

IMO – ACCORD MG

ACCORD MG visit to IMO Sept. 28 2023

Bolli Pálmason

Guðrún Nína Petersen

Xiaohui Zhao

Sigurður Þorsteinsson

The NWP staff at IMO

Small team and many tasks!

▶ **Guðrún Nína Petersen – coordinator of NWP**

- **Interests: Extremes, especially winds, mountain meteorology and Arctic**
- **Interests in NWP: Physics and verification**

▶ **Bolli Pálmason**

- **Interests: Surface modelling, soil, snow, glaciers and physiography**
- **Other tasks: Operational runs, data flows (obs. & forecast output, bufr/grib)**

▶ **Xiaohui Zhao**

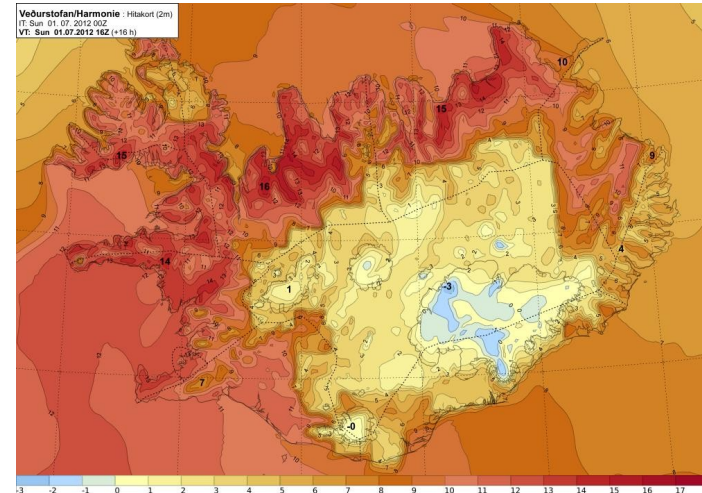
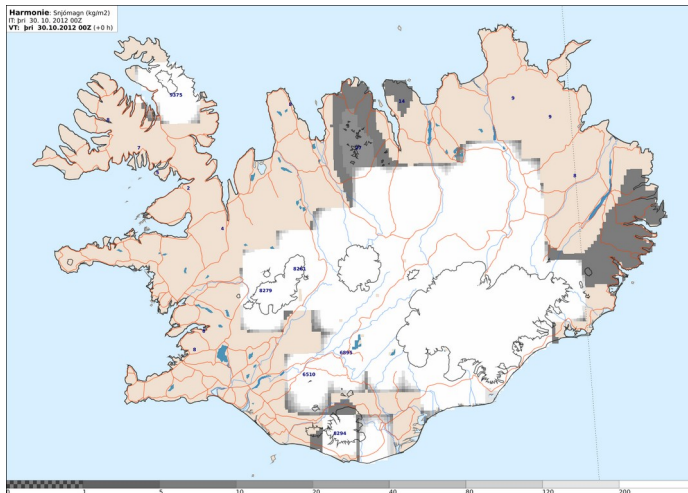
- **Interests: tropical cyclones, EPS, physics parameterizations in NWP**

▶ **Sigurður Þorsteinsson (retiring)**

- **Interests: Mountain effects, cyclones near Iceland and variational DA**

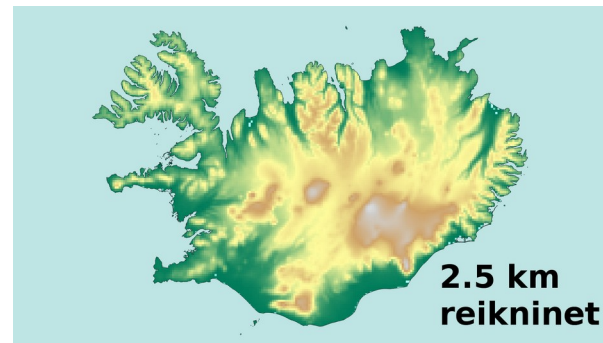
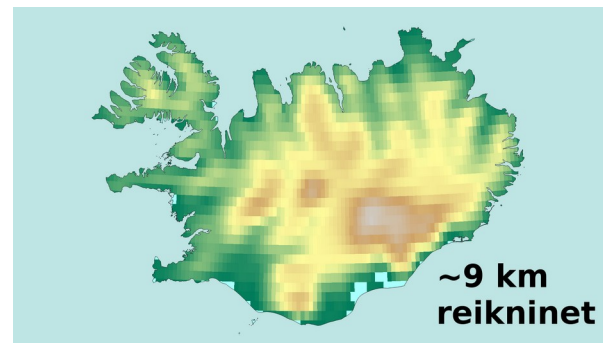
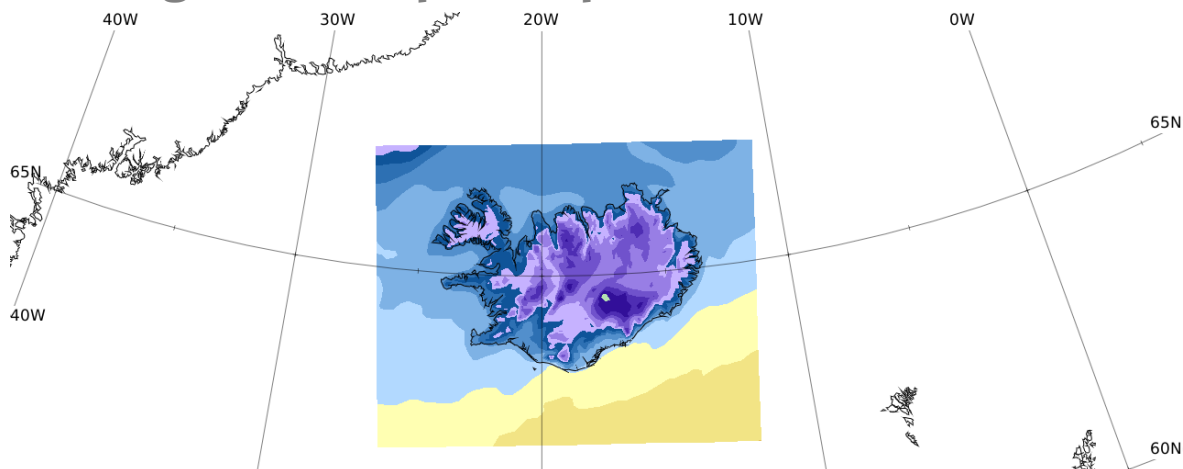
First steps with HARMONIE-AROME 2011-13

- First semi-operational run in 2011 - Cold start each cycle (ECMWF glaciers, see maps)
- Surface DA in autumn 2012 - Seasonal snow accumulation and melt
- Tuning of 10 m windspeeds 2013 - Big improvements in scores
- Fix T2m cold bias over lakes 2013 - Obvious errors removed
- Physiography database (PGD) upgrade starts in autumn 2014 in collaboration with Agricultural University of Iceland (best local vegetation and soil databases)



HARMONIE-AROME run 2012-2015

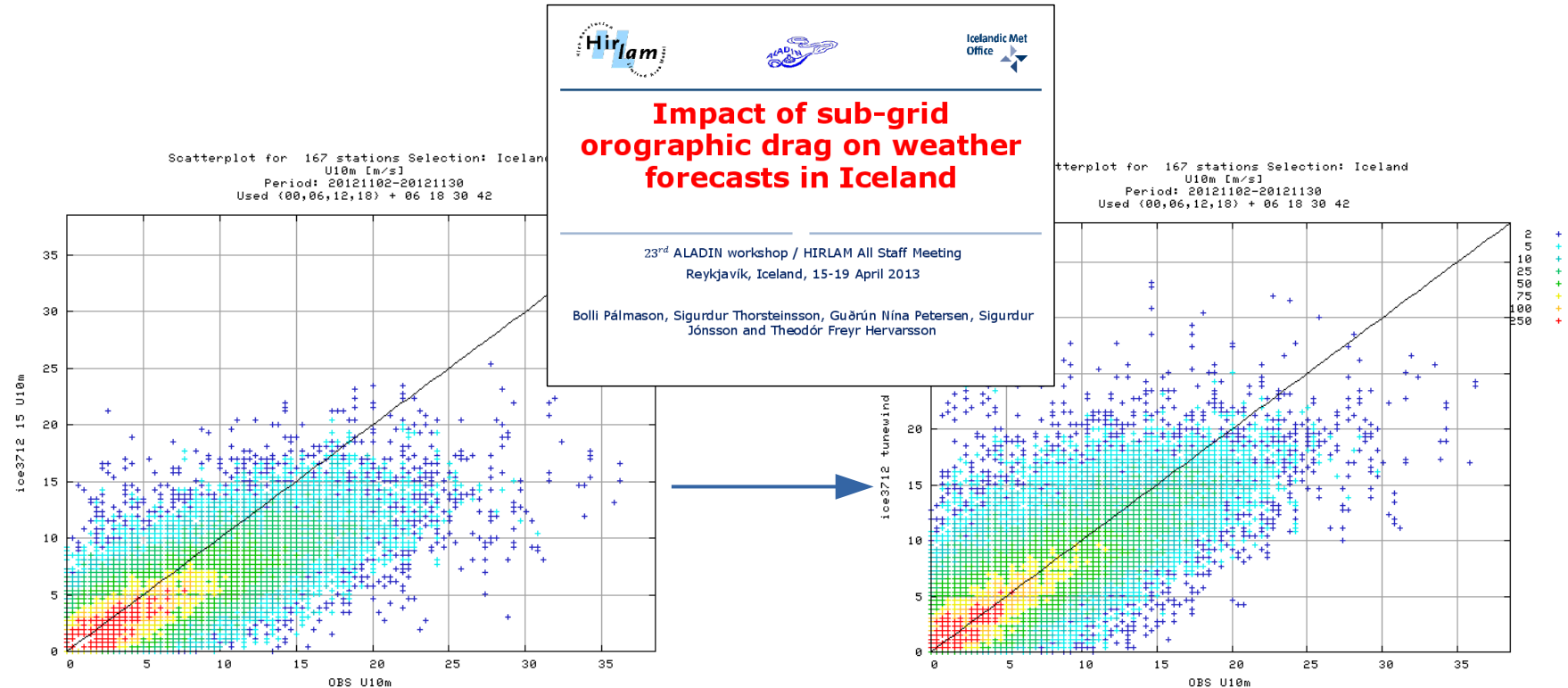
Using ECMWF supercomputers



IMO Operational Harmonie Model
Version: 37h1.2 on the ECMWF ecgate/c2a platform
Domain: 300x240x65. Top at 10 hPa
Horizontal res.: 2.5 km. Coupled hourly with ECMWF fc
Dynamics: Non-hydrostatic. Physics: Arome
Surface DA: Canari + OI_Main. Around 230 SYNOP obs.
Upper-Air DA: None. Run: 48h/4 times a day

Windspeed bias improved 2012-13

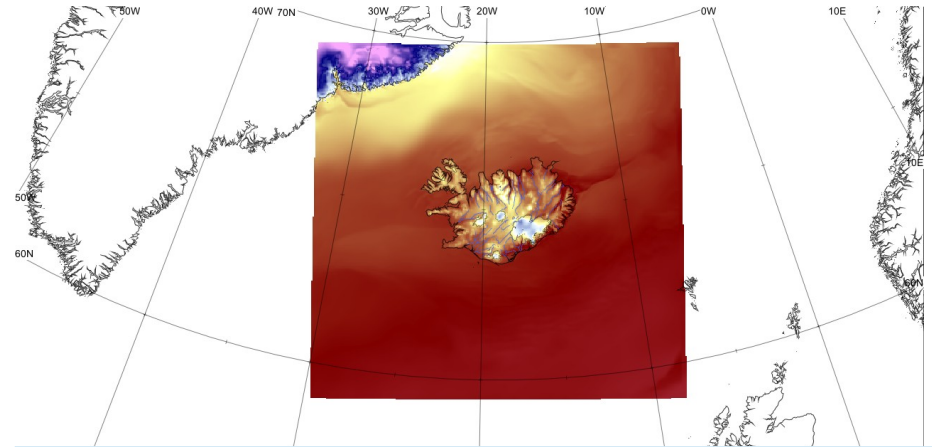
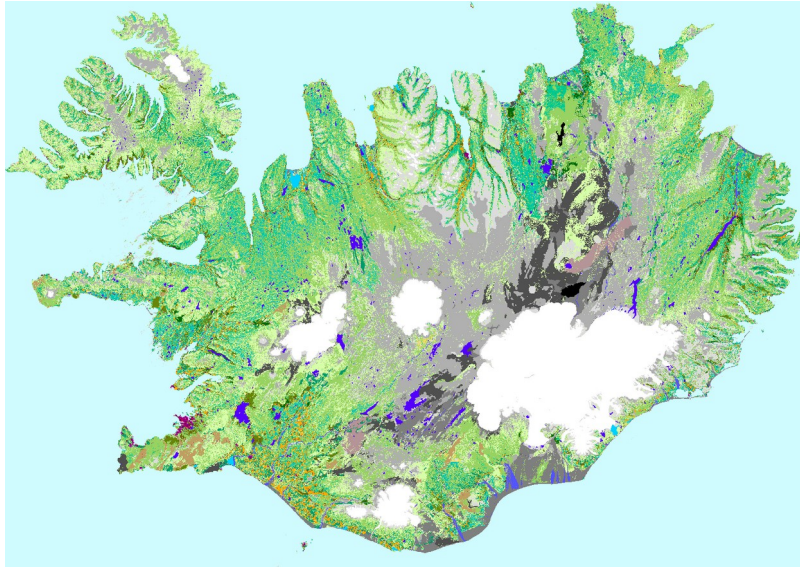
Forecasters gain confidence in our model after tuning



Major upgrade in autumn 2015

Operational 2015 - 2022

- ▶ New physiography (ECOCLIMAP-II)
- ▶ Bigger domain (fix precip. issues)
- ▶ Cy38h1.2



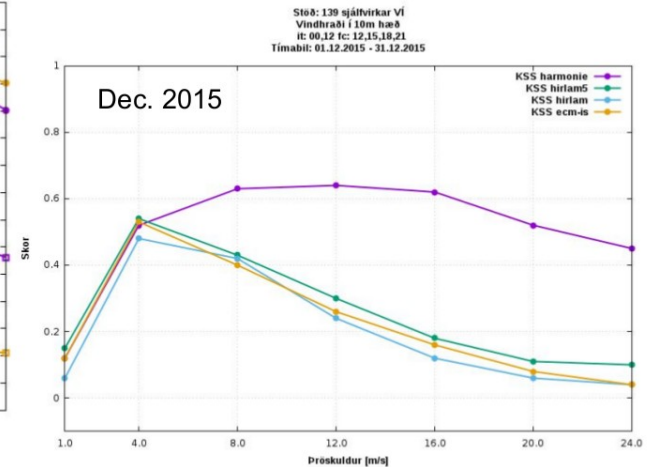
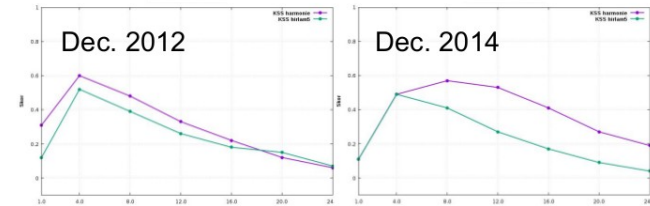
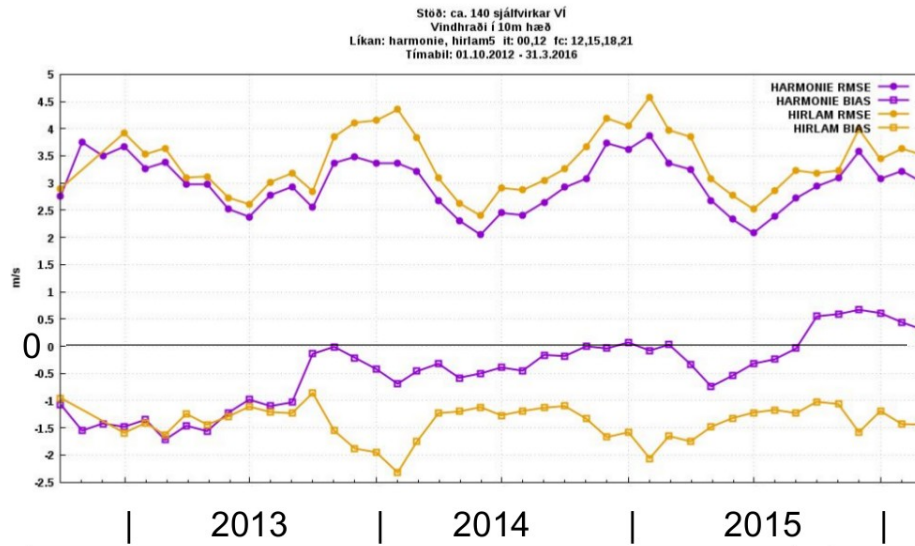
IMO HARMONIE-AROME model
Version: 38h1.2 running on ECMWF cca/ccb
Domain: 500x480x65. Top at 10 hPa
Horizontal res.: 2.5 km. Coupled hourly with EC-HRES
Dynamics: Non-hydrostatic. Physics: Arome
Surface DA: Canari + OI_Main. Around 230 SYNOP obs.
Upper-Air DA: None - Blending mode. Run: 66h/4 times a day
SURFEX model for surface and soil processes

Windspeed forecast important in Iceland

F10m Tuning

Improved HARMONIE 10 m wind speed forecast after tuning 2013 and further improvement in Sep. 2015 with PGD upgrade

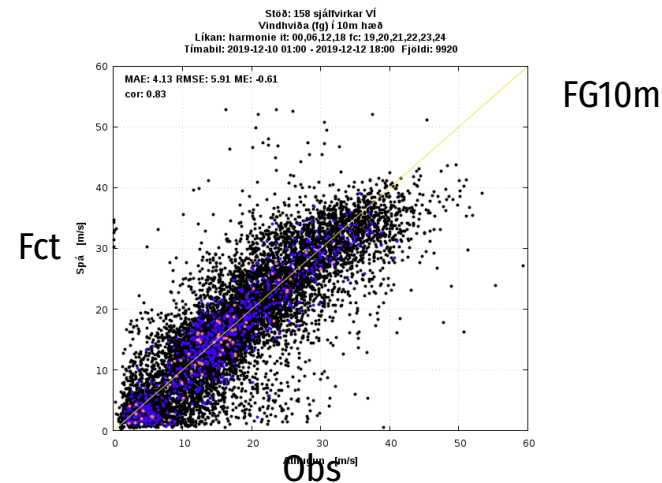
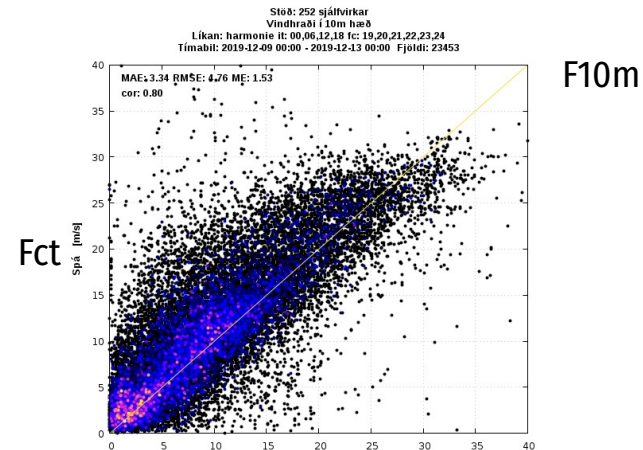
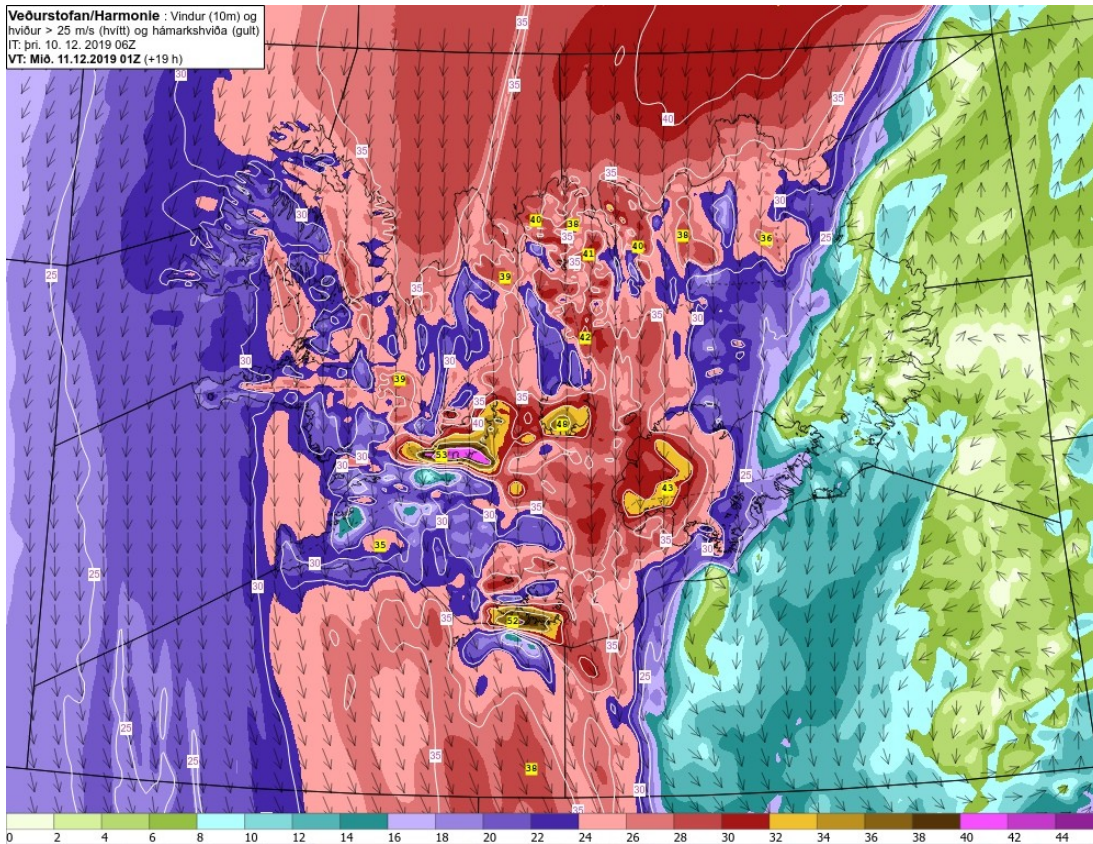
Kuiper Skill Scores



First red warning with new CAP in Dec. 2019 Veðurstofa Íslands

The 2.5 km run been the main model at IMO

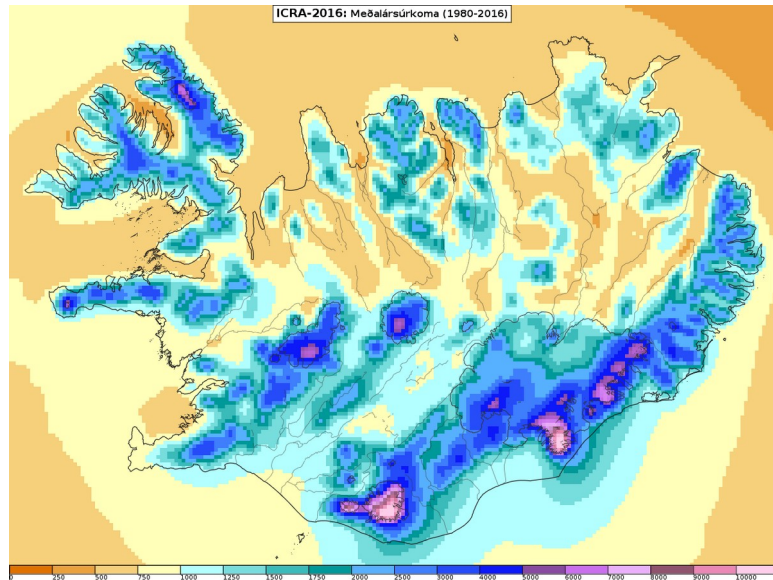
Veðurstofan/Harmonie : Vindur (10m) og
hviður > 25 m/s (hvítt) og hámarksþviða (gult)
IT: þri. 10. 12. 2019 06Z
VT: Mið. 11.12.2019 01Z (+19 h)



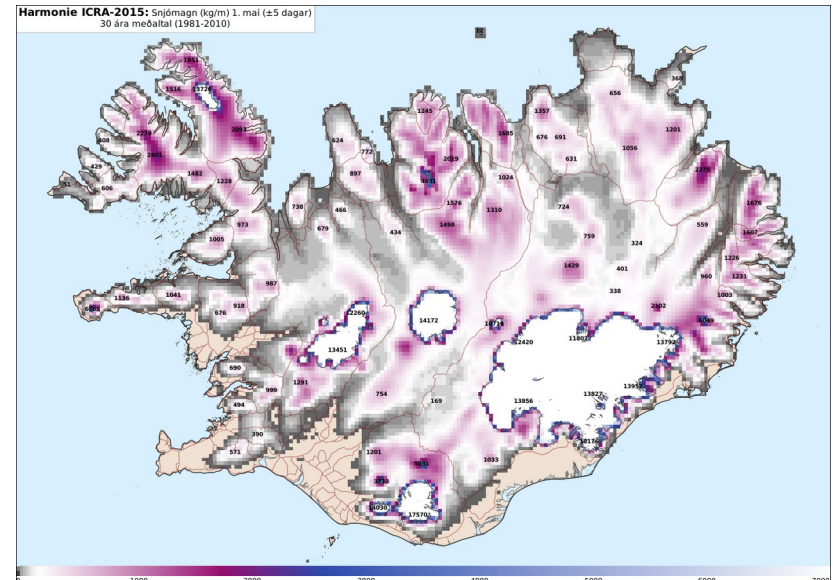
ICRA-2016 reanalysis

Iceland reanalysis (ICRA-2016) project done in 2015-16. HARMONIE-AROME (cy38h1.2) at 2.5km resolution over the smaller previous domain. The new physiography used. The whole ERA-Interim period covered (1979-2017). Model in forecast mode and run 4xday with surface DA and selected 6-12h forecast fields make the main reanalysis dataset.

IMO report: http://www.vedur.is/media/vedurstofan-utgafa-2017/VI_2017_005_rs.pdf



Average annual precipitation (1981-2010)



Average snow on ground on May 1 (1981-2010)

Cooperation with DMI

Danish Met. Institute HPC installed at IMO in 2015



IGB run from 2017 (IGA 2016-17)

- ▶ HARMONIE-AROME cy40h1.1
- ▶ Grid @ 2.5 km and 65 vertical
- ▶ Updated physiography (ECO-II)
- ▶ 3D-Var analysis
- ▶ 4x +66klst 4x +48klst

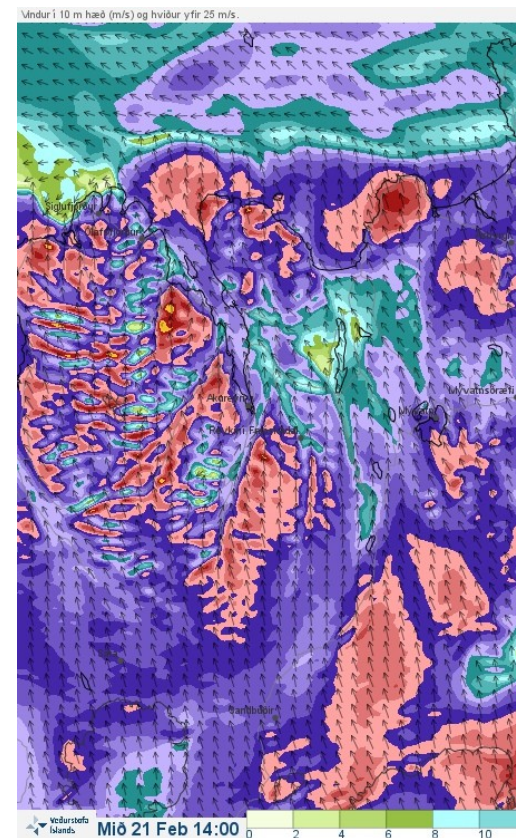
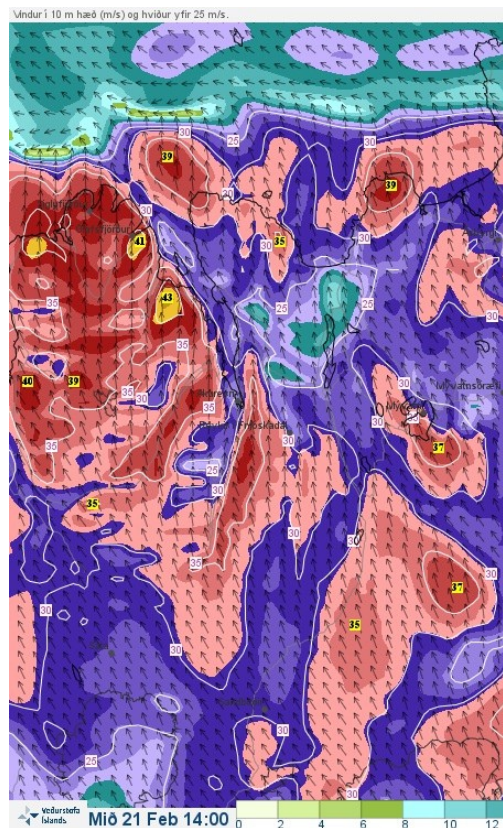


Hectometric 750 m run

Semi-operational run from Dec. 2018 to Oct 2022

Cy40h1.1 on 750 m grid (65 vI)

- ▶ Some bad overestimations of windspeeds in towns in narrow fjords
- ▶ First tests with 750 m grid gave good results and 36h runs from Dec. 2018
- ▶ Verifications have shown added value for wind and temperature
- ▶ The 2.5 km and 750 m run were retired with the move to Atos (older versions of Harmonie)

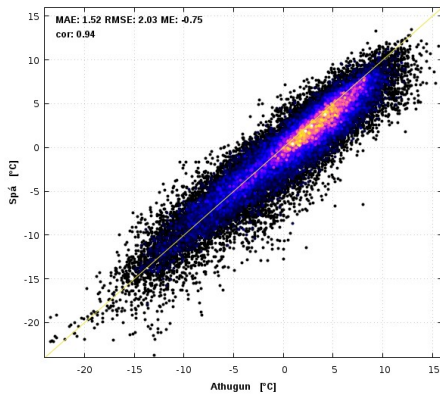


Verifications Apr 21 (t2m) & Dec 20 (f10m)

Stað: 171 sjálfvirkir VÍ

Hiti í 2m hæð

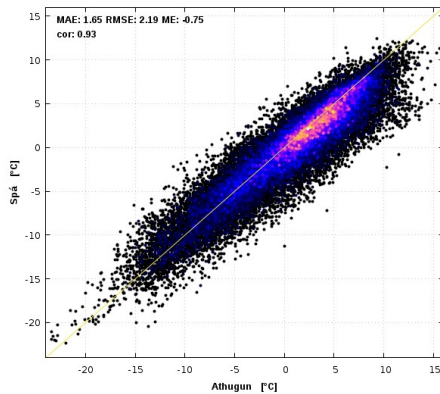
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Tímabil: 01.04.2021 - 30.04.2021 Fjöldi: 40242



Stað: 171 sjálfvirkir VÍ

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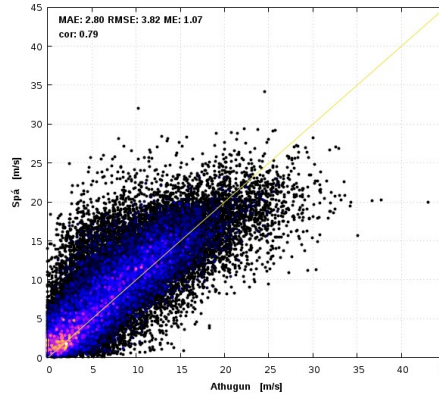
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Stað: 148 sjálfvirkir VÍ

Vindhraði í 10m hæð

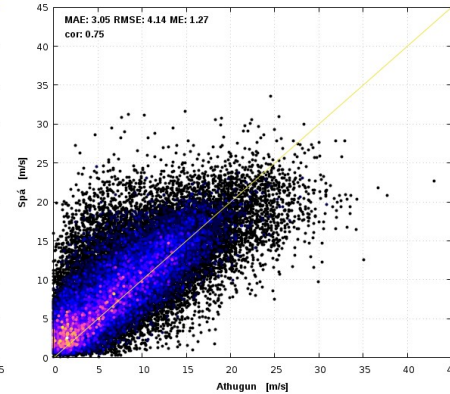
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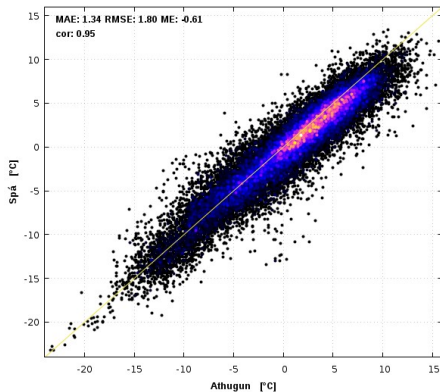
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Stað: 171 sjálfvirkir VÍ

Hiti í 2m hæð

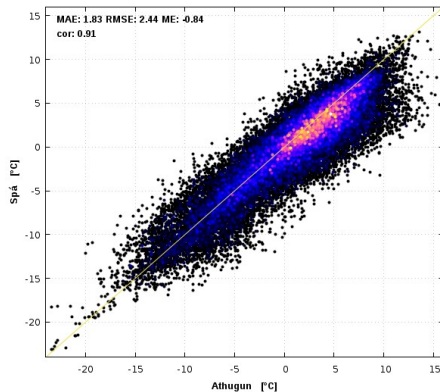
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Stað: 171 sjálfvirkir VÍ

Hiti í 2m hæð

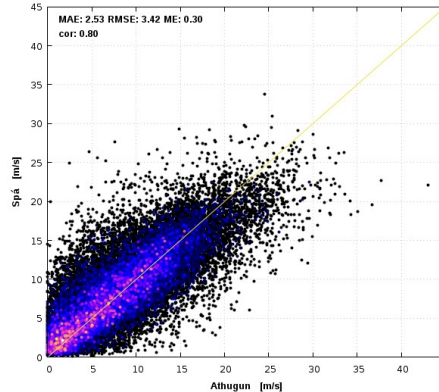
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Stað: 148 sjálfvirkir VÍ

Vindhraði í 10m hæð

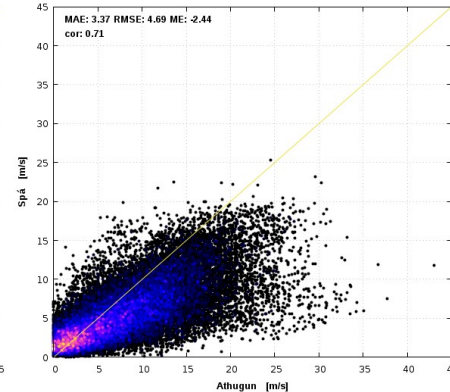
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Stað: 148 sjálfvirkir VÍ

Vindhraði í 10m hæð

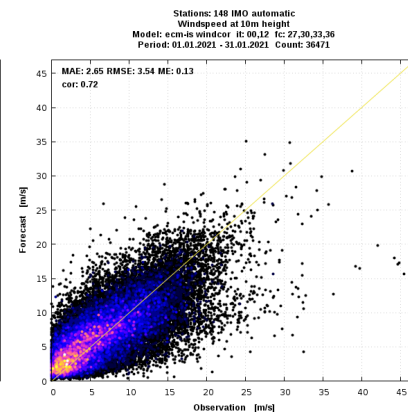
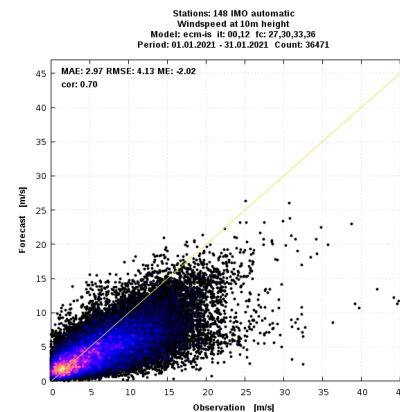
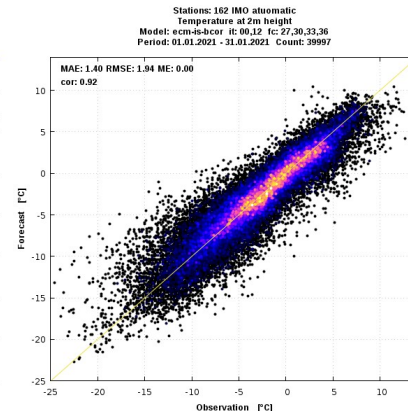
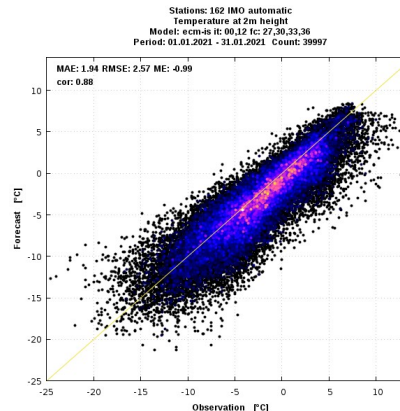
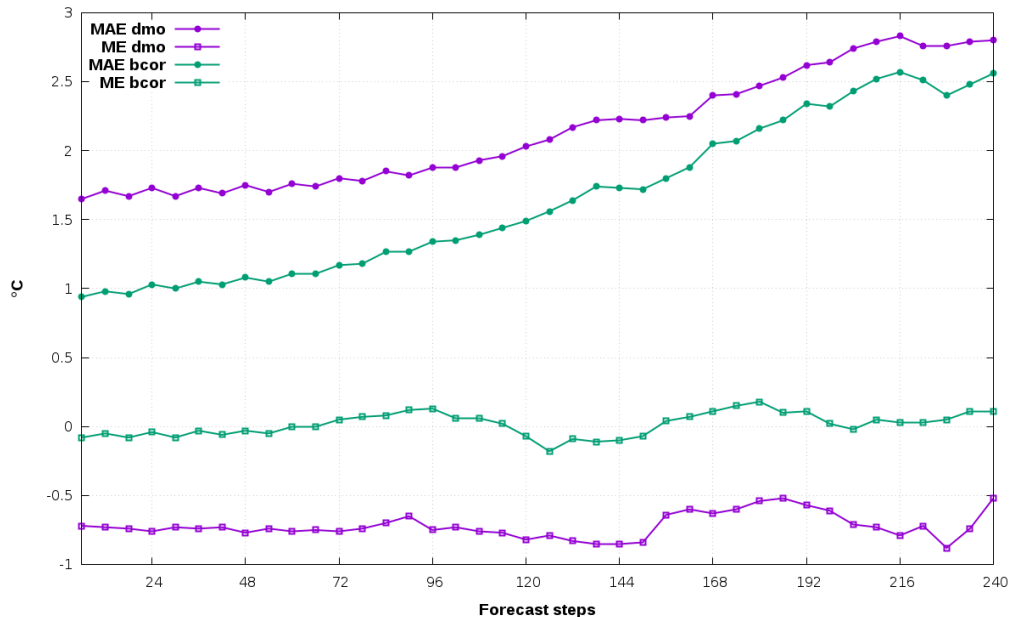
Líkan: ecm-ís-ít: 00.12.íc: 27.30.33.36
Tímabil: 01.12.2020 - 31.12.2020 Fjöldi: 36556



Bias correction for T2m (all) and F10m (EC)

Simple bias correction of 2 m temperature done for all models and improved windspeed forecast done for EC-HRES by using F10m and F100m forecast output

Bias corrected EC-HRES T2m forecast for May 2016
155 IMO automatic stations (>9000 cases per forecast step)



United Weather Centre – West (UWC-W)

- ▶ Operational cooperation (supercomputer and joint forecast runs)
- ▶ Denmark, Ireland, Netherland og Iceland (DINI)
- ▶ Budget split 3x30% and IMO 10%
- ▶ Preparations began in 2018 and will become operational in Q2/3 2024 (hopefully – many delays with the HPC until now)



UWC West



Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

New HPE Cray supercomputer installed 2022 ✨ Veðurstofa Íslands

Ken delivered the new UWC-West HPC in his pink truck!



Common operational domains

UWC-W operational runs in 2024

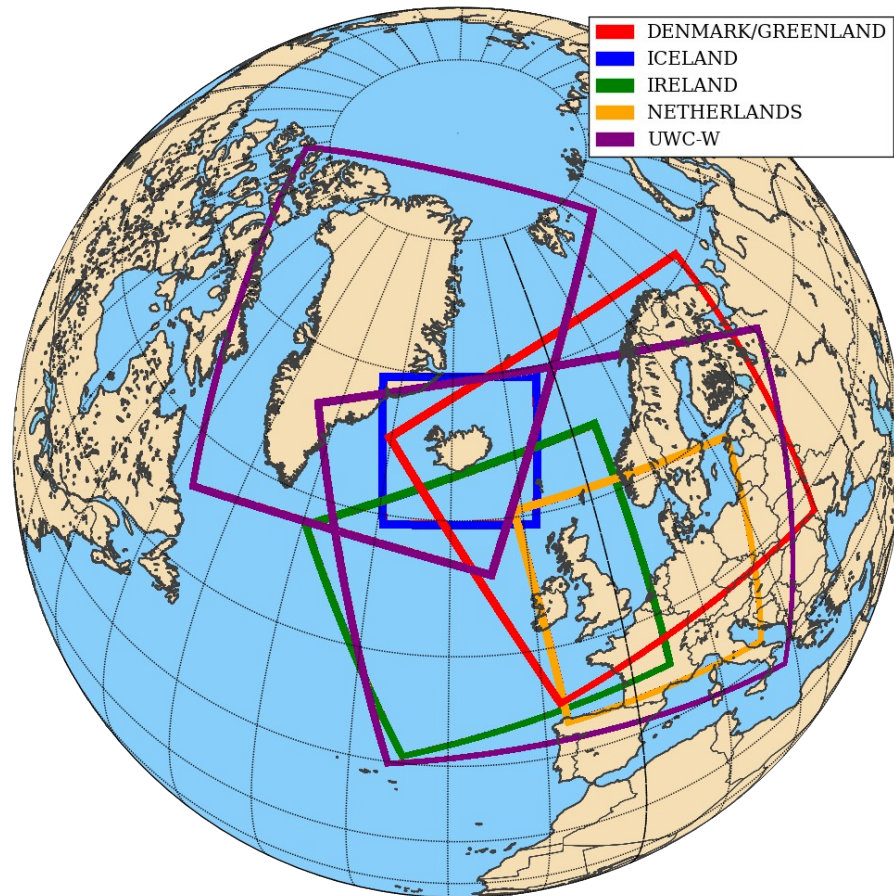
Two domains

► IG

- 2 km horizontal grid
- 90 model levels
- An. 8x +66 h forecast

► DINI

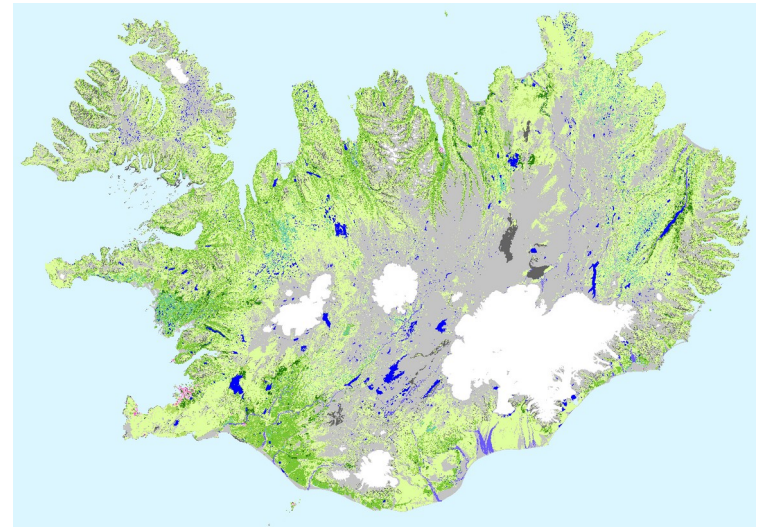
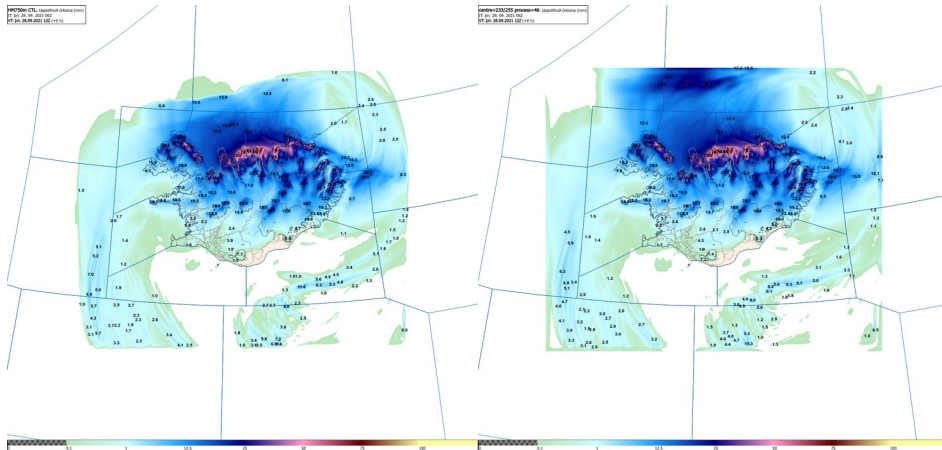
- 2 km grid spacing
- 90 ml 5m -> 10 hPa
- EPS
- 1+5 members every hour



Our national application on the new HPC

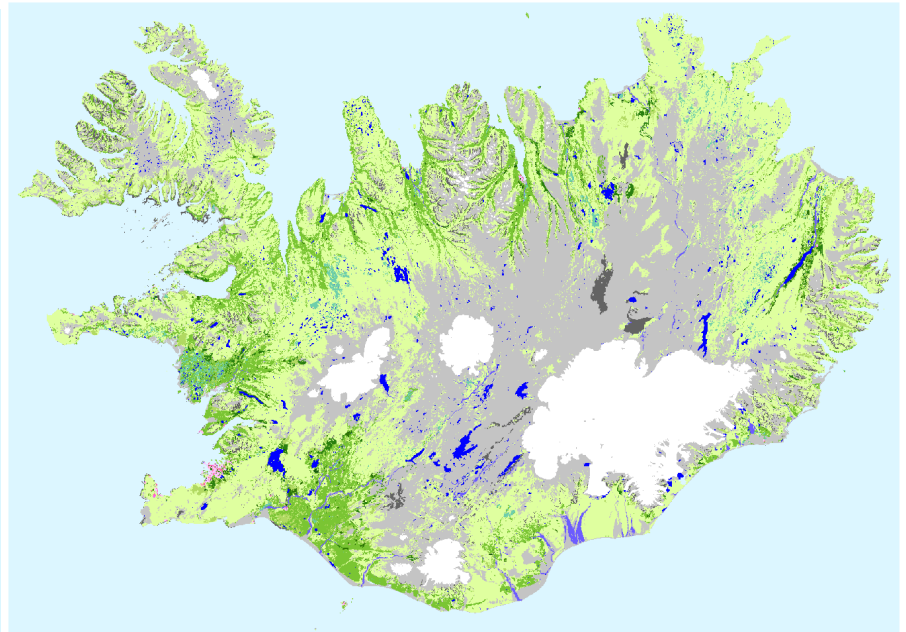
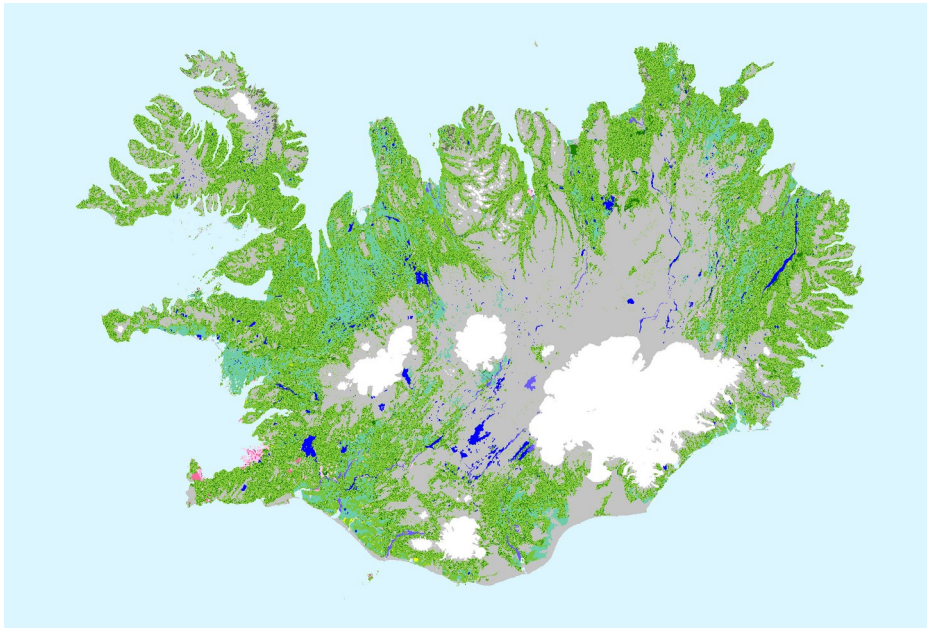
We plan to operate a new 750 m run as our national application on the new HPC

- ▶ Common code with local changes (cy43h1.2), but test run with cy46h1 on Atos with ISBA DIF+ES
- ▶ Bigger domain at 750 m with 90 vertical levels
- ▶ EC-HRES on the boundary with full hydrometeors coupling
- ▶ New ECOCLIMAP SG physiography



ECOCLIMAP SG – original vs new

Ready in 2022 and included in UWC-West IG and DINI runs. Many local databases used to create the new land cover map. Available in 30 m resolution and plan to use it at that resolution in the 750 m run.



Daily technical and operational duties

We are a small team and rely heavily on our partners in HIRLAM, ACCORD and UWC-West!

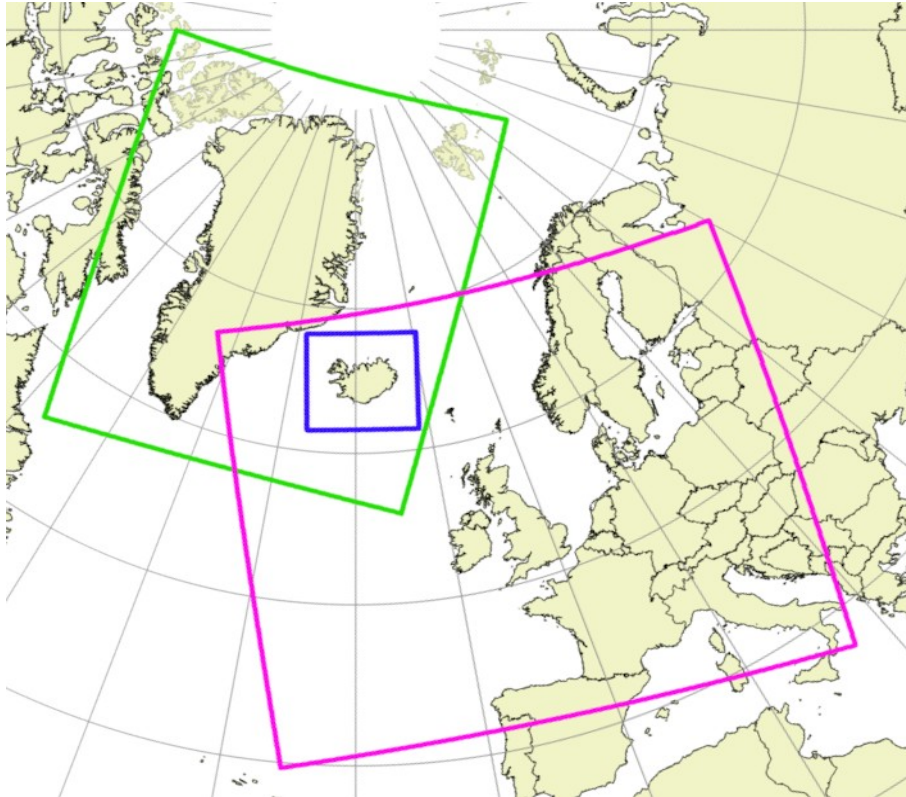
- ▶ Current operational IGB run is managed by DMI, but we deliver SYNOP obs. to the system and post-processing of output forecast data is done at IMO for our needs (station forecasts, extra parameters, bias correction of T2m, etc.)
- ▶ Our partner institutes in UWC-West will mainly handle future operational runs on the new HPC. Input datastream (LBCs, sat. data and conv. obs.) are IMO responsibility, but backup streams are in place from Met Éireann
- ▶ National application for IMO on 750 m grid is the focus of our NWP team and if well documented in ecFlow the first operators will probably be DMI personnel, but if quick requeue does not work it's our responsibility to get it back up
- ▶ The NWP team at IMO works closely with the duty forecasters, snow avalanche and land slide group and hydrologists at IMO to identify problems and develop our own model run and joint runs in collaboration with our partners in UWC-West

From HIRLAM to ACCORD

IMO has been a HIRLAM member for a long time and now one of the many institutes in ACCORD

- ▶ Our contributions to ACCORD have been in data assimilation (Siggi), surface group (Bolli) and physics (Guðrún Nína)
- ▶ Siggi is now retiring and has not promised any contributions to RWP2024, but new contributions may be seen as additional welcome bonus
- ▶ Xiaohui Zhao started in NWP at IMO this spring and is mainly working in DEODE but will be able to contribute to ACCORD next year (EPS?, physics?)
- ▶ The current NWP team at IMO will hopefully get a replacement member on the team for Siggi this year

Forecast runs operational next year



IG: Iceland-Greenland (cy43h, 2L90 and 3D-Var) 8x66h

IS750m: Our national application on 750 m hectometric grid (cy43h, 0.75L90 and sfxDA only) 4x66h + 4x3h

DINI: 24-30 member ensemble (cy43h, 3D-Var 2L90) 1+5 hourly +54h