

## Overview

In May 2016 Met Éireann contacted ECMWF staff requesting access to a copy of their SAPP (Scalable Acquisition and Pre-Processing) System. A series of video meetings followed and Met Éireann hosted a SAPP workshop in 2017 which was attended by ECMWF staff and HIRLAM colleagues. In 2018 ECMWF Council approved a new Optional Programme to make SAPP available to Member and Co-operating States. During 2018 and 2019 Met Éireann staff installed and developed the SAPP system for operational use.

The SAPP system has provided Met Éireann a robust flexible framework for processing and monitoring observations used in NWP. With SAPP more conventional observations are now available for operational data assimilation. New observation types, such as wind profiler and GNSS, are also available for testing and planned use in the next model upgrade. Observations processed by SAPP were first used operationally in November 2019.

## SAPP Optional Programme

The SAPP System is provided by ECMWF by means of an Optional Programme. The system itself is made available as an Open Virtual Application (OVA) (or Virtual Machine (VM)) and support is provided to participating ECMWF Member and Co-operating States by a dedicated staff member. Documentation is available on a dedicated wiki and an online user forum is used to track issues and queries. A user workshop was hosted by ECMWF in 2019 and a workshop planned for 2020 has been split in to a series of short training webinars.

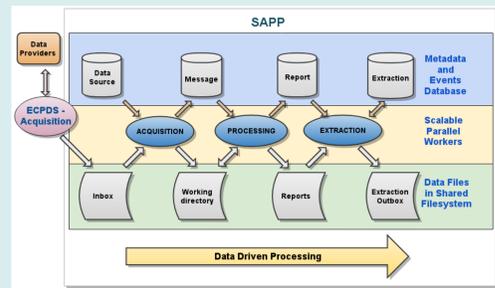
The System will be updated approximately once per year. Minor technical updates have been provided offline. As part of the Optional Programme two additional staff have joined ECMWF on secondment to further develop SAPP for Participants. More recently, the provision of a containerised version of SAPP using Docker and collaboration using a dedicated git repository has been investigated and developed.



SAPP Optional Programme Participating ECMWF Member and Co-operating States.

## SAPP components

The SAPP System is comprised of software that performs acquisition, pre-processing and extraction of observational data for use in NWP. Metadata associated with the observations and the system's processing tasks are stored in a database.



SAPP data flow. (ECMWF 2020)

SAPP components can be categorised as follows:

- 1 Engine: Scripts for acquisition, processing and extraction, a database, a web administration interface and an ecflow scheduling/monitoring suite.
- 2 Converters: Programs that read input messages and produce consolidated BUFR output data.
- 3 Configuration: Definition of input data sources, converters' properties, rules to route incoming data to the converters, composition of extraction files and other application settings.
- 4 Monitor: Monitoring of SAPP is mostly based on queries to the database coupled with a web interface or ecFlow interaction.

## Irish installation

The second version of the SAPP System was provided by ECMWF in 2019 as a VM. The VM consists of a CentOS 7 PC with a single quad-core processor and 8 GB of memory. With the assistance of IT staff, two of these virtual machines were installed in Met Éireann's virtual environment to provide operational resilience. Data from both VMs are pulled to the operational suite running at ECMWF's HPCF.

In order to install SAPP locally the hostname of the VM was changed and the new hostname was applied to SAPP configuration settings, the django web installation and the ecFlow server. Various "inbox" and "outbox" directories were created. The ftp service was enabled to allow the dissemination of GTS messages from Met Éireann's message switching server. Full details of this installation process are available on request.

SAPP, as provided by ECMWF, carries out an extraction every six hours for the entire globe with a cut-off of four hours. A copy of the extraction script has been installed to carry out hourly extractions for a limited area defined by a north-south, east-west latitude-longitude bounding box. Three extraction "streams" have been defined and are summarised in the table below.

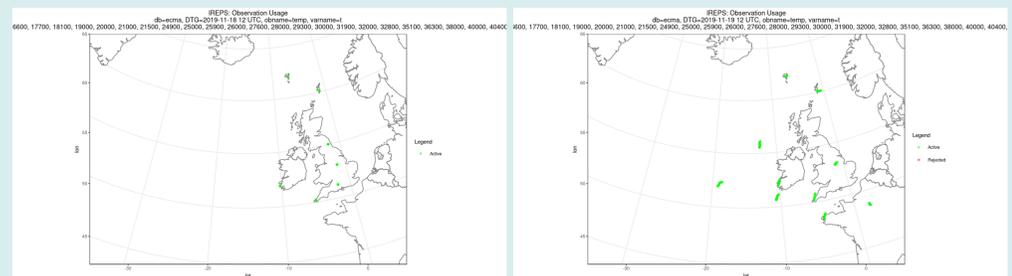
Name	Frequency	Cut-off	Description
sc	Hourly	00:45	Limited area for operational EPS (IREPS)
nc	Hourly	00:20	Limited area for future nowcasting suite
da	Six hourly	06:00	Global for monitoring purposes only

Summary of SAPP extraction streams for use in NWP

## Changes to HARMONIE

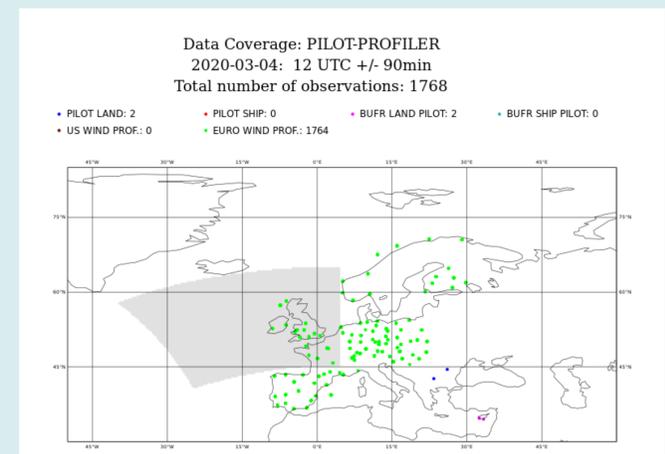
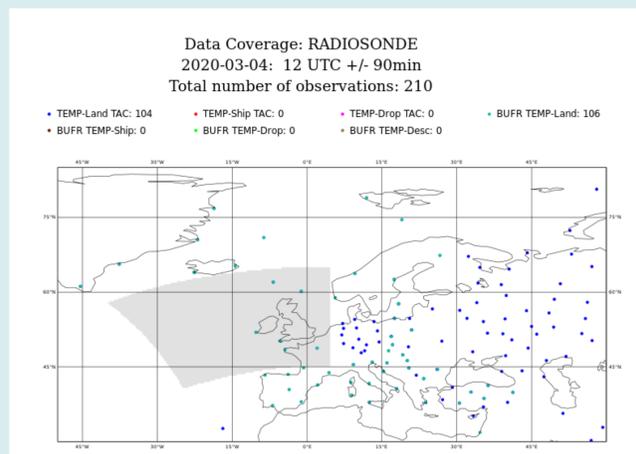
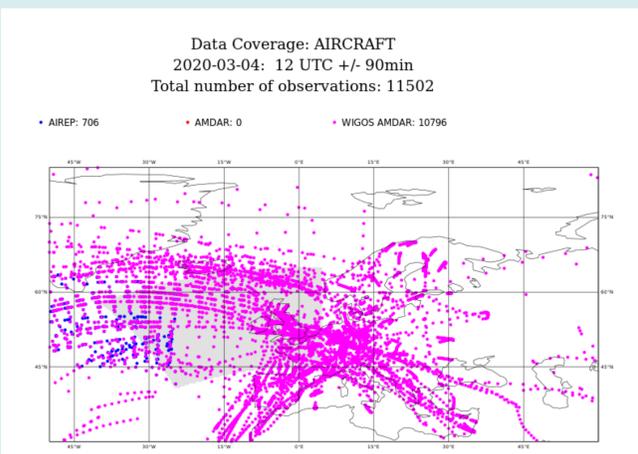
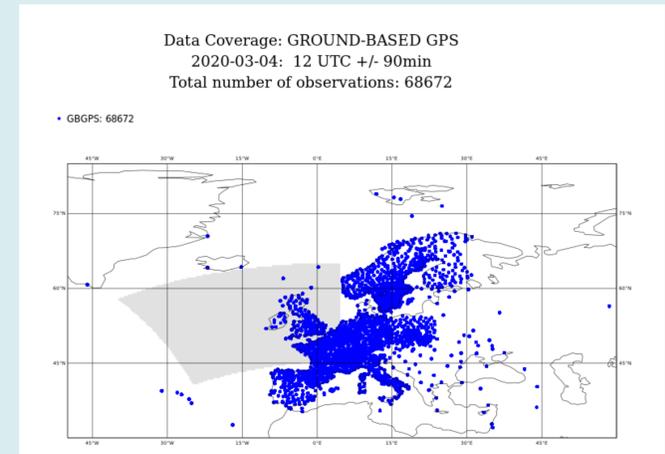
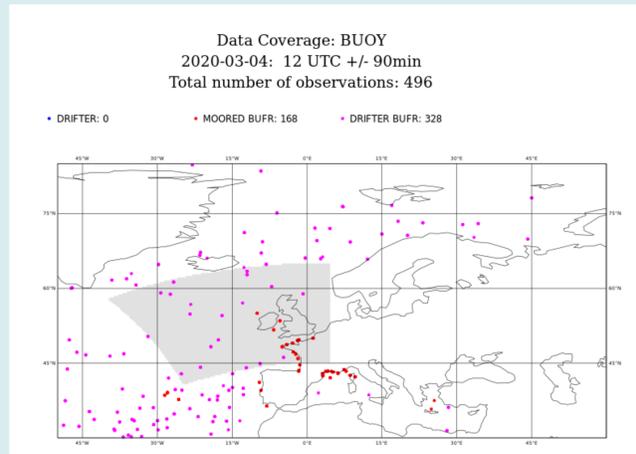
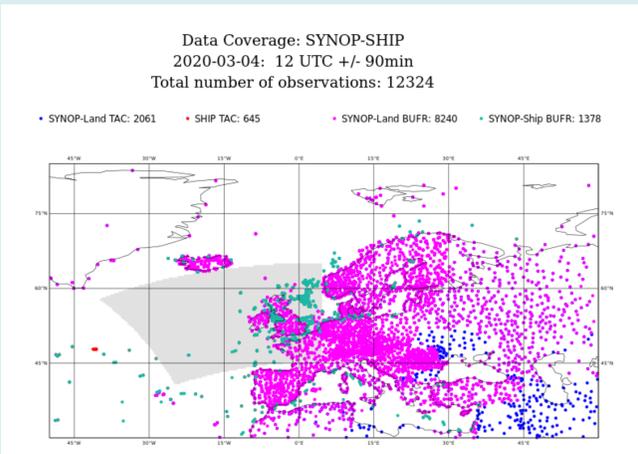
Met Éireann's operational configuration of HARMONIE-AROME cycle 40h1, IREPS, is used to provide short-range forecasts for Ireland. With the export version of the code (40T1), developments by ALADIN (Maria Monteiro, 2017) and back-porting of developments from CY43 it was possible to use Bator to convert WMO and ECMWF formatted conventional BUFR to ODB (Whelan, 2017). Further minor changes to Bator and observation operator code were required for SYNOP SHIP reports.

The changes made to HARMONIE-AROME code, namelists and scripts were tested for a period of a month in an e-suite. It is not useful to show comparisons as the old pre-processing system was unable to process BUFR BUOY (drifting and moored), BUFR SHIP and BUFR TEMP (land and ship). The use of SAPP BUFR by IREPS was made operational for the 1200 UTC cycle on November 19<sup>th</sup> 2019.



TEMP data usage maps for 1200 UTC November 18<sup>th</sup> using old observation pre-processing software (left) and for 1200 UTC November 19<sup>th</sup> using SAPP. With SAPP high-resolution BUFR TEMP were available for assimilation.

## Data coverage of SAPP BUFR



## References

- [1] Fucile, E. et al., 2014: *SAPP: a new scalable acquisition and pre-processing system at ECMWF*. ECMWF Newsletter No. 140 – Summer 2014, pp. 37–41. doi: 10.21957/3ylomoa6
- [2] Monteiro, M., 2017: *Upgrade of the source code BATOR to WMO AMDAR template 311010v7*. ALADIN Project Stay report.
- [3] Whelan, E., 2017: *An Update On Observation Processing*. Presentation at Joint 27th ALADIN Workshop & HIRLAM All Staff Meeting, Helsinki.