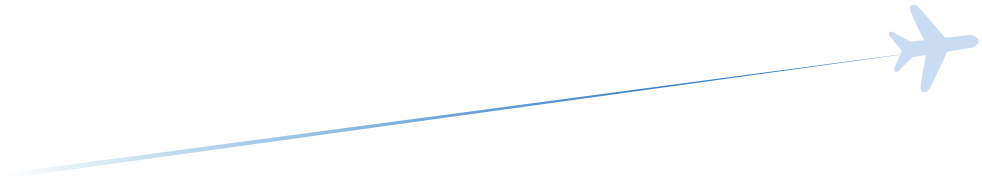

Definition of Data Formats and Routines to Transfer Ensemble Forecasts for Tools Generation

PNOWWA D2.5

PNOWWA

Grant:	**699221**
Call:	**H2020-SESAR-2015-1**
Topic:	**Sesar-04-2015**
Consortium coordinator:	**Finnish Meteorological Institute**
Edition date:	**[09 November 2016]**
Edition:	**[00.01.00]**

Founding Members

EUROPEAN UNION EUROCONTROL

SESAR JOINT UNDERTAKING

Authoring & Approval

Authors of the document

Name/Beneficiary	Position/Title	Date
Harri Hohti / FMI	Senior Scientist	9.11.2016
Seppo Pulkkinen / FMI	Senior Scientist	9.11.2016
Elena Saltikoff / FMI	Science and WP Manager	9.11.2016

Reviewers internal to the project

Name/Beneficiary	Position/Title	Date
Harri Haukka / FMI	Project Manager	9.11.2016
Heikki Juntti / FMI	Quality Manager, WP 5 leader	9.11.2016
Elena Saltikoff / FMI	WP2 leader	9.11.2016
Rudolf Kaltenboeck / AUC	WP 4 leader	9.11.2016

Approved for submission to the SJU By — Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date
Ari-Matti Harri / FMI	Project Coordinator	9.11.2016
Rudolf Kaltenboeck / AUC	WP 4 leader	9.11.2016
Elena Saltikoff / FMI	Science and WP Manager	9.11.2016

Rejected By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date

Document History

Edition	Date	Status	Author	Justification
00.01.00	9.11.2016	First release	Harri Hohti Elena Saltikoff Seppo Pulkkinen Harri Haukka	

PNOWWA

PROBABILISTIC NOWCASTING OF WINTER WEATHER FOR AIRPORTS

This "D2.5: Definition of Data Formats and Routines to Transfer Ensemble Forecasts for Tools Generation" -deliverable is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 699221 under European Union's Horizon 2020 research and innovation programme.

Abstract

PNOWWA project will develop nowcasting tools using parameters which have not yet been defined in widely known information models. This deliverable document the extensions for common data models created for these tools.

Table of Contents

1 Executive Summary

PNOWWA - Probabilistic Nowcasting of Winter Weather for Airports – is a research project developing methods to support the Air Traffic Management (ATM) challenged by winter weather. PNOWWA will demonstrate very short-term (0-3h nowcast) probabilistic winter weather forecasts in 15min time resolution based on extrapolation of the movement of weather radar echoes. This deliverable documents the data flow and extensions for common data models created for the nowcasting tools. The overall data model is based on local extensions of ODIM, OPERA Data Information Model.

2 Introduction

PNOWWA - Probabilistic Nowcasting of Winter Weather for Airports – is a research project developing methods to support the Air Traffic Management (ATM) challenged by winter weather. Our methodology is based on probabilistic nowcasting of winter weather, which will enable the estimation of winter weather conditions affecting the ground part of air traffic 4D trajectories. This kind of ATM methods and tools are called for, because the uncertainties during flight, departure and arrival at airports create a need to effectively utilize probability forecasts, both in the local operational user environment and en-route.

Our research work focuses on quantifying the uncertainties related to delays in ground operations due to winter weather situations. When applied to ATM applications, our methods will enhance timely operations in surface management and ATM decision making, will increase airport capacity, shorten delays and will also promote safety. PNOWWA will demonstrate very short-term (0-3h nowcast) probabilistic winter weather forecasts in 15min time resolution based on extrapolation of the movement of weather radar echoes and improve predictability of changes in snowfall intensity caused by underlying terrain (such as mountains and seas). During January-March 2017 we will execute research demonstrations that are conducted both offline and online at the Operative User Environment (OUE) site representing influence of the underlying terrain to forecast accuracy.

This document describes the required definition of data formats and routines to transfer Ensemble forecasts for generation of tools, which will be used first time during these demonstrations. Data produced for these tools includes parameters which have not yet been defined in widely known information models. This deliverable document the extensions for common data models created for the demonstrations, and the general data structure

3 Data Formats and Routines

3.1 ODIM (Opera Data Information Model) HDF5

There are four successive routines in WP2 which all use an enhanced version of ODIM (Opera Data Information Model) HDF5 format, which is documented and supported by EUMETNET OPERA community: EUMETNET OPERA weather radar information model for implementation with the HDF5 file format, Version 2.2 (http://eumetnet.eu/sites/default/files/OPERA2014_O4_ODIM_H5_v2.2.pdf).

These local enhancements will be introduced to OPERA Expert team meeting 2017.. Introduction of suggested local enhancements is a normal procedure as part of OPERA support task, in order to avoid namespace clashes.

3.2 Radar Reflectivity Composite Generation

- combines volume data in polar coordinates from several radars in HDF5 format to one Cartesian HDF5 file per observation time
- both input and output data follow the standard ODIM 2.2 data model

3.3 Analysis of Motion Vectors of Precipitating Areas from Successive Radar Composites

- ouputs motion vectors and their uncertainty as deviations as enhancements to ODIM HDF5
- new quantity attributes *"/dataset1/dataN/what/quantity*" (AMV stands for "Atmospheric Motion Vector")
    - *AMVV* velocity in m/s
    - *AMVVD* velocity deviation in m/s
    - *AMVD* direction of movement in degrees (0 is north, 90 is east)
    - *AMVDD* direction deviation in degrees
- the attribute "/dataset1/what/product" is set to "AMV"
- the motion vector data is delivered at the same projection as the radar composite

- the time attributes /what/date and /what/time will be of the last reflectivity field used for motion analysis

3.4 Computation of Ensemble Nowcasting

- uses both AMV and reflectivity composite data
- generates 51 members of reflectivity (Z) time series in the same projection as the observed reflectivity composites
- uses internal shared memory information model because of execution speed optimization (could be converted to ODIM HDF5 if needed in WP5)

3.5 Analysis of Precipitation Accumulation Probabilities

- uses the internal nowcasting data from previous routine
- applies R(Z) conversion with external precipitation type information to get precipitation intensities for accumulation
- outputs time series of accumulation probabilities in cartesian ODIM HDF5 and GeoTIFF formats for pre-defined precipitation accumulation periods and accumulation thresholds
- the quantity is ODIM HDF5 "PROB"
- for every accumulation period dataset N there is an additional attribute defining the accumulation threshold in millimeters for data M *"/datasetN/dataM/what/ threshold_value"*
- the accumulation period of a datasetN is defined with attributes
    - */datasetN/what/startdate and /datasetN/what/starttime*
    - */datasetN/what/enddate and /datasetN/what/endtime*
- the time of the data used for nowcasting is defined with attributes */what/date* and */what/time*

The predictability field for internal use is also calculated during this process. The process has been defined so, that in later phases of the project the enhancements to the data implementing WP3 results can be done within these routines or separately.

4 References

1. EUMETNET OPERA weather radar information model for implementation with the HDF5 file format, Version 2.2
http://eumetnet.eu/sites/default/files/OPERA2014_O4_ODIM_H5_v2.2.pdf

2. SESAR 2020 Exploratory Research First Call for Research Projects
http://ec.europa.eu/research/participants/data/ref/h2020/other/call_fiches/jtis/h2020-call-doc-er-sesar-ju_en.pdf

3. H2020 Participants Portal Online Manual
http://ec.europa.eu/research/participants/docs/h2020-funding-guide/index_en.htm

4. H2020 Annotated Model Grant Agreement. This document summarizes all H2020 contractual requirements applicable during project execution. It can be found on H2020 Participants Portal at
http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

5. SJU Model Grant Agreement
http://ec.europa.eu/research/participants/data/ref/h2020/other/mga/jtis/h2020-mga-er-sesar-ju_en.pdf

6. Probabilistic Nowcasting of Winter Weather for Airports (PNOWWA): Part A and Part B (699221)

7. Consortium Agreement For the Horizon 2020 project PNOWWA (699221)