

Update on observation impact studies coordinated by EUCOS and plans for future studies

5th WMO Workshop on the Impact of Various Observing Systems on NWP Sedona, AZ, United States, 22-25 May 2012

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Content

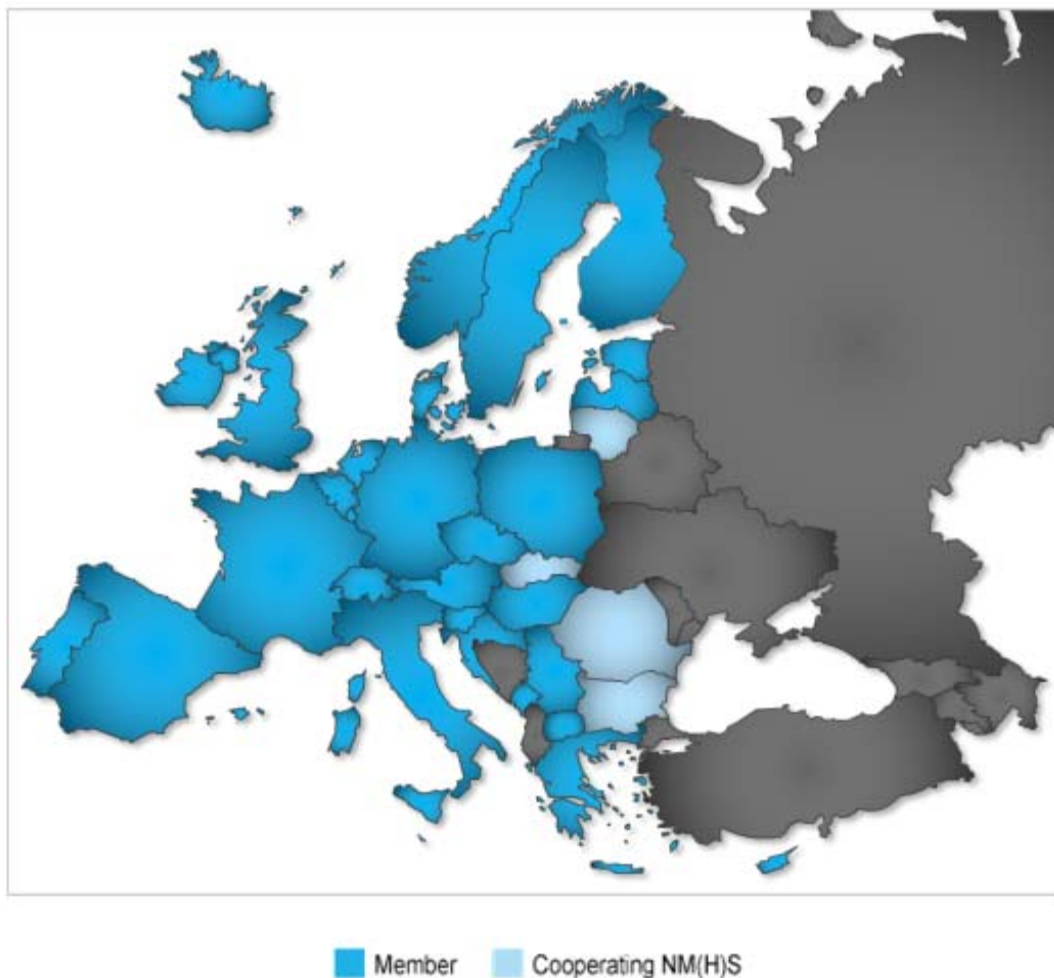
- **About EIG EUMETNET and EUCOS**
 - EUCOS objectives
 - The current EUCOS network
- Motivation for impact studies
- Upper-Air Network Redesign UANR
 - Recommendations
- 2nd space Terrestrial study
- AMDAR q/TAMDAR study

About EIG EUMETNET and EUCOS

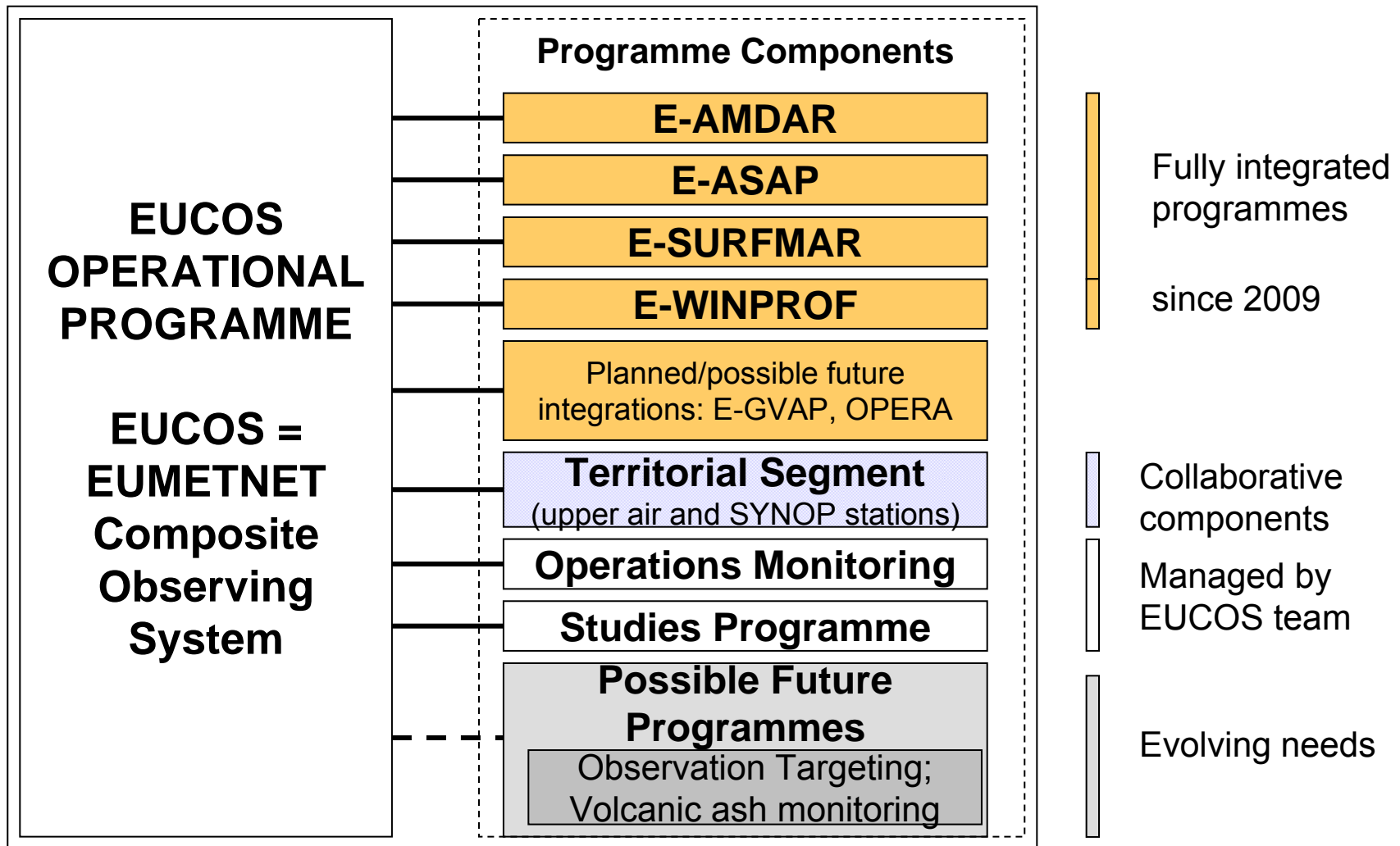
EIG (**E**conomic **I**nterest **G**rouping) EUMETNET is a grouping of 29 European National Meteorological Services

that provides a framework to organize co-operative programmes between its Members in the various fields of basic meteorological activities.

These activities include observing systems, data processing, basic forecasting products, research and development and training.



About EIG EUMETNET and EUCOS



About EIG EUMETNET and EUCOS

EUCOS programmes, in future called operational services,

Fully integrated:

- E-AMDAR EUMETNET Aircraft Meteorological Data Relay
- E-ASAP EUMETNET Automated Shipboard Aerological Programme
- E-SURFMAR EUMETNET Surface Marine Programme
- E-WINPROF EUMETNET windprofiler network

Integrated in the next phase from 2013 on:

- E-GVAP *EIG EUMETNET GNSS Water Vapour Programme*
- OPERA Operational Programme for the Exchange of Weather Radar Information

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EUCOS objectives – in the current phase

- Ensure integrated management for agreed components such as E-ASAP, E-AMDAR, E-SURFMAR and E-WINPROF
- Monitor and control the EUCOS performance (EUCOS Quality Monitoring portal: www.eucos.net)
- Design and coordinate the evolution of the ground based EUCOS to be optimized at European scale with a view to improve short range forecast over Europe without increasing the overall cost
- Support the evolution of EUCOS through a studies programme

EUMETNET Observation Goals

Defined in the EUMETNET Roadmap 2011.

O1: EUMETNET will develop an integrated composite observing system for Global, Regional and 1 km Scale Convection resolving Models and for Climate, building on existing infrastructure.

O2: EUMETNET will ensure that observational and climate data gathered by the composite observing system will be of appropriate quality to meet the requirements of NWP and climate by working with Members to share and implement best practice and methodologies within the system.

EUCOS development

The EUCOS Team together with the PMs of the observation programmes were highly involved in the

- EUMETNET Observation Roadmap development for the period 2012-2020 during the year 2011 and
- will continue to be involved in the drafting of the Observation Programme Requirements for the next programme phase 2013-2017 during the first half of 2012.
- The latter will belong to the tender documents and thereby serve as a basis for the programme proposals for the next programme phases.

Future Priorities for the Observation Programme

Observations Roadmap 2012-2020 high-level activities:

- radar activities,
- standardization of surface weather stations and
- improvement of vertical profile measurements which are of highest importance for Members.

Especially the latter item has several aspects:

- improvement of vertical resolution,
- improvement of horizontal coverage and
- general investigation of new upper air observing capabilities.

Priorities for the Observation Programme

- To foster the OPERA developments in order to be able to produce quantitatively usable 2D radar products and to exchange single site 3D volume data (reflectivity, Doppler winds) by the end of the programme phase;
- To further expand the E-AMDAR Operational Service by trying to extend the horizontal coverage over the EUCOS area and by considering a further roll-out of humidity sensors on board E-AMDAR aircraft;

Priorities for the Observation Programme

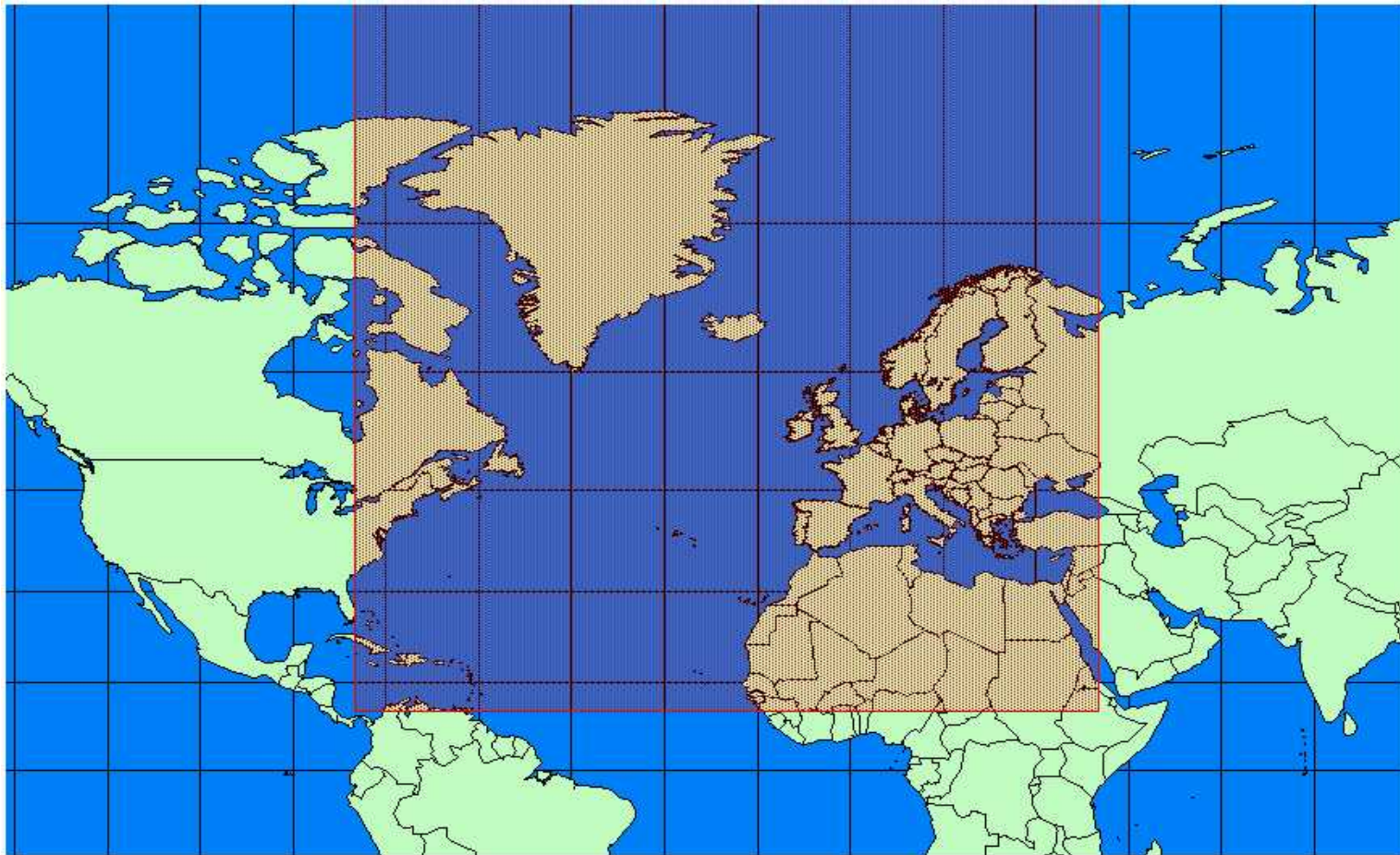
- To extend the remit of the E-WINPROF Operational Service with the aim to include Lidar/Ceilometer Observations for the main purpose of volcanic ash monitoring (with the new name E-Profile, as a consequence of the eruption of Eyjafjallajökull in April 2010 which grounded the complete European air traffic) and
- To improve the user consultation process with data users from the Climate and Forecasting Programmes and Members via the central Observation Programme and its Scientific Advisory Team E-SAT.

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EUCOS area (10N-90N, 70W-40E)



The current EUCOS network

- All European ships of the Automated Ship Aerological Programme ASAP (currently 18 ships)
- All measurements from European commercial aircraft (AMDAR)
- Selected moored buoys and all European drifting buoys
- European Voluntary Observing Ships VOS
- Selected European radiosonde stations (incl. Ekofisk)
- Selected European synoptic weather stations
- Selected European wind profilers (+ wind profiles derived from weather radar data)

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Motivation for impact studies

(External) drivers and developments:

- Different observation networks evolve differently (e.g. regarding availability, accuracy, cost, ...)
- Data assimilation algorithms improve and can make use of more data

EUCOS objective:

- Design and coordinate the evolution of the ground based EUMETNET composite observing system (EUCOS) to be optimized at European scale with a view to improve short range forecast ...

→ A modification of the meteorological observing network might become necessary

- EUCOS needs approval for network changes or modifications from STAC/PFAC and EUMETNET Assembly respectively

In order to get the 29 Members convinced of such changes it was decided to base them on scientific analyses (e.g. impact studies)

Motivation (1)

- Definition of a European-wide network of ground-based upper-air observing systems for regional NWP requirements
- EUCOS upper-air network design for the previous programme phase 2003-2006 comprised of:
 - 50 selected radiosonde stations operated by Members,
 - The E-AMDAR network (3-hourly profile sites),
 - and was based on the WMO guidelines from 1999.

Motivation (2)

- The EUCOS upper-air network now requires a redesign because:
 - Of the need to take into account the significant evolution of the AMDAR network;
 - Members were not able to install the proposed EUCOS radiosonde network design with 4 ascents per day at most of the sites;
 - Results from the Space Terrestrial Studies 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.

Motivation (3)

- The expected result from the envisaged OSE is to find an optimum setting of upper-air measurements in space and time which maintains forecast skills.
- 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 (scenarios), each realising a specific setting of horizontal and/or vertical spacing of observations.

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OSE scenarios (already showed by Andras)

- **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:** All currently available data in the EUCOS area
- **Scenario no 3a:** Experiment with horizontal spacing of 100 km for profiles. Control “–” those land-based radiosondes which are beyond a network with 100 km horizontal spacing, thereby replacing radiosonde sites with AMDAR data if 3-hourly AMDAR measurements are available at those locations

OSE scenarios

- **Scenario no 3b:** The same as for 3a but keeping 0 UTC radiosonde ascents at those sites which are replaced 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; all other settings like those of scenario 3a.
- **Scenario no 5:** Experiment with horizontal spacing of 500 km for profiles from radiosondes and aircraft; all other settings like those of scenario 3a.

E-SAT UANR conclusions and recommendations

E-SAT stands for EUCOS scientific advisory team which usually meets once per year. The E-SAT group consists of people from different NMSs working on NWP issues and members of ECMWF.

Chairman of E-SAT is Erik Andersson.

E-SAT UANR conclusions (1)

Conclusions from the EUCOS upper-air network redesign study

- The OSE studies concerning the EUCOS upper-air network redesign (UANR) were conducted with the global model of ECMWF and the limited area models of OMSZ and several HIRLAM members. In general the experiments show similar results.
- In agreement with the previous Space-Terrestrial study the baseline scenario shows a significant and the strongest reduction in forecast skill.
- Scenarios 3a and 3b which removed radiosonde sites collocated to 3-hourly visited E-AMDAR airports show almost no degradation in forecast skill. Results from OMSZ' regional model show better results for a scenario where 0 UTC radiosonde observations –in vicinity to airports- are kept.

E-SAT UANR conclusions (2)

Conclusions from the EUCOS upper-air network redesign study

- Further thinning of upper-air observations to 250 km or 500 km spacing show a significant degradation of forecast skill for most parameters, and for summer and winter periods.
- When thinning radiosonde observations the parameter most negatively affected is relative humidity in lower troposphere.
(see presentation from Andras Horanyi yesterday)
- Biases are observed between radiosonde and AMDAR temperature measurements. More investigations are needed to correct biases of AMDAR observations.

E-SAT UANR recommendations

Recommendations derived from the EUCOS upper-air network redesign study

- A collocation of operational radiosonde observations and 3-hourly AMDAR profile measurements should be avoided. Scenario 3b is recommended for implementation.
- Humidity information in the lower troposphere should not be degraded, E-SAT therefore recommends to improve the coverage of lower tropospheric moisture observations.
- E-SAT recommends to work towards a horizontally more homogeneous distribution of upper-air observing sites.

EUCOS upper-air network redesign - actions (1)

EUCOS proposed to work towards a denser network of upper-air observations by defining the following actions:

- Definition of a combined radiosonde and E-AMDAR network comprising of
 - 90 operational radiosondes of EUMETNET members
 - 60 airports – visited 3-hourly by E-AMDAR aircraft
- EUCOS recommends to review within the NMSs the requirements for 12 UTC radiosoundings at RS sites close to airports

EUCOS upper-air network redesign - actions (2)

- EUCOS recommends to fill gaps in the European upper-air network where the average distance of profiles still exceeds 100 km.
- EUCOS recommends to work towards a denser network of humidity profile measurements in the lower troposphere.

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EUCOS Studies Programme

2nd S-T study on the impact of future developments of the space based and ground based observing system on NWP (I)

- Focus on: impact of reduced ground based observations on correction of satellite observation biases
- work at ECMWF started 1st Sep 2010
- Presentation at E-SAT meeting in April 2012 in Reading
- E-SAT will have to discuss the results and derive recommendations for EUMETNET/EUCOS in summer 2012 (Erik's presentation on Tuesday)

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AMDAR q/TAMDAR study

A Business Case for AMDAR q/TAMDAR investment is required.

Key questions to inform the business case:

1. Does it make sense to install more WVSS-II?
2. Is TAMDAR an alternative to E-AMDAR observations or is it complementary to E-AMDAR?
3. If WVSS-II or TAMDAR sensors have beneficial impact to NWP forecast skill, how many sensors should be installed?

AMDAR q/TAMDAR study further usage

EUMETNET won the SESAR JU (Single European Sky ATM Research Joint Undertaking) invitation to tender for a sub work package of WP 11 'Flight and Wing Operations Centres / Meteorological Service'. Part of this work package is WP WP11.02 which is divided into two projects:

P11.02.01 and P11.02.02.

The scope of P11.02.02 is to develop the MET infrastructure & services.

Task 11.2.2.1: Met Prototype Specification, Development & Verification has a sub task called X2.2 E-AMDAR humidity observations

AMDAR q/TAMDAR study

For 2012 an AMDAR humidity and TAMDAR study is planned. The study shall be conducted over the USA because a sufficiently dense network of AMDAR humidity and TAMDAR observing systems is available only in this region.

The results shall help to configure an optimized EUCOS upper air network comprising of

- radiosondes,
- a number (to be defined) of humidity sensor equipped E-AMDAR aircraft
and possibly
- TAMDAR equipped aircraft as well.

AMDAR q/TAMDAR study

Scenarios:

1. Baseline (as control run), satellite, screen level obs (SYNOP, buoy, ship, METAR,..), radiosondes, AMDAR
2. Baseline + 50% of AMDAR q
3. Baseline + AMDAR q
4. Baseline + TAMDAR
5. Baseline + AMDAR q + TAMDAR
6. Baseline + AMDAR q but RS blacklisted at airports
7. Baseline + AMDAR q + TAMDAR but RS blacklisted at airports

AMDAR q/ TAMDAR study

Scenarios:

8. Baseline + near surface precipitation rate

9. Baseline + AMDAR q + TAMDAR + near surface precipitation rate

10. Baseline + ground-based GNSS

11. Baseline + AMDAR q + TAMDAR + ground-based GNSS

Scenarios 8 to 11 are optional as they aim at assessing the impact of non-standard, non-aircraft moisture related observations

AMDAR q/ TAMDAR study

The scenarios have been presented at the last E-SAT meeting in April 2012. At the moment they are in discussion, a final decision shall be made in a few weeks.

As soon as possible the study shall be started, so that in one year at the next E-SAT meeting in spring 2013 first results are available.

Questions and answers

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EUCOS Information System (www.eucos.net)



EUMETNET
The Network of European Meteorological Services

Referenz für Meteorologie



Deutscher Wetterdienst

EUCOS public

- About EUCOS
- EUCOS networks

EUCOS restricted

- EUCOS HL reports
- E-AMDAR
- E-ASAP
- E-SURFMAR
- WINPROF
- Quality Monitoring
- Studies Programmes
- Meetings
- Documents, Protocols

Related Activities

- WG-INS
- WG-RS
- EUMETNET radiosonde
- RA VI Monitoring

› EUCOS public

EUCOS Information System



The **EUMETNET Composite Observing System (EUCOS)** Operational Programme was established in 2002, based on recommendations resulting from the EUCOS Implementation Programme (1999-2001). It aims to establish and operate a truly European observing network under the auspices of the European Meteorological Network (EUMETNET), to deliver increased efficiency, leading to better-quality numerical and general forecasts, initially on a European scale.

The EUCOS Programme Management 2002-2006 rested with the Met Office, UK. Currently the Deutscher Wetterdienst (DWD) is responsible member of the EUCOS Programme Phase 2007-2011.



This website was established to provide all EUCOS members with necessary background information, documents and quality monitoring results. Due to this most of the topics are restricted by password login. Only general information about EUCOS and its subprogrammes provided under the topics [About EUCOS](#) and [EUCOS networks](#) are open to public. Please contact the [EUCOS Team](#) to receive login details.

News about the EUCOS programme

Last news update:
07.04.2008

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Contact Information

Contact the **EUCOS Programme Management Team at DWD**

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Related programmes and organizations

Links to **EUMETNET, EUMETSAT, OPERA, ECMWF and others.**

› More