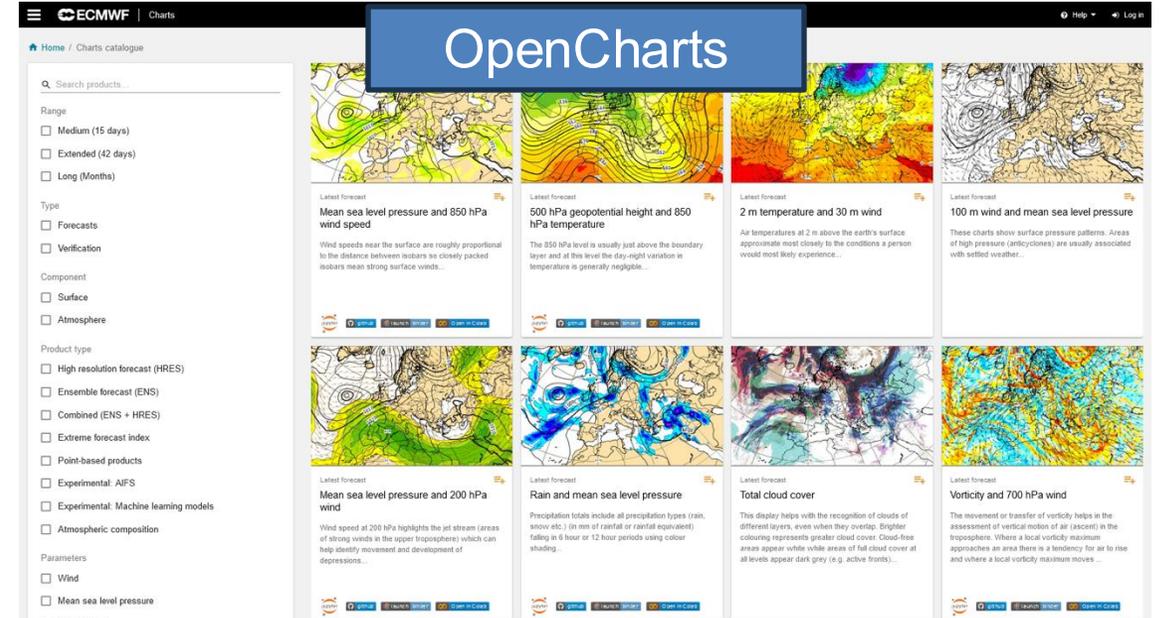
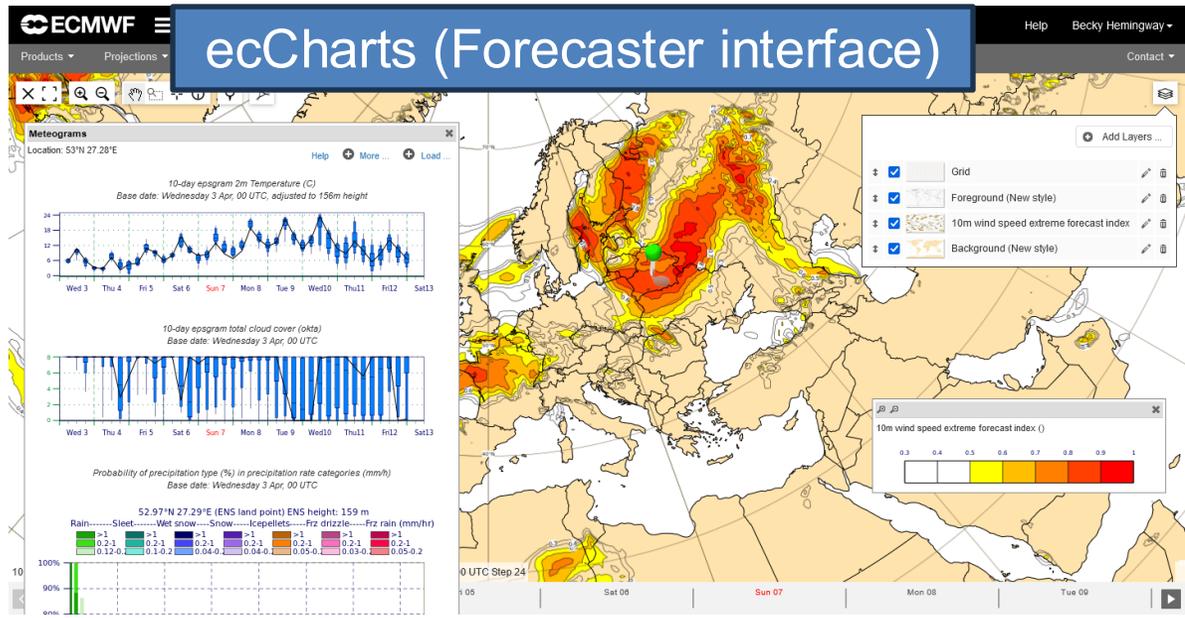


ECMWF forecast products, data access and upgrades

ECMWF Forecast Products and Services

ECMWF Forecast Products Access interfaces



<https://www.ecmwf.int/en/forecasts/accessing-forecasts>

ecCharts

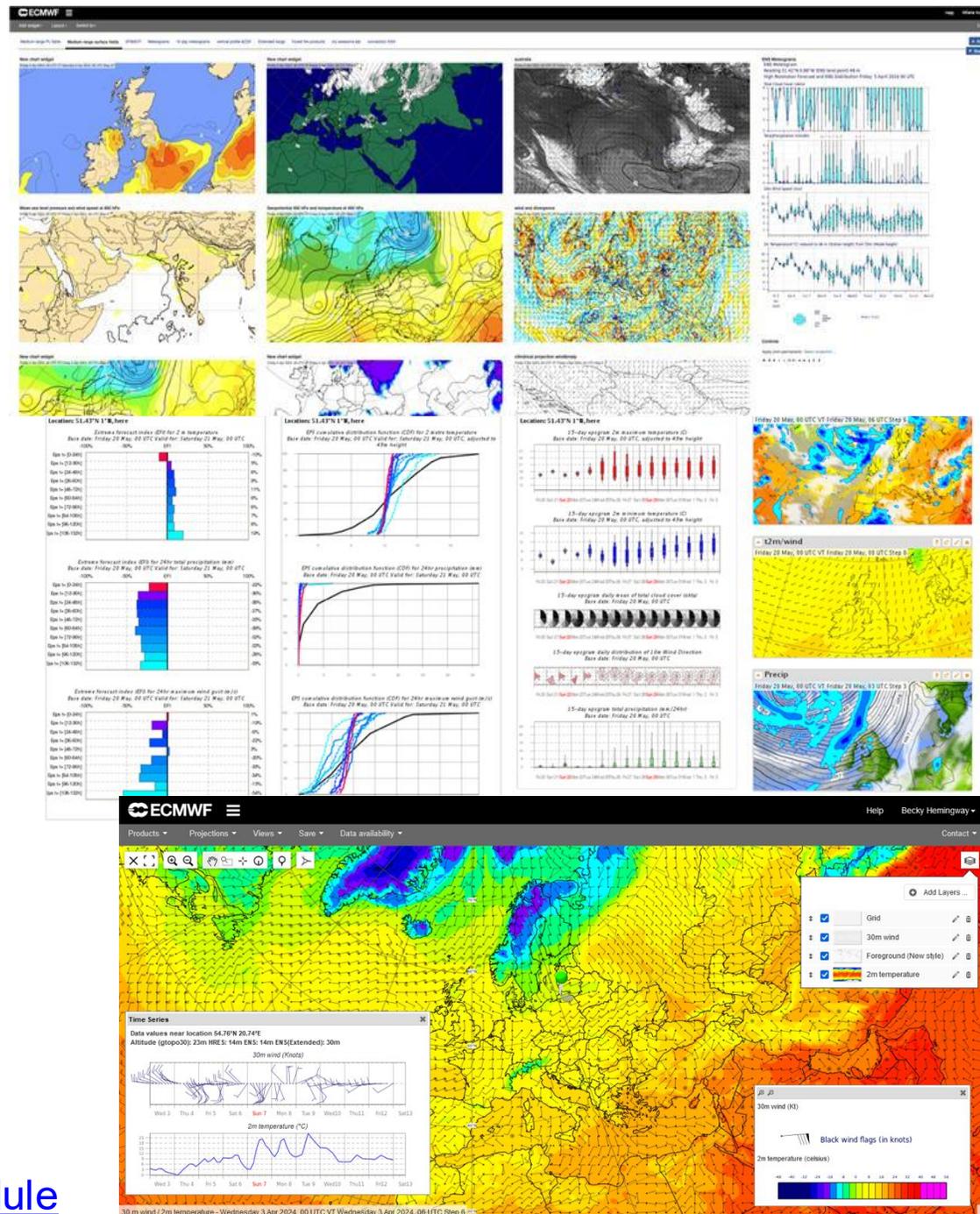
A web-based interactive application to inspect and visualize ECMWF medium-range and sub-seasonal data

Every WMO country has access from 2024

- Rich and dynamically growing content
- Web-based immediate access to charts
- Native data resolution
- Interactive features (zoom, pan, click, extract data information, ...)
- User controlled visualization
- Customisable parameters
- Download charts (through WMS)
- Build your own products

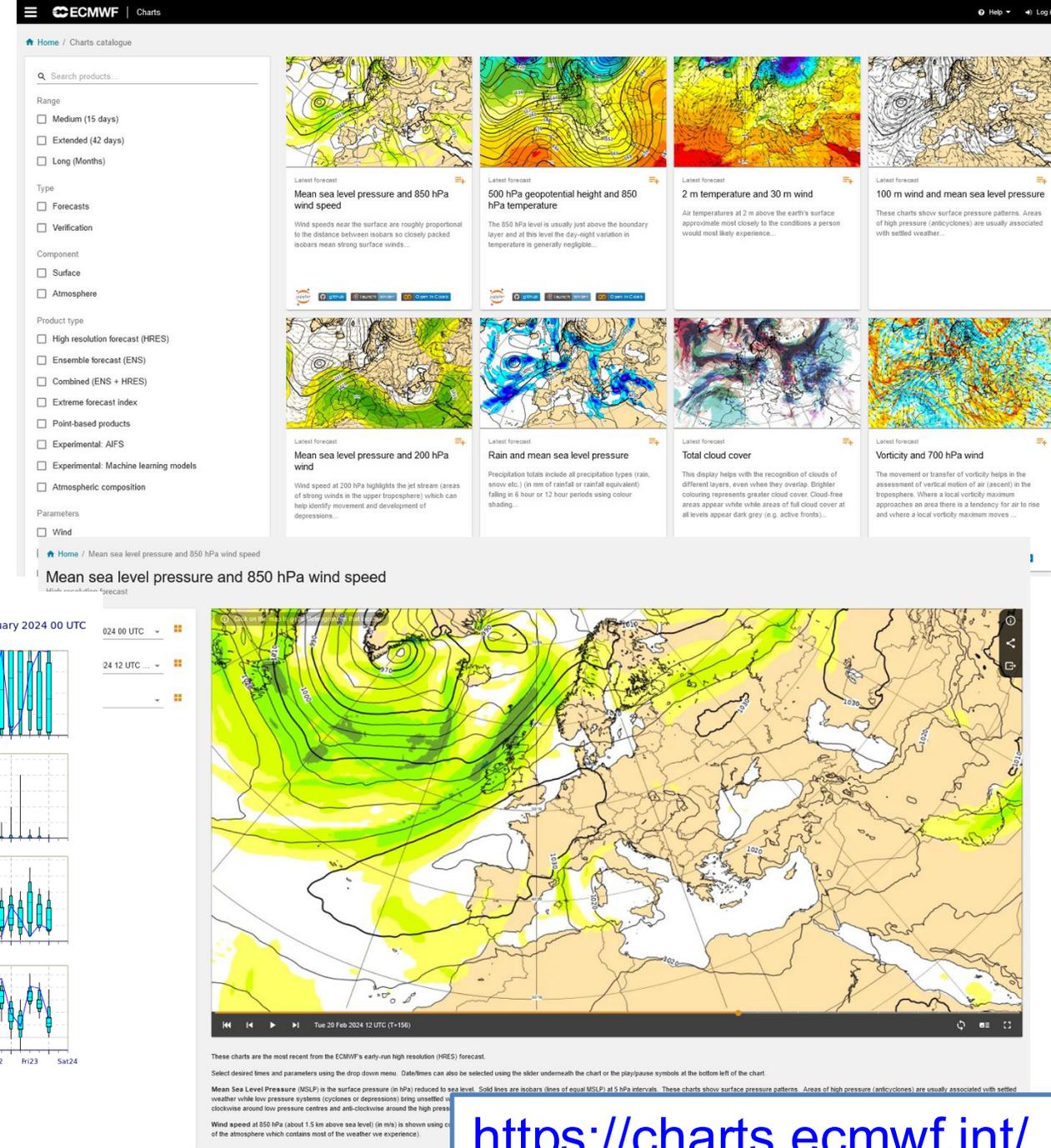
<https://eccharts.ecmwf.int>

<https://confluence.ecmwf.int/display/DAC/Dissemination+schedule>

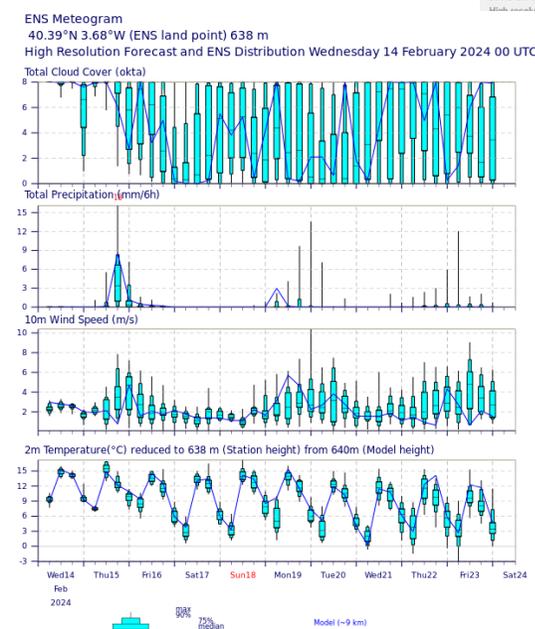
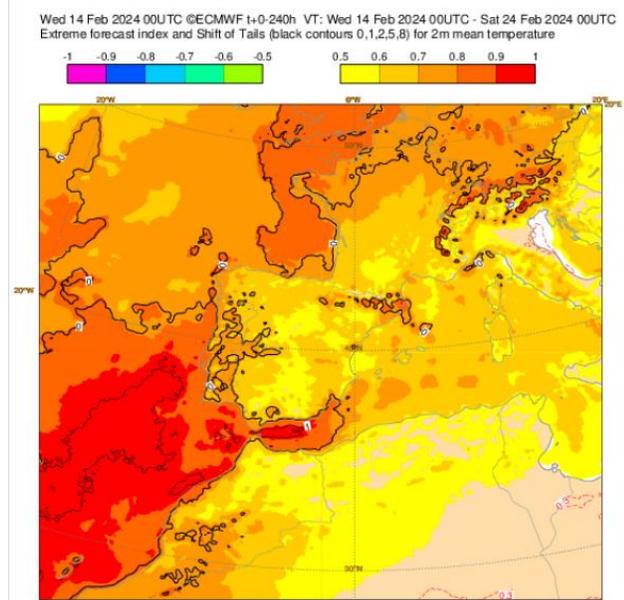


ECMWF OpenCharts

- Publicly available – free to access
- Originally released October 2020
- Continual updates with new products and improved features
- Predefined static maps with time sliders
- Can interact with some of the maps to get more information e.g. meteograms
- Content comes from ecCharts



<https://charts.ecmwf.int/>



Added Jupyter Notebook functions



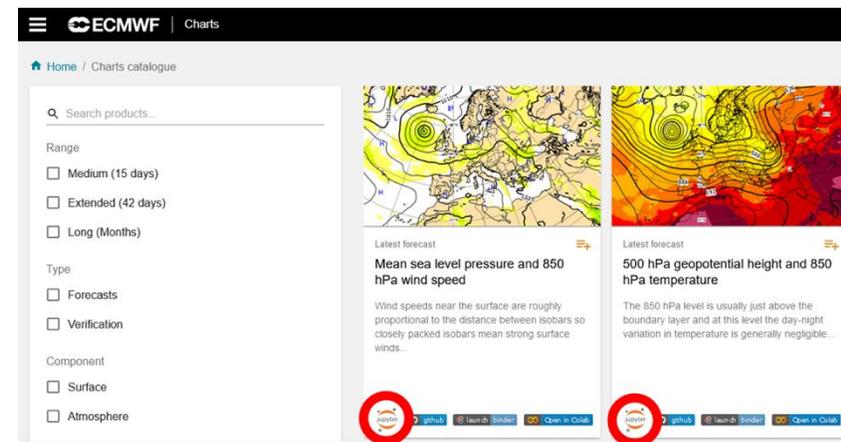
The problem

Many users ask us **how to reproduce** the open charts



The solution

Jupyter notebook for each product to reproduce it using archived data



Explain

- Which data is used
- Where to find it
- How to **download** it

Provide

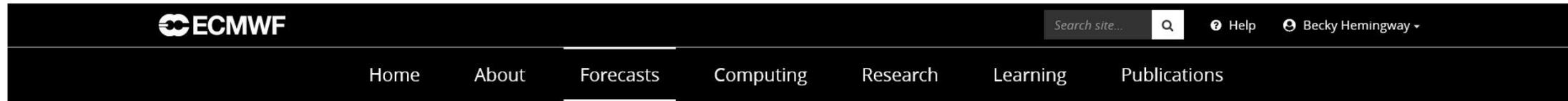
- Calculations for the product

Show

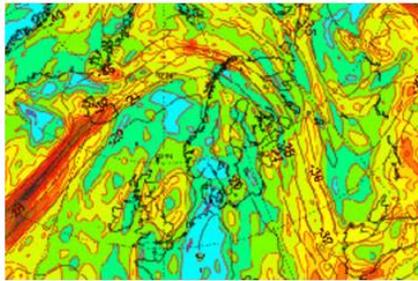
- How to plot it

Information on ECMWF Forecasts and data

<https://www.ecmwf.int/en/forecasts>



[Charts](#) | [Datasets](#) | [Quality of our forecasts](#) | [About our forecasts](#) | [Access to forecasts](#)



Charts

Our Integrated Forecasting System (IFS) provides forecasts and associated verification at different resolutions and for multiple time ranges. The verification provides essential feedback on the [quality of the forecasting system](#).

[Medium range](#)

[Extended range](#)

[Long range](#)

Quick access:



Datasets

Real-time and archive forecasts, analyses, climate re-analyses, reforecasts and multi-model datasets.

[Real-time datasets](#)

[Archive datasets](#)

[Open data](#)

Quick access:

[Public Datasets](#) >



Monitoring of the observing system

We continually monitor the quality and availability of the different components of the global observing system used at ECMWF.

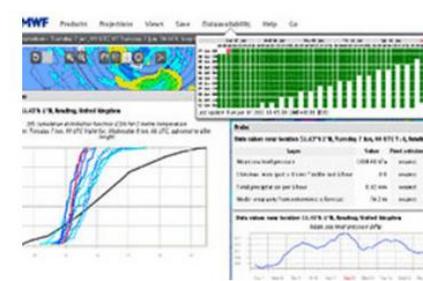
[Availability](#)

[Satellite data monitoring](#)

[Conventional data monitoring](#)

[Ocean observation monitoring](#)

[Automatic data checking](#)



The Integrated Forecasting System

Key characteristics of the Integrated Forecasting System (IFS), documentation on specific areas, and description of our forecasts.

[Medium range overview](#)

[Extended range overview](#)

[Long range overview](#)

[Changes in the IFS](#)

[IFS documentation](#)

Forecast User Guide (FUG)

<https://confluence.ecmwf.int/display/FUG>

ECMWF Spaces Calendars Create Search

Forecast User Guide

Pages

Forecast User Guide

Search this user guide for ...

"Behind good forecast practices are often hidden good theories; equally, good theories should provide a basis for good forecast practices." Professor Tor Bergeron, personal communication, 1974

Chart Dashboard

ecCharts

How to Find:
Type: "forecast user guide" into google and use the first link !

er Guide is to help meteorologists make the best use of the forecast products from ECMWF - to increase understanding of the ensemble forecast process, to develop new products, to reach new sectors of society, to satisfy
e User Guide presents the Integrated Forecasting System (IFS) and advises on how best to use the output, not least on how to build up trust in the forecast information. A good forecast that is not trusted is a worthless
hesis is on the medium-range forecast products, as this is ECMWF's primary goal, and because medium-range NWP output generally differs significantly from that dealing with short-range or seasonal NWP. Extended
ys 16 to 42) output concentrates on the probabilities of anomalies from the norm during a 5-7day forecast period at a location and the time of year. Seasonal forecasts give an indication of likely conditions beyond 6 weeks
run monthly giving forecasts to 7 months ahead, and run quarterly with forecasts extended to 12 months ahead. Output concentrates on the anomalies relative to the seasonal climate.
easingly aid early warning of severe or hazardous weather.

This guide is intended to give an outline of structure and use of the ECMWF IFS and how the high-resolution forecast (HRES), ensemble forecast (ENS), extended range forecast and seasonal forecast models inter-depend and interact. Links

Space tools

Severe Event Catalogue

IFS and AIFS Known Forecasting Issues

Topic / title	Description
2m Temperature	
T1. 2m temperature in the presence of inversions	In common with all models, 2m temperature forecasts from the IFS tend to have much larger errors, on average, at high latitudes in winter. The basic physical explanation is that a set change in atmospheric energy inversion situations than in unstable situations, because the energy change is computed through a much larger distance. The lower the inversion, the larger is the potential error. There is also sensitivity here to the model lowest model level (~10m) and skin temperature (2m temperature is a diagnostic, not direct model output).
T2. City temperatures too low	Due to the urban heat island effect not being represented, screen temperatures in large urban areas, particularly in winter, can be significantly lower than observed. The problem can be accentuated in winter by snow cover.
T3. Screen temperatures fall too much near coasts	As a consequence of the radiation grid being larger than the model grid (due to computational constraints), screen temperatures near coasts are often too low. This is because cooling progresses according to T ⁴ and at near-coast points T is approximately a result screen temperatures drop too much - related errors can sometimes exceed 10C. The problem is enhanced where coasts have a convex shape (land-relevant).
T4. Metogram temperature issues in complex topography	In addition to the normal problems of representing screen temperatures in complex topography in current-gm method by which screen temperatures on Metograms are generated from model screen temperatures at various altitudes, and so if the difference in height between the site chosen, and the nearest model gridpoint (as the errors/biases increases. This is especially true in winter-time when inversions are more common, by getting decrease, so the temperature correction applied could even be in the wrong direction. This issue is compounded by complex topography.
T5. China 'cold spot'	In products that intrinsically display 2m temperature output in some 'anomaly' form - such as monthly forecast ranges Eri and SOT - there has been a semi-permanent winter-time 'cold spot' over eastern China. It is not...

Topic / title	Description	Related activities / comments
General issues		
G1. Overly smooth forecasts	A result of the mean-squared-error optimisation in training AIFS Single is to deliver smooth fields. This can be seen in energy spectra, where there is less energy at length scales less than 1000km. This feature increases to a small extent with lead time. One example area would be objective fronts - identification of such requires the nearby thermal gradient to exceed a threshold; then in practice total front length will reduce with forecast lead time as gradient peaks get smoothed out.	Whilst this behaviour is also a well-known characteristic of an ensemble mean, the issue is less pronounced in AIFS. Plus, successive AIFS implementations have managed to further reduce the smoothing effect.
G2. Underestimation of small-scale extremes	AIFS resolution is ~35km. Where the spatial extent of extreme values is smaller the AIFS cannot and should not represent peak values. Examples include topographically- or convectively-forced localised rainfall extremes, low level wind extremes around tropical cyclones or extreme extra-tropical cyclones, localised temperature extremes in complex topography (e.g. in valleys or on mountain tops).	IFS output exhibits the same behaviour, but for the current medium range ensemble the issue is much less because gridlength is much smaller. In AIFS such issues are exacerbated by G1.
G3. Parameter consistency	As the AIFS lacks hard physical constraints between variables there is more scope for inter-parameter consistency to be lacking at specific locations at specific times.	Ordinarily this is not a major problem, but there have, for example, been cases of precipitation without cloud. T1 provides a more substantive example.
Low level winds		
W1. Underestimation of wind speeds around cyclones	For both tropical and extra-tropical cyclones the AIFS has a slow bias, underestimating the strongest winds.	
Cloud cover		
CC1. Underestimation of cloud cover	In AIFS cloud cover is often underestimated, particularly in the tropics.	

Changes to forecasting system

- Forecast User Home: <https://software.ecmwf.int/wiki/display/FCST/Forecast+User+Home>
- Severe Event Catalogue: <https://confluence.ecmwf.int/display/FCST/Severe+Event+Catalogue>
- Forecast System Changes: <https://confluence.ecmwf.int/display/FCST/Changes+to+the+forecasting+system>
- IFS Forecasting Issues: <https://confluence.ecmwf.int/display/FCST/Known+IFS+forecasting+issues>
- AIFS Forecasting Issues: <https://confluence.ecmwf.int/display/FCST/Known+AIFS+Forecasting+Issues>

ECMWF's Open Data Policy

Open Data at ECMWF



Free and open charts including
meteograms (Open Charts)



Free and open data available on
ECMWF Data Portal and in Microsoft
Azure, Google & Amazon AWS

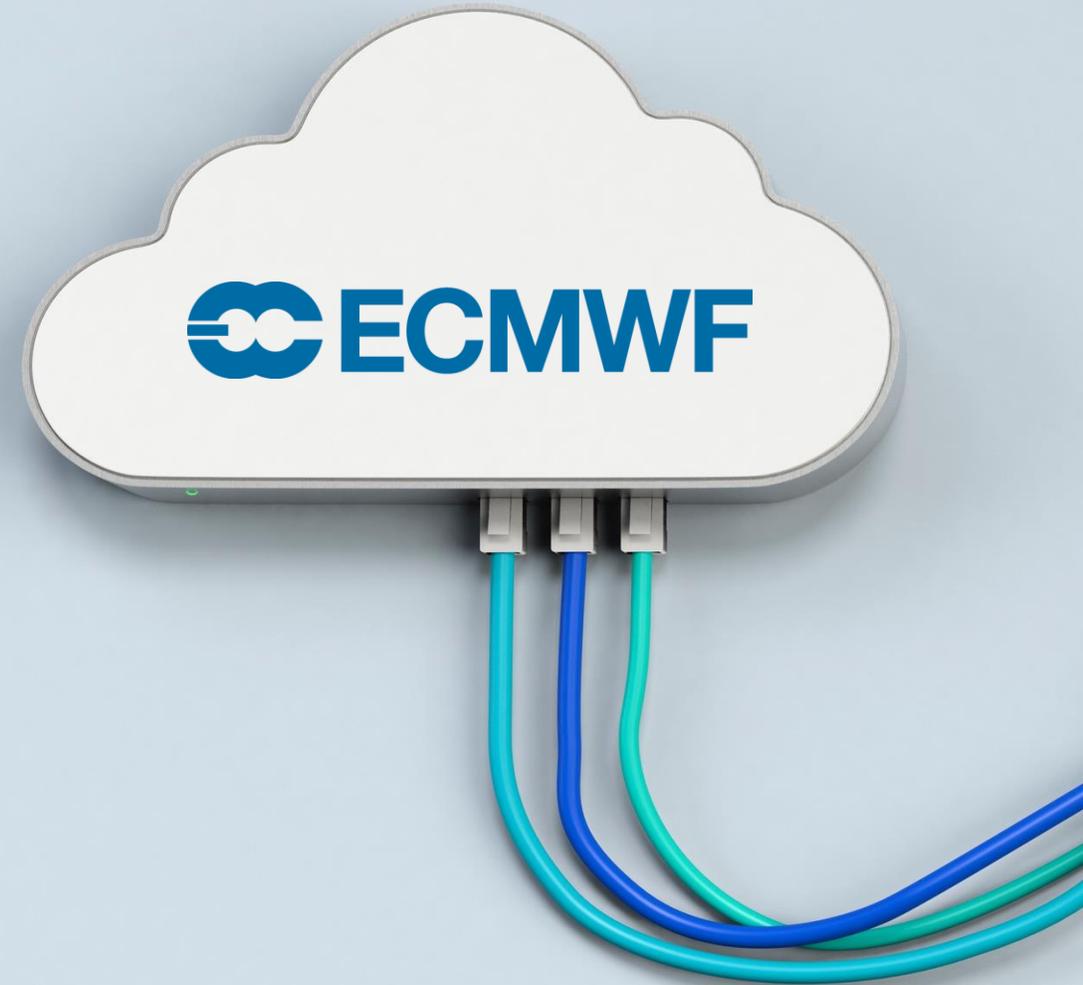


Contents of the ECMWF real-time
catalogue provided with an open licence
(CC-BY-4) for data ≥ 0.4 degrees



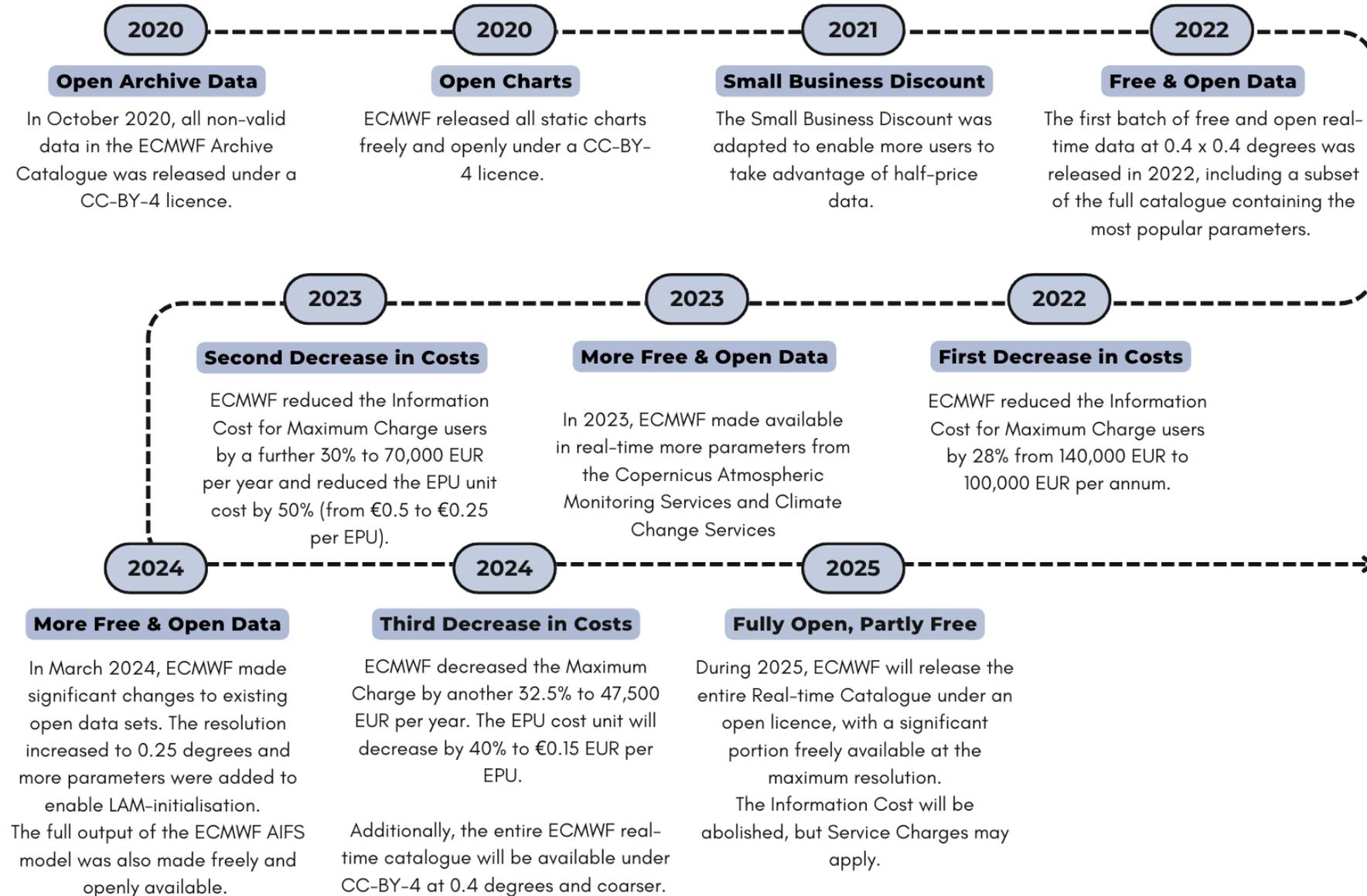
Reduced fees for some
licence types

<https://confluence.ecmwf.int/display/DAC/ECMWF+open+data%3A+real-time+forecasts+from+IFS+and+AIFS>



ECMWF Open Data Roadmap

underscores commitment to support UN Early Warning for All (EW4All)



What is available to WMO Members



OpenCharts, including WMO charts for lead centre activity



ecCharts



“SOFF” dataset - approved subset of the full catalogue available to all WMO Members



NMHS Licence for access to the complete catalogue with applicable service charges



<https://charts.ecmwf.int/wmo/>



ECMWF model upgrades

ECMWF's models, forecast ranges, and update cycles

- IFS (physical model)
- AIFS (data driven model)

- Medium range - 15 days
- Sub-seasonal – 46 days
- Long range – one to seven/thirteen months ahead

Model is updated in 'cycles' and the current cycle is 49r1

- Implemented 12 November 2024

The operational forecasting system

Changes in
48r1 and 49r1

ENS Control and HRES including ocean waves (WAM) – computationally identical in 49r1:

- **9 km**, 137 levels, to 15 days at 00UTC and 12UTC and to 6 days at 06UTC and 18 UTC

Ensemble forecast (ENS) including ocean waves (WAM):

- 4 x per day, 50 members, **9 km**, 137 levels, to 15 days ahead
- **ENS Sub-Seasonal (Extended-range)**: once a day (00UTC), 100 members, **36 km**, 137 levels, to 46 days ahead

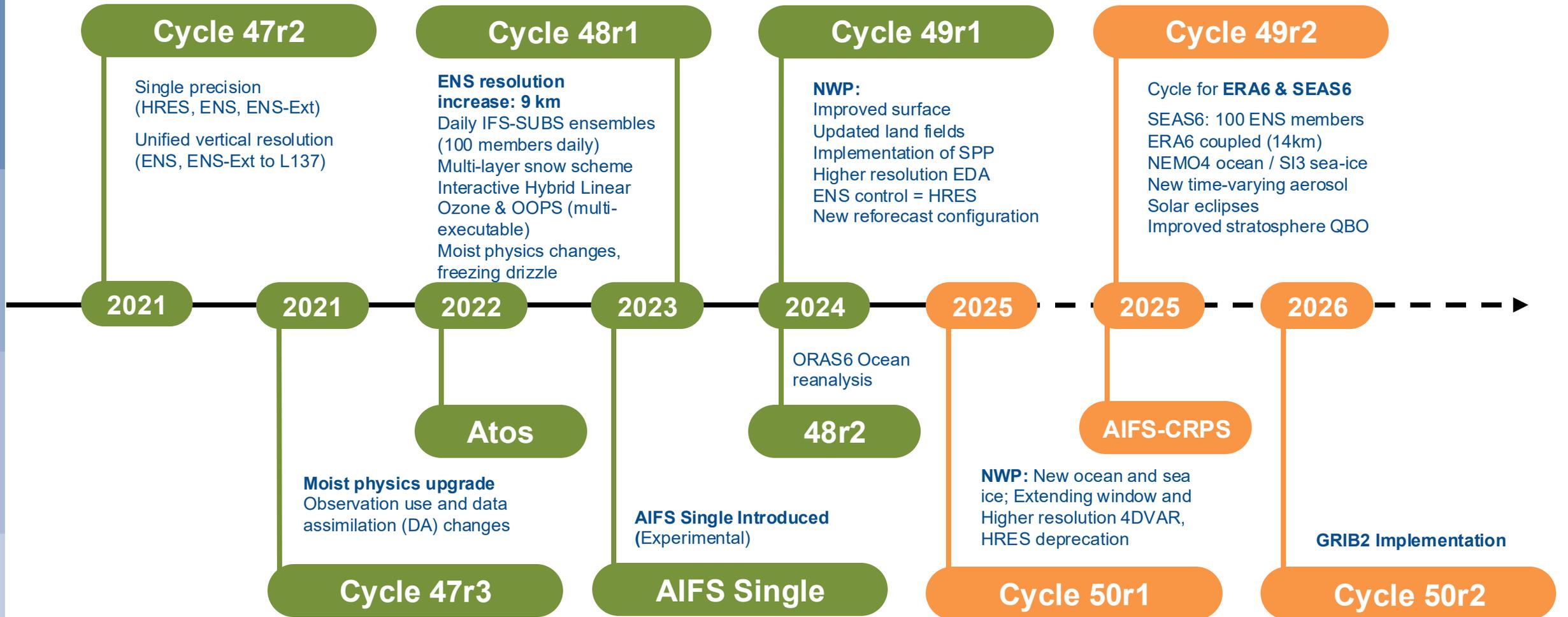
Long range:

- **SEAS5**: Once a month, 51-members, **36 km**, 91 levels, to 7 months ahead, 4 x a year (3-monthly) to 13 months

AIFS Single v1 (released 25 February 2025):

- Same schedule as IFS, **36 km**, 13 levels, to 15 days ahead, limited parameters

Integrated Forecasting System (IFS) Upgrades – past and future



49r1 – Implemented 12 November 2024

Article “Upgrade of the integrated Forecast System” Newsletter 181

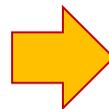
Model Changes

- Wave model and convection package
- Land-surface model updates
- Activation of the Stochastically Perturbed Parametrisations (SPP) scheme
- Physics and numerics contributions
- Atmospheric composition package

Data assimilation changes

- Microwave and RTTOV assimilation package
- Non-microwave observations package
- T2m assimilation package
- VarQC and stratospheric balance assimilation package
- Land-surface assimilation package
- Updates to EDA

New Reforecast Configuration !



49r1 Data webinar explains this well! – See ECMWF YouTube

In Cycle 49r1

Sub-seasonal: 10 perturbed + 1 control forecast **every odd day of the month (1,3,5,...)**, over past 20 years (excluding 29 February).

Medium-range: 10 perturbed + 1 control forecast **every 2 odd days of the month (1,5,9,...)**, over past 20 years (excluding 29 February).

49r2 – SEAS6 planned for 2025/2026

Scientific improvements

- New IFS version (Cy49r2 vs Cy43r1)
- New ocean model (NEMO4 SI3 vs NEMO3.4 LIM2)
- New ocean re-analysis
- New offline land surface re-analysis / real-time analysis

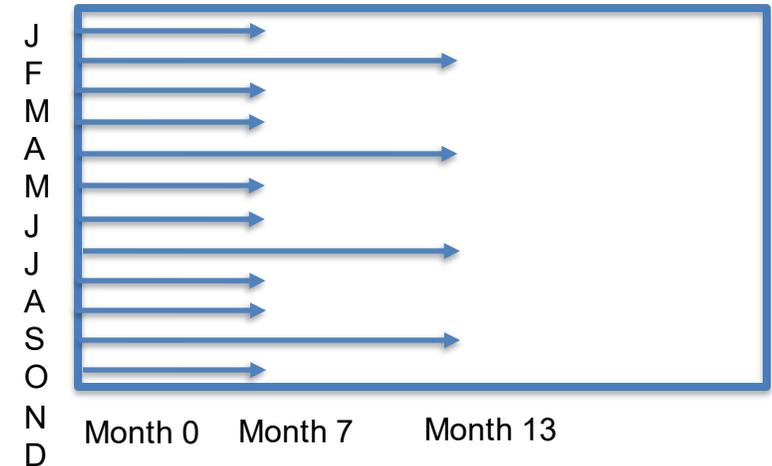
Resolution improvements

- Horizontal resolution unchanged
- IFS vertical resolution L91 -> L137
- IFS and NEMO from double to single precision, overall cost neutral

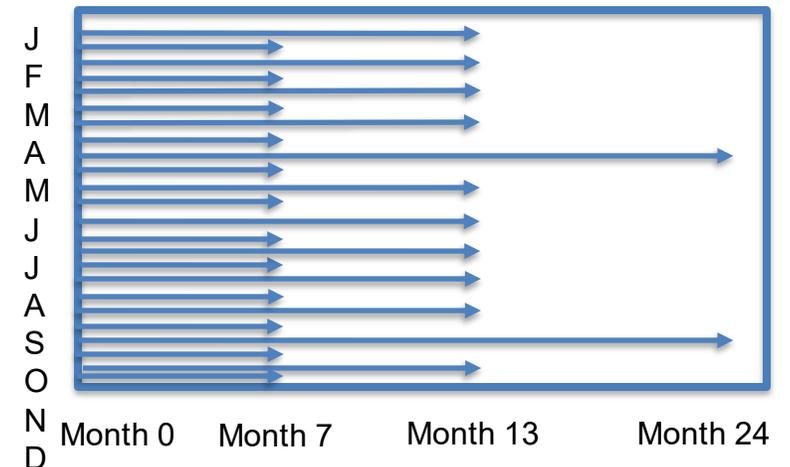
Configuration improvements

- Real-time 101-member ensemble
- Initiated twice a month (1st and 16th)
- Larger ensemble sizes and larger set of years
- 13-month range ENSO forecasts will be produced monthly, and will run out to 24 months twice a year

SEAS5



SEAS6

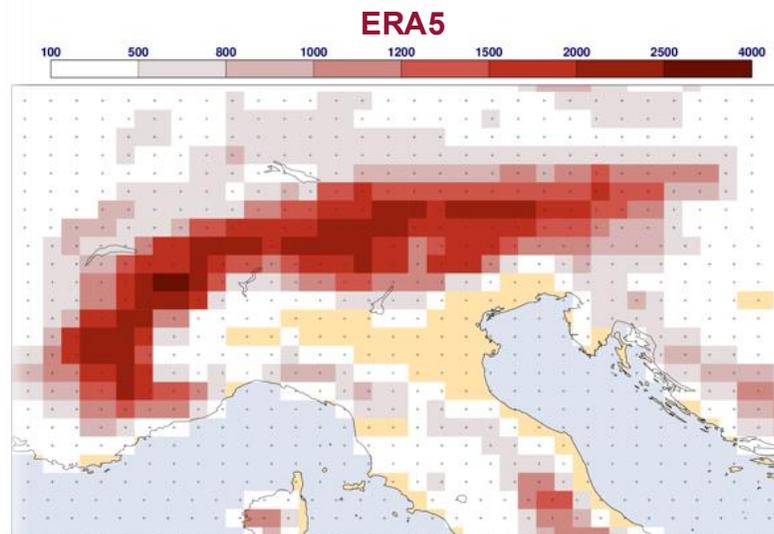
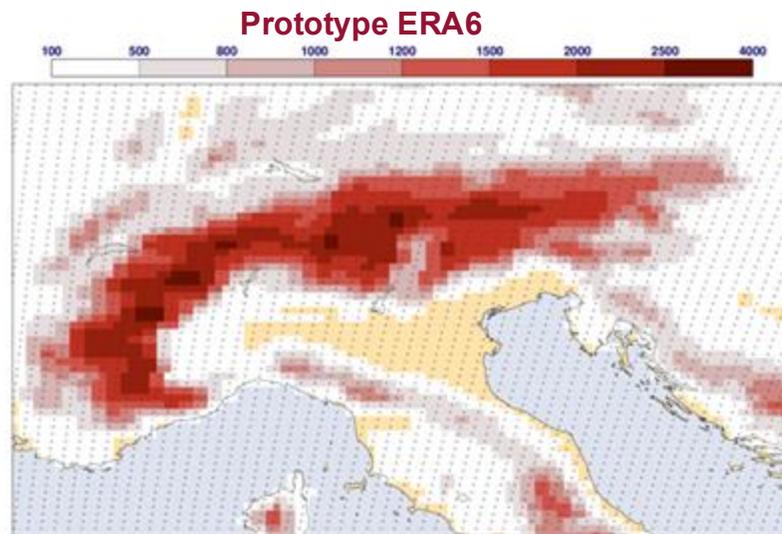


From ERA5 to ERA6: new climate dataset is being developed

ERA5 is *the* world-leading climate reanalysis dataset for many applications

Preparations of its follow-up, ERA6 are well underway:

- Taking onboard recorded user requirements from our huge ERA5 user base (over 160,000)
- Will capitalise on an additional **8 years of R&D** at ECMWF, plus increased compute power
- Double the atmospheric resolution: **14km globally** vs 31km; **ocean waves 14km** vs 40km
- Has coupling with the ocean, providing additional information on the climate system



**ERA6 started
production in 2025
hope to make the first
20 years (2006-2025)
available Q3/4 2026**

**ERA6-T (real-time
stream) from Q3/4 2026**

The operational forecasting system

50r1 in 2025

“Control” including ocean waves (WAM):

- **9 km**, 137 levels, to 15 days at 00UTC and 12UTC and to 6 days at 06UTC and 18 UTC

Ensemble forecast

- 4 x per day
- **ENS Sub-S** 0 members, **36 km**, 137 levels, to 40

Long range:

- **SEAS5**: On 4 x a year to 13 months ahead,

AIFS Single v1 (released 25 February 2025):

- Same schedule as IFS, **36 km**, 13 levels, to 15 days ahead, limited parameters

In 50r1 (Q4 2025):

- Current “ENS Control” run will be stopped
- Data stream currently called “HRES” will be the “Control” run
- This “Control” run will be available on same schedule of current “HRES” (earlier than perturbed ENS forecasts)

50r1 – new ocean-sea ice model in NWP

	Operational/current system	In the pipeline (Cycles 49r2/50r1)
Ocean Model	NEMO3.4-LIM2 0.25 deg 75 vertical levels Single category, 2-layer (+ 1 snow) ice model	NEMO4.0.6-SI3 0.25 deg 75 vertical levels Multi-category, 4-layer (+1 snow) ice model
Ocean initial conditions	ORAS5 – OCEAN5	ORAS6 – OCEAN6
Output	netcdf (some variables in GRIB on atmos grid)	GRIB2

Features of the upcoming system:

- Improved Western Boundary Currents (e.g. Gulf Stream).
- Snow on sea ice – in NWP, reduces the warm bias seen in winter over the ice surface especially in cloud free situations.
- Multicategory sea ice model, with melt ponds is more responsive but tends to be biased too thin
 - No thickness assimilation in ORAS6
- Reduced the known SST warm bias in Southern Ocean

NEMO4-SI3 will already be used in ORAS6, ERA6, SEA6.

IFS Cycle 50r1 – technical details

- Currently running RD e-suites (winter & summer)
- In parallel, building pre-operational 50r1 e-suite
- Tentative timeline (assuming no big issues)
 - 50r1 e-suite running from June/July 2025 – data in MARS
 - Test dissemination (Release Candidate Phase) – Sep/Oct 2025
 - Target implementation – **Oct/Nov 2025**
- Communication with users in coming months
- Significant technical change – termination of enfo/cf (& waef/cf)
- ENS CTRL available in oper/fc (49r1 ctrl in both oper/fc & enfo/cf)

IFS Cycle 50r2 – Big Change – GRIB2!

- Changes to encoding of forecast output
- GRIB to GRIB2 for all ensemble, control and sub-seasonal forecast output

The estimated timeline for the migration to GRIB2 is as follows:

- Q2 2025: static test dataset in full GRIB2 available via MARS and ftp
- Q4 2025: test data in full GRIB2 available in dissemination
- Q2 2026 implementation of IFS Cycle 50r2 ; full GRIB2 data only

<https://www.youtube.com/watch?v=oEo4ViSIHpM&t=7s>



EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

Mailing list: mtg2@lists.ecmwf.int

[Migration to GRIB edition 2 Information page](#)

Migration to GRIB2 – impact on users

- Period of frequent changes in the definitions of parameters
 - The changes will be announced in ecCodes release notes
- Kind of changes to be expected:
 - paramIds and shortNames may change
 - underlying GRIB2 definitions of parameters may change
 - MARS keyword mapping may change
 - ecCodes behaviour may change (in very specific situations)
 - Re-ordering of ecCodes GRIB2 definition files and templates
 - Sub-hourly time steps – coming soon !
- Balance between handling legacy practice without adding more technical debt
 - Minimise impact on users where possible
 - Break things only when necessary to ensure futureproof design



Mailing list: mtg2@lists.ecmwf.int

[Migration to GRIB edition 2 Information page](#)

Stay informed!

- [Migration to GRIB edition 2 Information page](#)
 - Includes ecCodes changes to parameters or templates
 - GRIB2–related only
- ecCodes [release notes](#)
- Sign up to the mailing list - mtg2@lists.ecmwf.int

Mailing List

Users who wish to receive regular updates about the progress in the migration to GRIB2 can subscribe to the mailing list mtg2@lists.ecmwf.int.

To subscribe, send an email to sympa@lists.ecmwf.int with the subject "SUBSCRIBE mtg2@lists.ecmwf.int".

- More details in ECMWF Newsletter Number 175 – Spring 2023
 - [Migration from GRIB1 to GRIB2: preparing ECMWF model output for the future](#)

The screenshot shows a web page titled "Migration to GRIB edition 2 Information page". The page content includes an overview of the migration, a short introduction into GRIB editions 1 and 2, and a note that the information is subject to further change. A "Mailing List" sidebar is visible on the right, providing instructions on how to subscribe. The page also features a table of contents with links to various sections like "Introduction", "About GRIB", "Advantages of GRIB2 over GRIB1", and "Changes in parameters".

The screenshot displays the ECMWF Newsletter Number 175, published in April 2023. The main article is titled "Migration from GRIB1 to GRIB2: preparing ECMWF model output for the future" by Robert Osinski, Matthew Griffith, and Sébastien Villaume. Below the article, there is a "Latest news" section listing several ecCodes releases, with the most recent being "ecCodes version 2.32.0 released".