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ITEM: 6

**SECOND AD HOC IPET-OSDE WORKSHOP ON
OBSERVING SYSTEM NETWORK DESIGN**

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**EUMETNET MATERIALS THAT COULD BE USED FOR DEVELOPING OSND GUIDANCE
MATERIAL**

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SUMMARY AND PURPOSE OF DOCUMENT

The document provides information on EUMETNET materials that could be used for developing OSND guidance consisting of the intermediate layer of general guidance that lies between the WIGOS OSND Principles and the lower layers of guidance/documentation that apply / will apply to the individual observing system components of WIGOS.

ACTION PROPOSED

The Meeting is invited to note the information contained in this document when considering its recommendations.

DISCUSSION

1. General considerations – How does EUMETNET decide on OSND recommendations?

Different drivers (external and internal) can force NMHSs to reconsidering the design of their different observing networks from time to time. Data users may have interest in getting observations of variables which haven't been monitored so far or users may ask for more (higher density in space and time) observations of a certain variable/element. A typical driver for such requests is the ongoing improvement of data assimilation algorithms which can make use of more and more data.

On EUMETNET level (i.e. sub-RA VI level) a mechanism has been established in order to standardize the process of designing or re-designing parts of the EUMETNET Composite Observing System (EUCOS).

First observation data users make a proposal for more or 'new' observations. In a second step the EUMETNET Observations Scientific Expert Team (Obs-SET; comprising of data assimilation experts) and sometimes also the Observations Programme Advisory Group (OPAG; comprising of national observations managers) consider such proposals and make a decision whether the Observations Programme Management shall coordinate data impact studies which can demonstrate the expected benefit of these new observations. Such data impact studies are considered to be 'objective' tools for the assessment of the impact or benefit of observations. When the advising bodies are in favour of conducting data impact studies the Obs Programme Management Team drafts a study specification and coordinates this with the Obs-SET. This is the third step. After identification of a suitable 'contractor' for the study (e.g. a NWP/ data assimilation section of a Member) the fourth step is the approval of the study proposal by the EUMETNET Science and Technology Advisory Committee (STAC) and Policy and Finance Advisory Committee (PFAC). Step five is the realisation of the study which can take between half a year and two years. Typical durations are between one and two years. E.g. classical Observing System Experiments take longer (usually at least one year) than new 'forecast sensitivity to observations' analyses (can be conducted in a few months in some cases). When final study results are available the sixth step is to analyse these and to agree on relevant OSND recommendations. The analysis of results and the drafting of recommendations are done by Obs-SET. Afterwards the recommendations are presented to STAC for their consideration (step seven). Finally, after a positive STAC decision for following such a recommendation and a corresponding PFAC decision for making available funding (if required) the Observations Programme Management can take measures to start step eight: the coordination and/or procurement of 'new' or more observations. The entire process starting with first ideas up to operational provision with new observations takes on average three years.

On EUMETNET level OSND recommendations are typically formulated in a rather concrete way. Usually Obs-SET aims for agreeing on OSND recommendations which demand for observation of a certain variable but do not prescribe the observing technology for obtaining such measurements.

Example from the EUCOS Upper-Air Network Redesign Study:

"Humidity information in the lower troposphere should not be degraded. It is therefore recommended to improve the coverage of lower tropospheric moisture observations."

Sometimes even the suggested/desired observing technology is specified.

Example from the 2nd EUCOS Space-Terrestrial Study:

"Use drifting buoys to fill gaps where VOS observations are not regularly available."

Further examples of data impact studies coordinated by the EUMETNET Observations Programme Management/ "EUCOS" and some basic description of studies' purposes, contents and their results and derived OSND recommendations can be found in the document "REVIEW OF

SPECIFIC REGIONAL ACTIVITIES RELATED TO OBSERVING SYSTEM DESIGN - EIG EUMETNET" (CBS/OPAG-IOS/OSDW1 / Doc. 4.4.2) and its annexes.

2. Concrete EUMETNET Observations Programme experiences and proposals for items to be discussed under the various Design Principles

1. SERVING MANY APPLICATION AREAS

In EUMETNET the centrally coordinated provision of observations was primarily done for NWP only. Very recently the Observations Programme Management was asked to also take into account the requirements of other application areas. So far, there's no mechanism in place which guarantees that the requirements of different application areas can be considered and analysed simultaneously, eventually leading to an integrated observing system which fulfils the requirements of all areas.

2. MEETING USER REQUIREMENTS

When aiming at properly fulfilling the user requirements it is very important to establish a procedure which allows a documented collection and analysis of user requirements. Subsequently an objective tool is required which informs about the potential impact and benefit of additional observations, so that it can be demonstrated whether the user requirements can be met or not. In EUMETNET such a procedure has been established. It is described in chapter 1.

3. MEETING NATIONAL, REGIONAL AND GLOBAL REQUIREMENTS

Ideally the procedure proposed under 2. is designed in a way that national, regional and global requirements can be met.

4. DESIGNING APPROPRIATELY SPACED NETWORKS

For the application area "NWP/ data assimilation" the EUMETNET procedure described in chapter 1 is a well-established mechanism, which employs data impact studies as a rather objective tool to determine the impact of observations. Especially the question of suitable spacing of observing sites can be investigated by doing e.g. data denial studies (assessing the impact of thinning) or Observing System Simulation Experiments (assessing the impact of not yet existing (virtual) observations).

5. DESIGNING COST-EFFECTIVE NETWORKS

In EUMETNET the demand for cost-effectiveness has led to the situation that not all observations are done by the NMHSs but that some observations stem or are procured from third parties. For example the existing non-meteorological infrastructure of ground-based GNSS receivers (operated by geodetic organisations) and temperature and pressure sensors on-board aircraft (operated by commercial airlines) is used as another source of information. From ground-based GNSS at least integrated water vapour content can be derived and from aircraft measurements temperature and wind observations can be taken.

6. ACHIEVING HOMOGENEITY IN OBSERVATIONAL DATA

Agreeing on common specifications for observing instruments and measurement practices is the key for achieving homogeneity in observational data.

A means for assessing the current status of homogeneity is to perform extensive data monitoring. A comprehensive monitoring of data availability, timeliness and accuracy – the latter through a comparison against short-term model forecasts – can help detecting large but sometimes also marginal errors. The reason for these errors can be inhomogeneities in observing standards and practices. The EUMETNET Observations Programme has gathered a lot of experience in monitoring observational data. The monitoring tools (web portals, regular reports, fault reports) help improving data availability and quality.

7. DESIGNING THROUGH A TIERED APPROACH

In EUMETNET most observing networks are so far designed in a way that all individual observations are independent of each other and 'take place on the same level'. However, in the E-PROFILE Service (among other tasks: coordination of Ceilometer and LIDAR measurements of aerosol and volcanic ash) it is intended to use more sophisticated LIDAR measurements for calibration of more simple Ceilometer observations. This activity has just started.

8. DESIGNING RELIABLE AND STABLE NETWORKS

In EUMETNET the permanent demand for cost-effectiveness almost inherently requires the design of reliable and stable networks. The monitoring mechanism mentioned under Design Principle no. 6 is a good means for also monitoring the reliability and stability of observing networks.

9. MAKING OBSERVATIONAL DATA AVAILABLE

'Making observational data available' is a permanent requirement for the EUMETNET Observations Programme. In the list of requirements for the Observations Programme Management there are corresponding activities mentioned: e.g. making available 'undiscovered' data, coordinating access to third party data. A practical means for facilitating data availability is to specify standardized data formats for data exchange, to demand for the implementation of such standards and to monitor the conformity with standards. A current example is the BUFR migration which is closely monitored by the EUMETNET Observations Programme.

10. PROVIDING INFORMATION SO THAT THE OBSERVATIONS CAN BE INTERPRETED

Beyond monitoring of e.g. conformity with BUFR standards the EUMETNET Obs Programme puts some effort into discussing requirements for additional metadata. E.g. in E-PROFILE and OPERA discussions have started about providing data users with flagging information about current data quality.

11. ACHIEVING SUSTAINABLE NETWORKS

The EUMETNET/ EUCOS experience with coordinating the collection of wind profile data from dedicated wind profilers and 'weather' Radars has shown that a long-term and repeated exchange of information is required between data providers and data users. Data providers have to inform about the error characteristics of their data and data users have to explain to data providers how they intend to make use of the different data types. Finally, data providers together with data users should develop a common understanding of usability or non-usability of a certain observation type for a certain application.

12. MANAGING CHANGE

Again, the already mentioned objective tool of conducting data impact studies can help demonstrating whether a new observing system 'B' can (at least partly) replace an existing observing system 'A'.

Also, the already described monitoring tools can support keeping track of certain changes. However, the EUMETNET monitoring tools are not that mature that they can serve as permanent databases for e.g. instrumentation logs etc.
