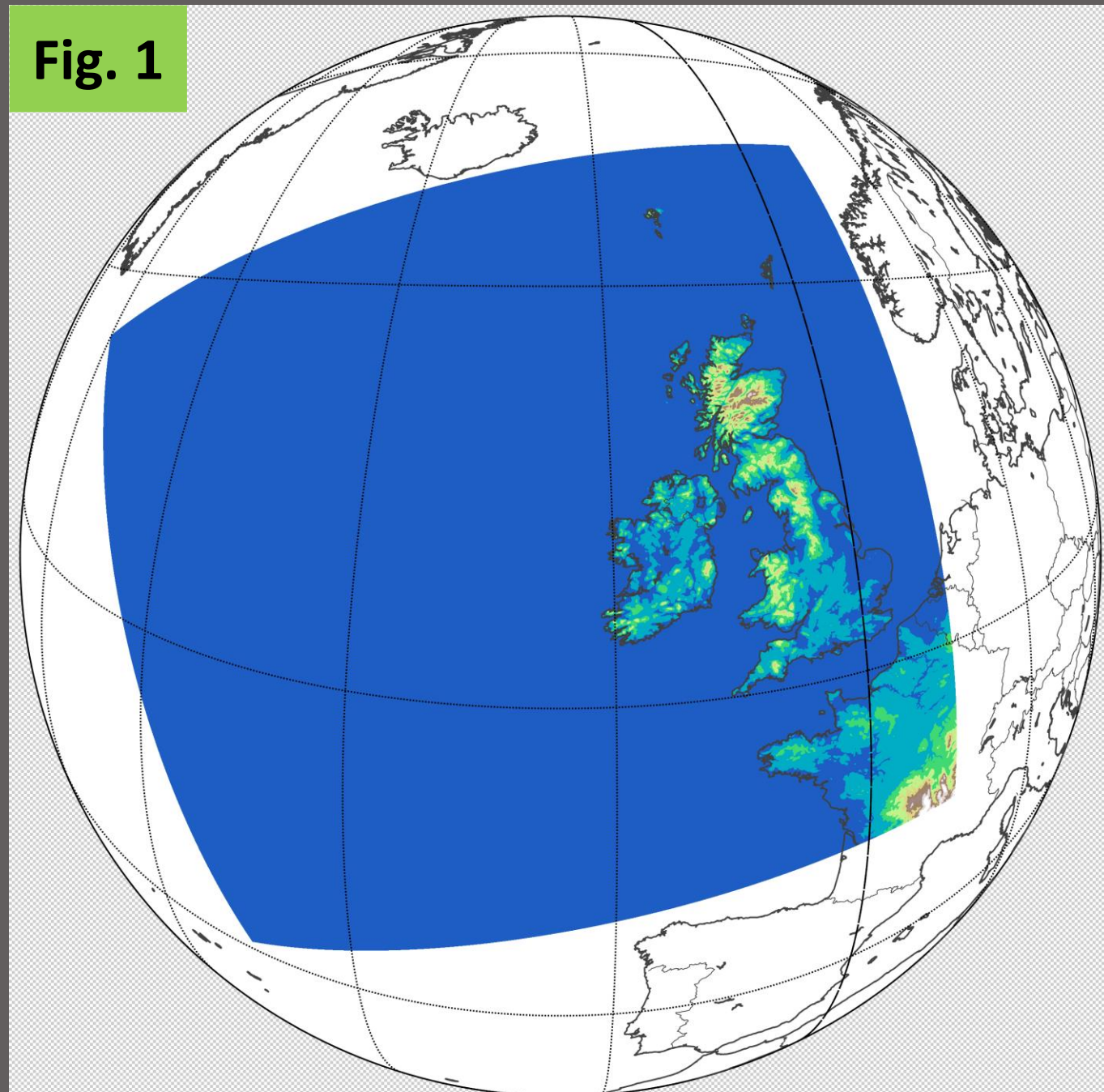




1. Introduction

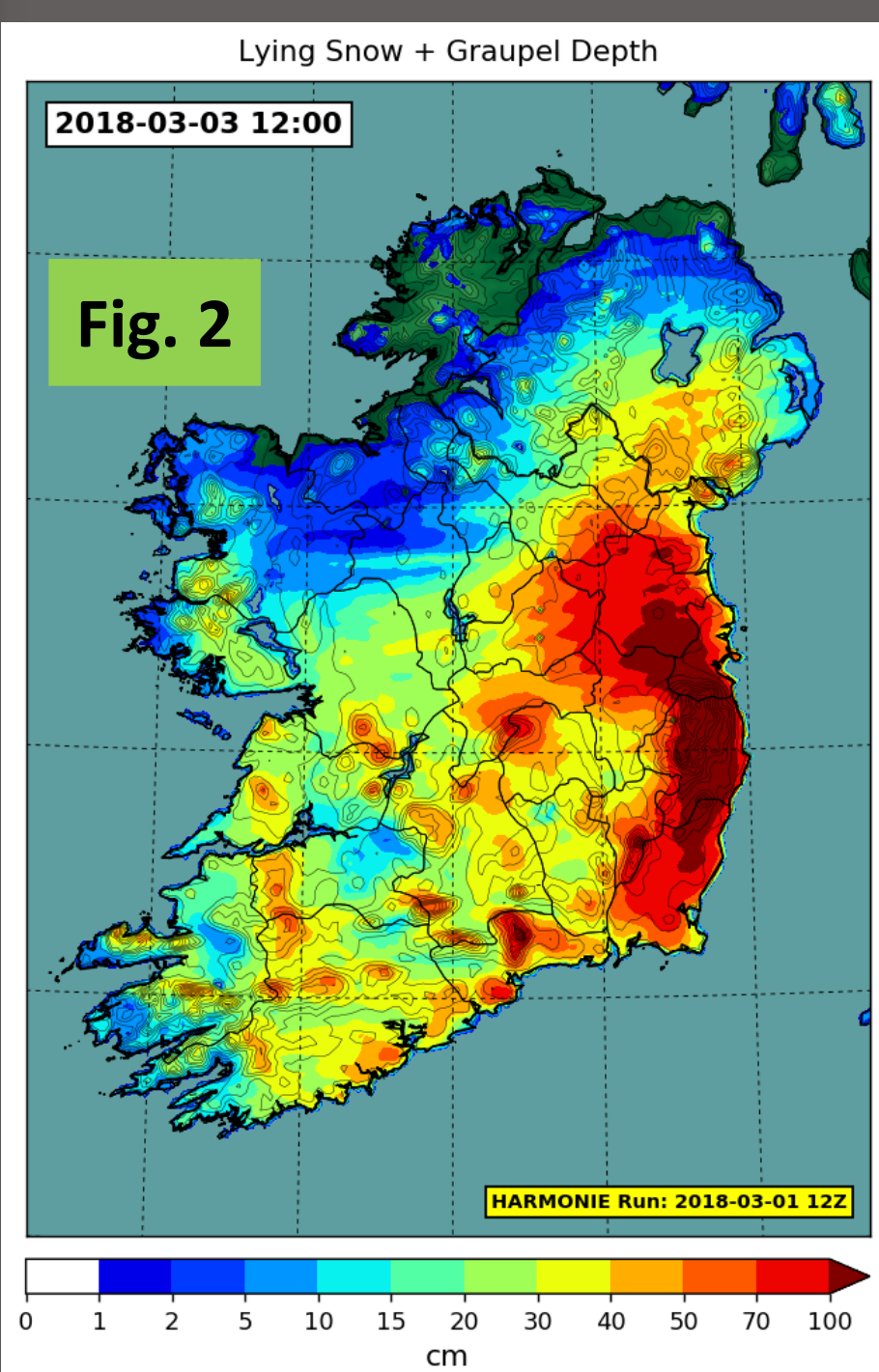
- In May 2018 Met Éireann upgraded its operational suite to include HARMONIE-AROME cycle 40h1 run on a larger domain (see Fig. 1) with 3DVar upper-air data assimilation.

| HARMONIE-AROME cy40h1 | |
|-----------------------|--|
| Code | METIE branch of cy40h1 |
| Domain | 1000 × 900 grid points 65 levels |
| Model Top | 10 hPa |
| Grid spacing | 2.5 km |
| Cut-off | 45 minutes |
| Observations | conventional |
| Data assimilation | Surface analysis & 3DVar (6 hour cycle) |
| Forecast | 54 hour forecasts at 00, 06, 12, 18 Z |
| Configuration | Aladin-NH dynamics and AROME physics |
| Boundary conditions | IFS |

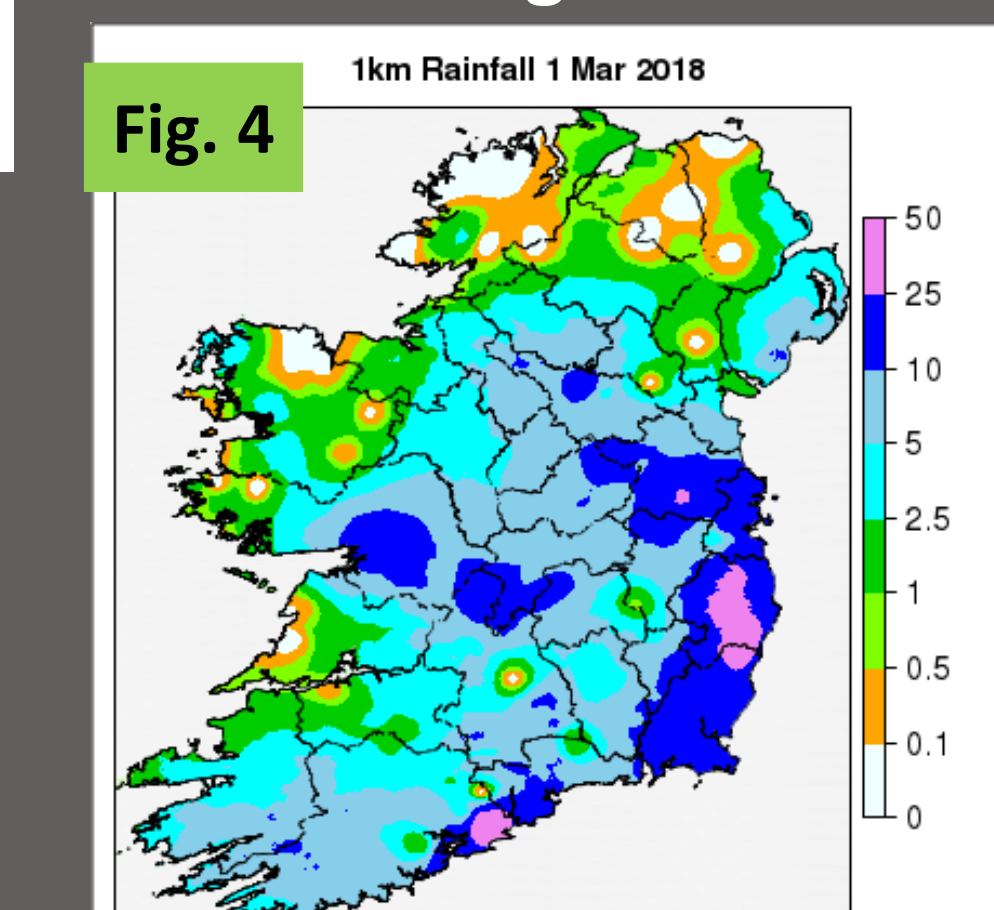
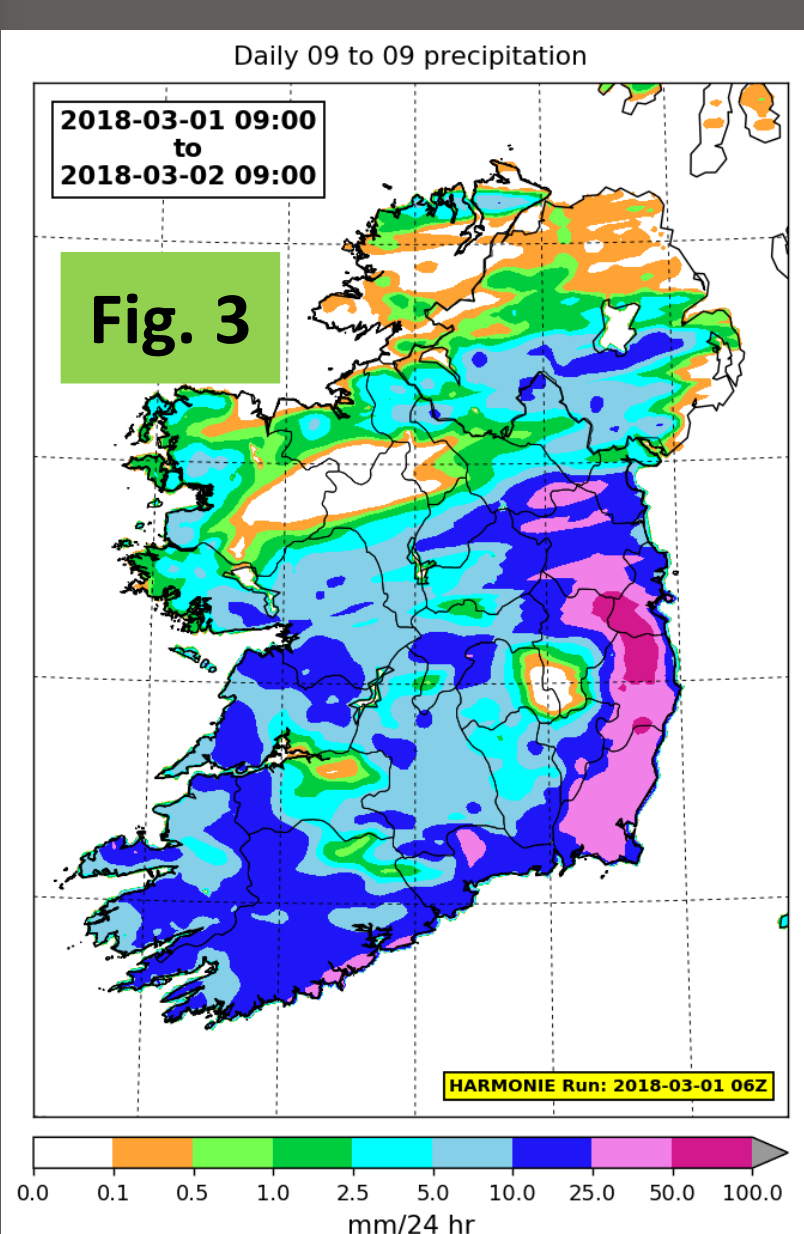


2. Case Study: Storm Emma

- Heavy snowfall occurred over eastern and southern Ireland from March 1-3 2018 due to precipitation bands associated with Storm Emma.



- In parts of the east over 50 mm of liquid equivalent fell each day leading to snow accumulations in excess of 1 m (Fig. 5).
- HARMONIE-AROME cy37h consistently forecast extreme snow depths and performed well in its total precipitation forecast shown in Fig. 2.

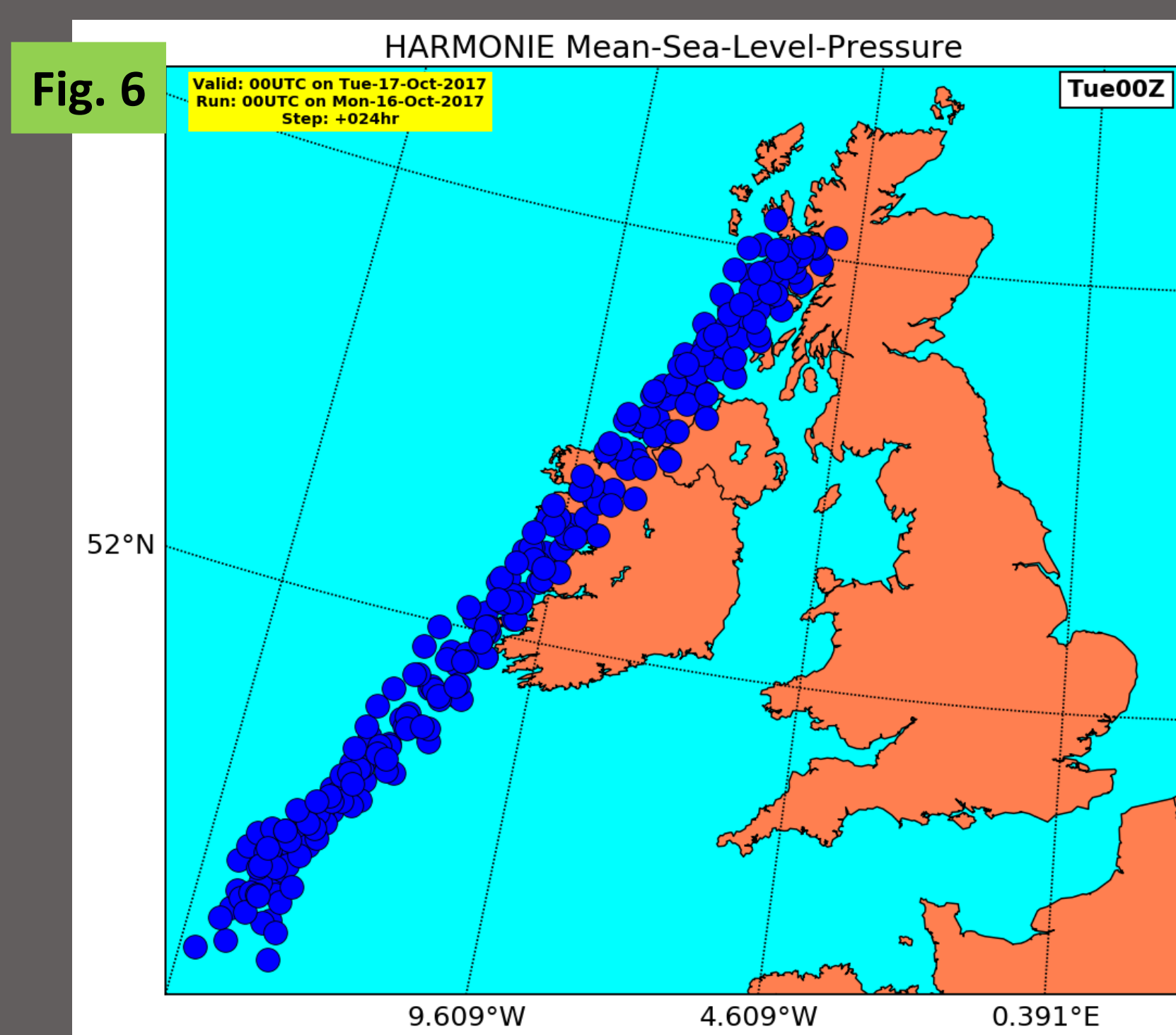


- Fig. 3 shows the HARMONIE-AROME 09 Z March 1st to 09 Z March 2nd 24-hour snowfall forecast. Fig. 4 shows observed totals.

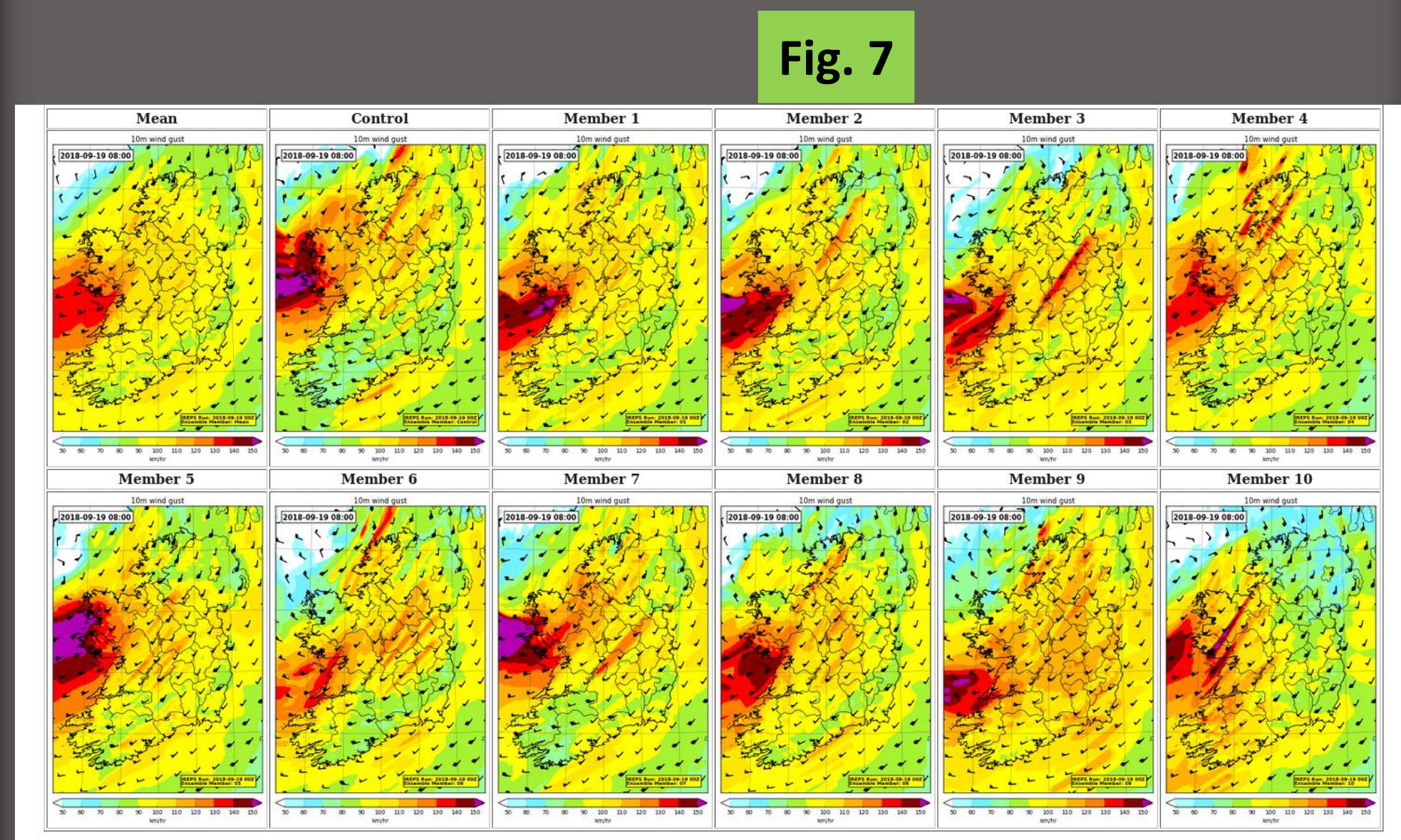


3. Met Éireann Ensemble

- Later this year Met Éireann plans to run a regional ensemble system for Ireland operationally.
- This ensemble system, called IREPS, is currently running pre-operationally.
- IREPS is an 11-member ensemble (10 perturbed members plus 1 control member) and will run 36-hour forecasts twice daily (00 and 12 Z).
- The perturbations are generated following the Scaled Lagged Average Forecasting (SLAF) technique developed by Ebisuzaki and Kalnay (1991).
- Lateral boundary perturbations are computed as scaled differences between previous forecasts from the ECMWF's HRES model that are valid at the forecast time.
- Testing has been done on the influence of Stochastically Perturbed Parameterisation Tendencies (SPPT) and perturbations of surface parameters (PERTSURF).
- Fig. 6 shows the track of the central low pressure of ex-hurricane Ophelia over 24 hours from the IREPS ensemble member forecasts at 00 Z on the 16th of October 2017.

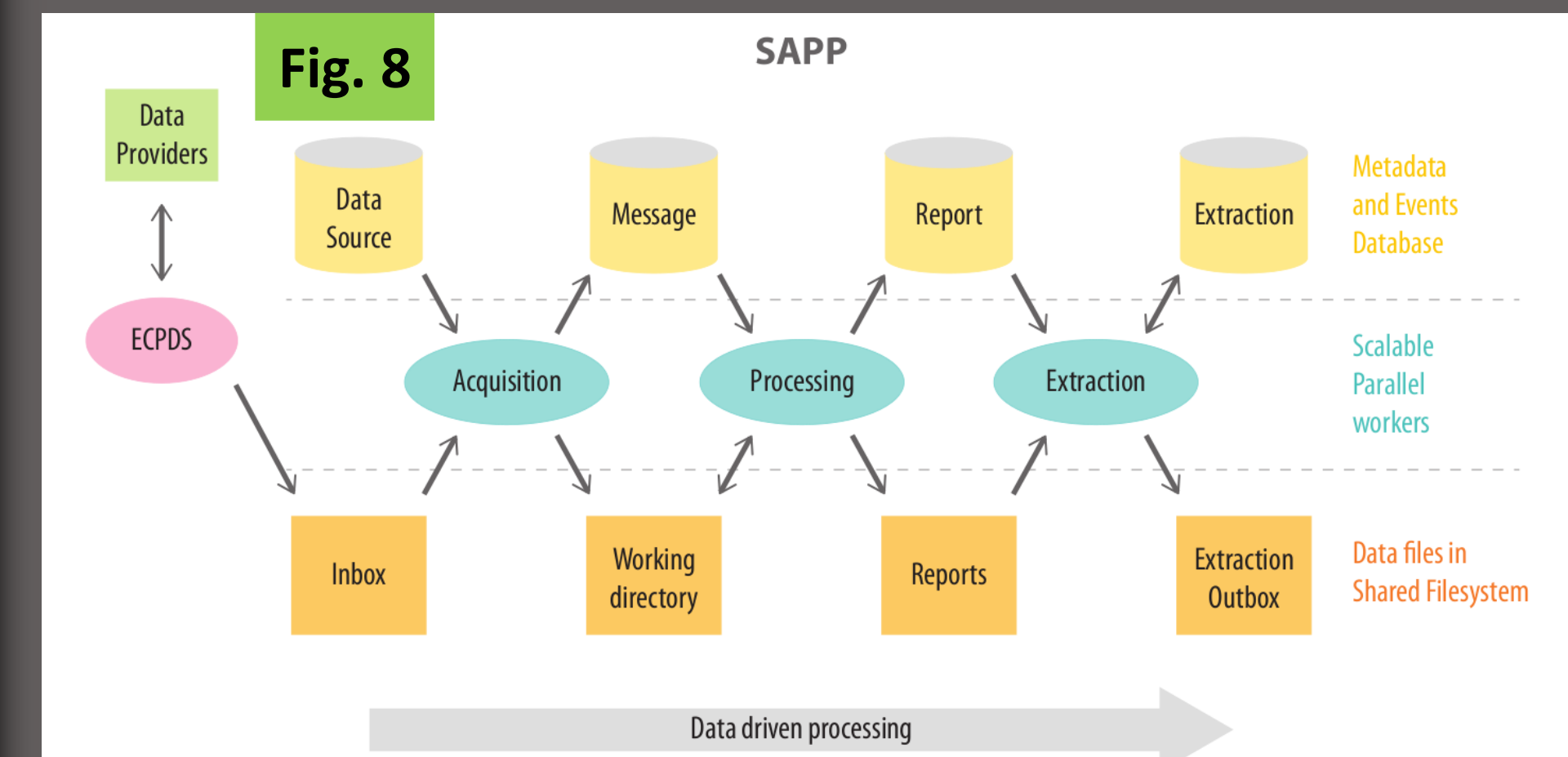


- Fig. 7 shows IREPS gust output (km/h) for 8 am on September 19th 2018 when Storm Ali caused a lot of destruction and 2 fatalities in Ireland. Gusts of 79 knots (146 km/h) were observed.



4. SAPP

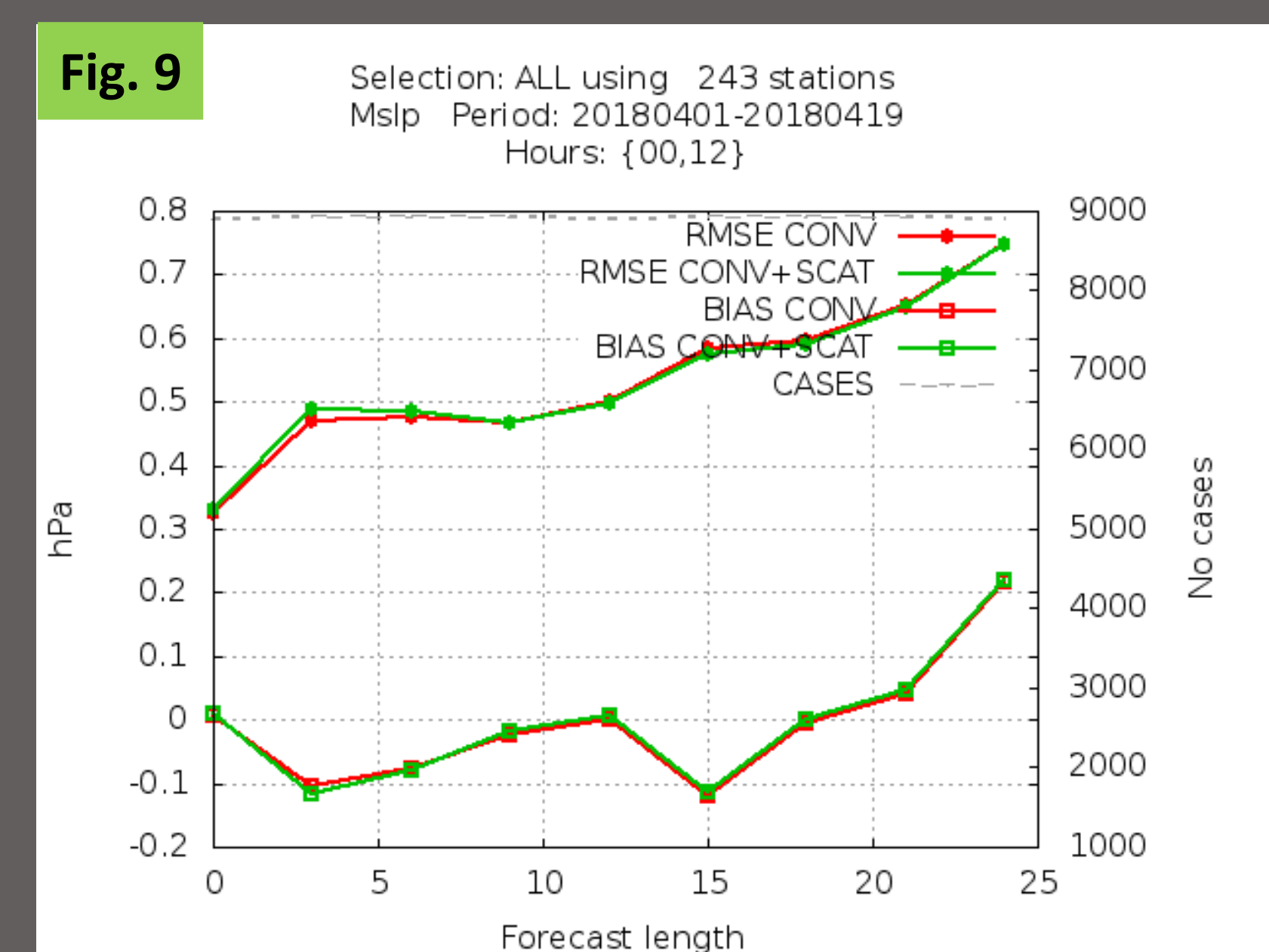
- Scalable Acquisition and Pre-Processing (SAPP, Fig. 8) is software developed by ECMWF to process GTS messages for use in NWP. It was introduced into operations at ECMWF in 2014.
- We have tested SAPP as a possible replacement for our current operational pre-processing system which has been in use since the 1990s.



- SAPP can acquire observations from multiple sources and decodes multiple formats (e.g. BUFR, GRIB, HDF, netCDF, ASCII)
- All data are converted to a consolidated format (BUFR/ODB2) before use in data assimilation
- ECMWF provided the test system as a virtual machine (SAPP-VM) with configuration and installation instructions.
- It has been running for over a year without any system failures and produces many more reports for NWP compared with output from local software.

5. Future Plans

- We plan to assimilate the following as soon as possible:
 - ASCAT data (see Fig. 9)
 - Radiance observations from AMSU-A, AMSU-B/MHS and IASI
 - ADD from Mode-S EHS observations (processed by KNMI)
- We also plan to assimilate the following by the end of 2019:
 - Radar volume data (reflectivities)
- Make IREPS operations by the end of 2018
- Nowcasting
- We currently run our operational suite at ECMWF. Between 2020 and 2022 we will run a selection of our IREPS ensemble members on KNMI HPC.



6. United Weather Centres (UWC)

- Met Éireann will be part of UWC-West, along with DMI, IMO and KNMI between 2022 and 2027.
- UWC-West will run NWP over common domains, use common HPC, ensembles, data assimilation and nowcasting.
- Beyond 2027 UWC-West and UWC-East (10 NM(H)Ss) will merge to UWC and will have joint NWP, common tools and sharing of HPC.