Experiences with Quality Evaluation of AMDAR Observations

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Contents

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Upper air observations
- *in situ*
- *remote sensing*
Upper air observations
- *in situ*: Aircraft Based

Aircraft Meteorological Data Relay System (AMDar)

(see [http://www.wmo.int/amdar](http://www.wmo.int/amdar))

Cost effective
Feedback mechanism

1. Data control and validation versus reference
2. Evaluation versus requirements
3. Improvements versus technology

1. automatically? → part of control, automatic pre-validation & control
2. Manually by the operator
3. R&D project
Feedback mechanism

Quality Evaluation

Improvements

Operations
QEvC system overview

Exeter → De Bilt → KNMI OBS database

Offenbach → De Bilt → QEvC Raw data archive → APL data processor

HIRLAM/HARMONIE → DM

ECMWF → DM

QEvC database → QSL server

DM = datamanagement

E-mail, ftp

DM
Background

QEvC system overview
Observations: Quality Assessment

Items for feed-back:

1. Quality of the **metadata**, like location and time of observation

2. Quality of the reported **variables** (derived from measurands, provided by the sensors), like air temperature, mixing ratio (humidity), wind vector (speed and direction) [pressure is for location {altitude}]

3. Performance, like **availability** and **timeliness** (*instabilities*)

But also:

- logistics *e.g.* bugs in reports (also *duplicates TAC+BUFR*)

Quality Evaluation Centre products

- daily, monthly, quarterly, etc., to become *real time*
- case studies, to analyse special issues
Data quality evaluation practices

Logistics & metadata

• Amounts
• Timeliness of observation (& time of dissemination and reception)
• Position (latitude, longitude, vertical) (PALT versus altitude)
• Aircraft ID (in BUFR: "Aircraft Registration Number")
• Phase of Flight (ASC, DEC, LVR, LVW, UNS)
Position

Altitude distribution
2002-09-01 - 2002-09-03

- LVR/LVW
- ASC/DES

number of observations

altitude (m)
Position
Data quality evaluation practices

Position

Frankfurt International Airport (EDDF, 10637)

ASC BUFR

DES BUFR

Pressure altitude (m)

Altitude EDDF: 111 m + MSL

Pressure altitude EDDF

Date & Time

2010-04-01 to 2010-06-30
Positional errors

PALT < 200 m
Timeliness

![Timeliness Graph]

The graph represents the number of data entries over time, with two categories: "OTHER" and "EUmmm". The x-axis represents minutes, and the y-axis represents the number of entries. The data is for 2009-06-12.
Timeliness

2017-10-01 - 2018-04-01

E-AMDar
(reference: ECMWF)

Δt < 100: 98.4%
Δt < 50: 93.3%

E-AMDar data quality evaluation practices
Variables: observational data

• TA: air temperature
• Wind vector: u/v, DD/FF (issue with \{FF;DD\}={0;0})
• MR: Mixing ratio
• turbulence & icing (for E-AMDAR still <empty>)
Data quality evaluation practices

Variables: observational data

See CIMO Guide
Variables: air temperature
Variables: air temperature
Variables: air temperature

all data for 03:45 to 04:44 and for 05:45 to 06:44 UTC
Variables: air temperature

Background reference: ECMWF
Variables: air temperature
Variables: air temperature

Background reference: ECMWF

$\sigma(\Delta T_A)$

2018B1
Variables: air temperature

IP=6 DES

IP=5 ASC
Variables: air temperature

Background reference: HIPLAM

all
Variables: wind direction
Variables: wind direction

*frequency distribution: wind direction differences 2018B1*

ECMWF
Variables: humidity

MIXING RATIO - Observations

PERIOD 2018-09-01 to 2018-09-30

Pressure Altitude / km

MIXING RATIO in mg/kg
Variables: humidity

Trend in %RH differences

E-AMDar
(reference: ECMWF)
Variables: humidity

EU0884

PERIOD
201709010656
20170930213

REFERENCE: HIRLAM
Conclusions

- Quality evaluation of AMDAR using NWP as background reference helps significantly to *improve the observations*

- Quality evaluation practices are suitable for *real time* quality control up-to *long term trend* analyses.

- Data quality analyses and research require a talented approach, but results in *improved NWP*

- Together with humidity, turbulence and icing these aircraft based observations provides the major upper-air datasets, to be used for *climate research*