ships online when operational (planned in June 2008). This database will facilitate the making of XML metadata files for WMO.
Drifting buoys: The deployment of drifting buoys will continue with an extension in the north-east of the North Atlantic; an area where a lack of air pressure measurements is evident.

References:

EUCOS PMT and PMs: “EUCOS Operational Programme, Performance Standards, Monitoring and Change Control Procedures”, EUCOS/PRG/102, Version 4.3, 25th June 2007.