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

EXPERT TEAM ON AIRCRAFT-BASED OBSERVING SYSTEMS

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ET-ABO WORK PLAN & PROGRAM DEVELOPMENT

Status & Progress on ET-ABO Work Plan Tasks 2013-14

Data Quality Control & Quality Monitoring

(*Submitted by Jitze van der Meulen)*

SUMMARY AND PURPOSE OF DOCUMENT

Short overview of the activities related to quality control and datamanagement.

ACTION PROPOSED

The Session is invited to take notice of the document for input of further discussions and consider any recommendations

Appendices

1. Outline for the Definition of the Global AO DM Framework

References

1. WMO AMDAR Panel, 15th session (Boulder, CO, USA, 2012), Final report
2. Workshop on Aircraft Observing System Data Management (Geneva, Switzerland, 2012)

PROGRESS AND ACTIVITY REPORT

Current Status

1. Recommendations on the further development of Data Quality Management and Assessment of Current Practices are formulated during the Workshop on Aircraft Observing System Data Management (see ref. 2). For Quality Control the following five of these recommendations are most relevant:

1) Recognize comparisons of aircraft observations to *NWP model background fields* as a critical component of Aircraft Observations Quality Control (AO QC).
2) Consider *whether or not* such comparisons should be done before AO data are exchanged on the GTS.
6) Semi-automatic near real time monitoring information such as data counts, missing data, higher than normal rejects by the assimilation system, etc. should be exchanged regularly (monthly or more frequently as required and agreed to) between designated centres and data managers (and/or producers). This could include and Alarm/Event system.
7) Consideration should be given to the designation of centres to carry out international QC of Aircraft Observations (WMO and ICAO), *possibly before insertion on the GTS*.\
10) That distribution of *ICAO automated aircraft observations* on the GTS be done using WMO approved format (BUFR) with an appropriate template (similar to the AMDAR ones) for clear identification of the source of the data (ADS, MODE-S, Aircraft ID, etc.).

2. The AMDAR Panel has identified 20 key aspects for further developing the Aircraft Observations Quality Control (AO QC); see Appendix.

Development & Other Activities

3. NWP model forecast background fields are regarded as the most appropriate references for (near) real time quality control. For operational practices it's will be necessary to evaluate these references to define the moist appropriate choices (update intervals, forecast interval), time and space interpolation techniques or algorithms.

4. NWP background fields as defined used for references require sufficient information on its uncertainties. Traceability to objective observations is required, providing information on its uncertainties (time and place related) and possible seasonal variations or daily characteristics (daytime/night time). In particular altitude related bias behaviour is relevant.

5. In practice NWP forecasts fields can be used for real time quality control, *i.e.* before dissemination over the GTS. For this practice data should not be filtered out (except for data outside a predefined fixed range), but supplied with a quality flag (a code number in BUFR), to inform the user on its validity. Detailed quality checks can be performed off line as part of the quality monitoring process, described in the AMDAR Reference Manual.

6. Real time (or near real time) data monitoring will be the leading process to research for reports containing erroneous data. This activity requires on-line communication with the data managers/producers for immediate acting to stop the dissemination of such reports (by the processing centres). Facilities for such (near) real time assessment are still not implemented generally. Timeliness of *near* real time should be understood as less than 24 H.

7. The source (originating centre or processing centre) of reports should be back traceable for feedback. Practices providing back tracing are still not commonly implemented.

8. In practice three type of erroneous (unacceptable) data can be distinguished:

a. Observations (air temperature, wind, humidity) are incorrectly measured or derived (*i.e.* not confirming the required measurement uncertainties)

b. Incorrect position or time of observation

c. Incorrect encoding (*e.g.* for altitude).

May be reporting incorrect positions affects currently NWP most seriously, especially when reporting from (virtual) areas with few observations (data sparse areas), like over oceans and seas and especially at lower altitudes. Using NWP background fields only, usually no distinction can be made between these three types and it is assumed that the quantities are incorrectly measured only. Appropriate tools to detect horizontal and vertical positional errors are still no part of standard QC practices, although some methods may help. The same holds for detecting inaccurate date and time stamps (may be Mode-S data comparisons may be useful).

9. Although the AMDAR Panel recommended the use of the latest BUFR template, currently a variety of different and old AMDAR BUFR templates are in practice, not all confirming the BUFR code regulations. Due to the lack of uniformity in this data reporting, confusion on the interpretation of the various descriptors exists (e.g. for altitude), decreasing the data quality in general. ET-ABO should implement a plan to improve uniformity by requiring the use of the latest BUFR template.

10. The definition of the headers, used for the dissemination of bulletins, needs improvement because currently any distinction between the various types of aircraft observations (AMDAR, automatic AIREP, ADS, etc.) is not possible, preventing any filter mechanism. A proposal (to CBS) for improvement has to be drafted.

11. Although the mutual deviations in biases are larger, some aircraft types (or sub-types) clearly demonstrate common biases. Moreover, and sometimes even more significant, aircraft of the same type, but operated by different airliners demonstrate different biases. At present it is not clear if differences in design or in maintenance procedures are causing these differences. Further studies together with airliners and industry should be carried out for a better understanding and possible solutions.

12. The frequency of single level observations during ascent and descent is lower than with e.g. radiosondes. As a result the fine details in inversion layers as shown by radiosonde profiles are currently not provided by AMDAR observations. Although the frequency (or time interval between observations) may be sufficient for NWP practices, the usefulness of profiles (for local use), generated through AMDAR might be significantly improved by increasing this frequency. A study on the required detailness of AMDAR profiles must be encouraged to determine an optimal frequency.

13. Based on timeliness studies it is found that some data originating or processing centra store (collect) data relatively long (e.g. 25 min) before transmission, reducing the usefulness of the data for real time applications (e.g. profiles). These data centres should be encouraged to withdraw any unnecessary delay.

Future Plans

14. Quality control and monitoring methods are already described in detail in the AMDAR Ref. Manual. The challenge however is to implement these methods as standardized procedures at the regional or national data processing centres. Especially the feedback mechanism, part of the quality evaluation process requires dedicated actions. Such standardized procedures will only be successful, if an appropriate DM framework like presented in the Appendix is generally adopted.

15. Introduction and implementation of data management practices in line with the recommended Data Management Framework shall be planned. Documentation on how data management practices should be organized is available and provided by the ICT community.

Relevant be the provision of good examples dedicated fro AMDAR data management, i.e. specific for the use of third party data.

DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

1.

2.

Items, relevant for developing an AO DM outline:

1. *3rd party data*
2. *ADS (ICAO), other new data sources (Mode-S)*
3. *Archiving (data and metadata)*
4. *Delivery (level II data; also profile data for local), relation to time/place resolution)*
5. *Optimization of observations*
6. *data targeting (additional, for applications)*
7. *data coverage (global), provision (e.g. Africa); programme extensions*
8. *Developing countries, special constraints (data comm. issues)*
9. *Data format (incl. resolution)*
10. *Code issues (incl. data header)*
11. *Data display*
12. *Data access*
13. *Data transfer*
14. *Typical data: Atmospheric. Composition data*
15. *Phenomena: Icing, Turbulence, use of data (e.g. direct input, verification)*
16. *Timeliness (taking into account Q/C processes)*
17. *Data checking, filtering, flagging (relation with rules, M.GDPFS)*
18. *Excluding aircraft (how to manage)*
19. *Quality control: monitoring (availability), techniques (NWP), stages (real time, off-line); flagging principles; archiving; logistics; feed back*
20. *Metadata (definition, use, archive)*

Documentation (overview and review for update)

1. *AMDAR Reference Manual*
2. *WMO regulatory material (TR, incl. Manuals and Guides)*
3. *WWW/DM, ISS/DM*
4. *QMF documentation*

Recommended Framework