

46R1 – The new ECMWF model cycle

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Science (Reminder)

The screenshot shows a webinar interface. On the left is a dark sidebar with 'Events Index', a search bar, 'Filter Events', and a 'Presentation [0:00:00]' indicator. The main content area displays a slide titled 'Cycle 46R1 overview' by Andy Brown, Director of Research, with the ECMWF logo and a copyright notice '© ECMWF March 7, 2019'. On the right, a video window shows Andy Brown speaking, and a chat window contains messages from technical support and Brian Etherton. At the bottom right is the ECMWF logo, and at the bottom center is a video player control bar showing a pause icon, a progress bar, and a timestamp of 0:00:08/0:36:02.

Cycle 46r1 live-streamed seminars

We will organise two live-streamed seminars to introduce the new IFS cycle 46r1. The first seminar has mainly covered the Scientific changes made in the new Cycle (see recording and slides below). The second seminar will focus more on the meteorological impact and scores of the new cycle, with details on how to access the Cycle 46r1 release candidate test data. This second seminar will take place on Wednesday, 15.05.2019 at 09:30 BST and repeated on Thursday, 16.05.2019 at 17:00 BST. You will have the opportunity to raise any questions during all these seminars. Please do not hesitate to contact us for additional questions.

To attend any of these seminars, please follow the link below:

<https://ecmwf.adobeconnect.com/ecmwf-46r1>

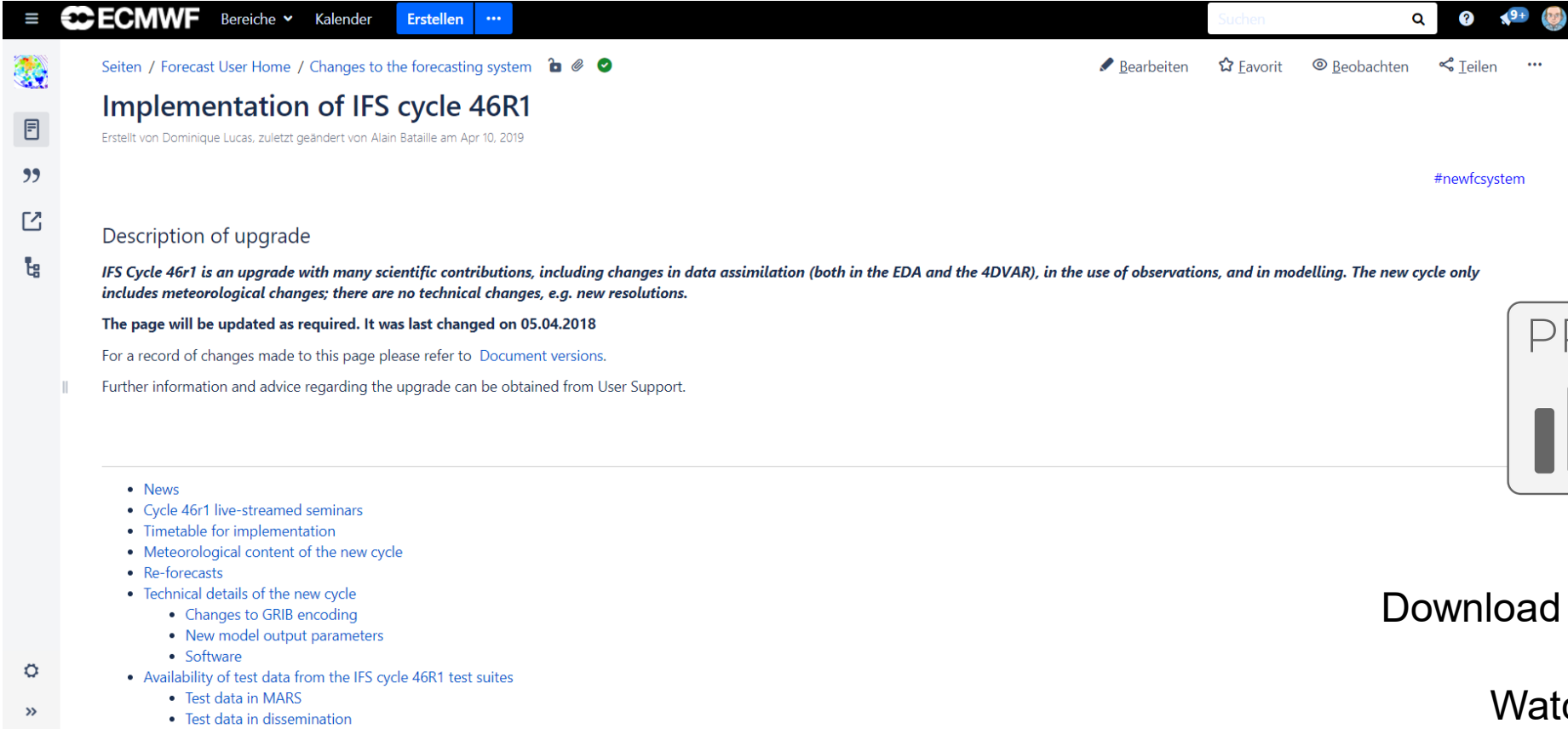
There is no need to pre-register.

The recording of the first cycle 46r1 seminar is available at <https://ecmwf.adobeconnect.com/pgy081jw03ya/>. The presentation slides are also available separately at https://www.ecmwf.int/sites/default/files/medialibrary/2019-02/46r1_overview_AndyBrown.pdf.

Information to new cycle 46R1

All information is published on the website

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>



The screenshot shows the ECMWF Confluence page for 'Implementation of IFS cycle 46R1'. The page title is 'Implementation of IFS cycle 46R1', created by Dominique Lucas and last updated by Alain Bataille on April 10, 2019. The page content includes a description of the upgrade, a note that the page will be updated as required, and a list of related topics such as 'News', 'Cycle 46r1 live-streamed seminars', and 'Technical details of the new cycle'. A large orange arrow points from the 'PPT' icon in the top right corner of the page to the text 'Download Presentation later or/and Watch recording'.

Seiten / Forecast User Home / Changes to the forecasting system

Implementation of IFS cycle 46R1

Erstellt von Dominique Lucas, zuletzt geändert von Alain Bataille am Apr 10, 2019

#newfcsystem

Description of upgrade

IFS Cycle 46r1 is an upgrade with many scientific contributions, including changes in data assimilation (both in the EDA and the 4DVAR), in the use of observations, and in modelling. The new cycle only includes meteorological changes; there are no technical changes, e.g. new resolutions.

The page will be updated as required. It was last changed on 05.04.2018

For a record of changes made to this page please refer to [Document versions](#).

Further information and advice regarding the upgrade can be obtained from User Support.

- News
- Cycle 46r1 live-streamed seminars
- Timetable for implementation
- Meteorological content of the new cycle
- Re-forecasts
- Technical details of the new cycle
 - Changes to GRIB encoding
 - New model output parameters
 - Software
- Availability of test data from the IFS cycle 46R1 test suites
 - Test data in MARS
 - Test data in dissemination

Information to new cycle 46R1 – READ CAREFULLY

All information is published on the website

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>

Technical details of the new cycle

Changes to GRIB encoding

Model identifiers

The GRIB model identifiers (generating process identification number) for cycle 46r1 will be changed as follows:

GRIB 1 Section 1 Octets	GRIB 2 Section 4 Octets	eccodes key	Component	Model ID	
				Old	New
6	14	generatingProcessIdentifier	Atmospheric model	149	150
			Ocean wave model	114	115
			HRES-SAW (HRES stand alone ocean wave model)	214	215

⚠ We recommend users to use the MARS keyword "PARAMETER=paramId", as the shorName or full name may be ambiguous. E.g. for the new Wave model output, use "PARAMETER=140098" and not "PARAMETER=weta" or "**PARAMETER=Wave induced mean sea level correction**".

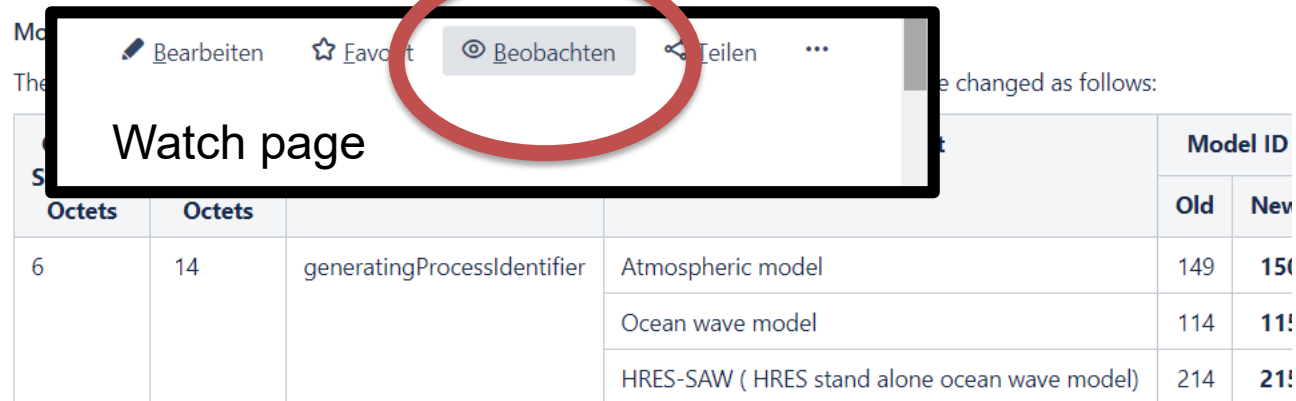
Information to new cycle 46R1 – READ CAREFULLY

All information is published on the website

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>

Technical details of the new cycle

Changes to GRIB encoding



The screenshot shows a Confluence page with a table of changes. A red circle highlights the 'Beobachten' (Watch) button in the top navigation bar. Below the table, there is a red-bordered box with a warning icon and text.

Octets	Octets			Model ID	
				Old	New
6	14	generatingProcessIdentifier	Atmospheric model	149	150
			Ocean wave model	114	115
			HRES-SAW (HRES stand alone ocean wave model)	214	215

⚠ We recommend users to use the MARS keyword "PARAMETER=paramId", as the shortName or full name "PARAMETER=weta" or "PARAMETER=Wave induced mean sea level correction".

Mailing list

A mailing list has been created to inform interested parties about IFS changes.

To subscribe to or unsubscribe, please send an email to

forecast_changes-request@lists.ecmwf.int

with the word *subscribe* or *unsubscribe* as Subject or click [subscribe](#)

Alternatively access

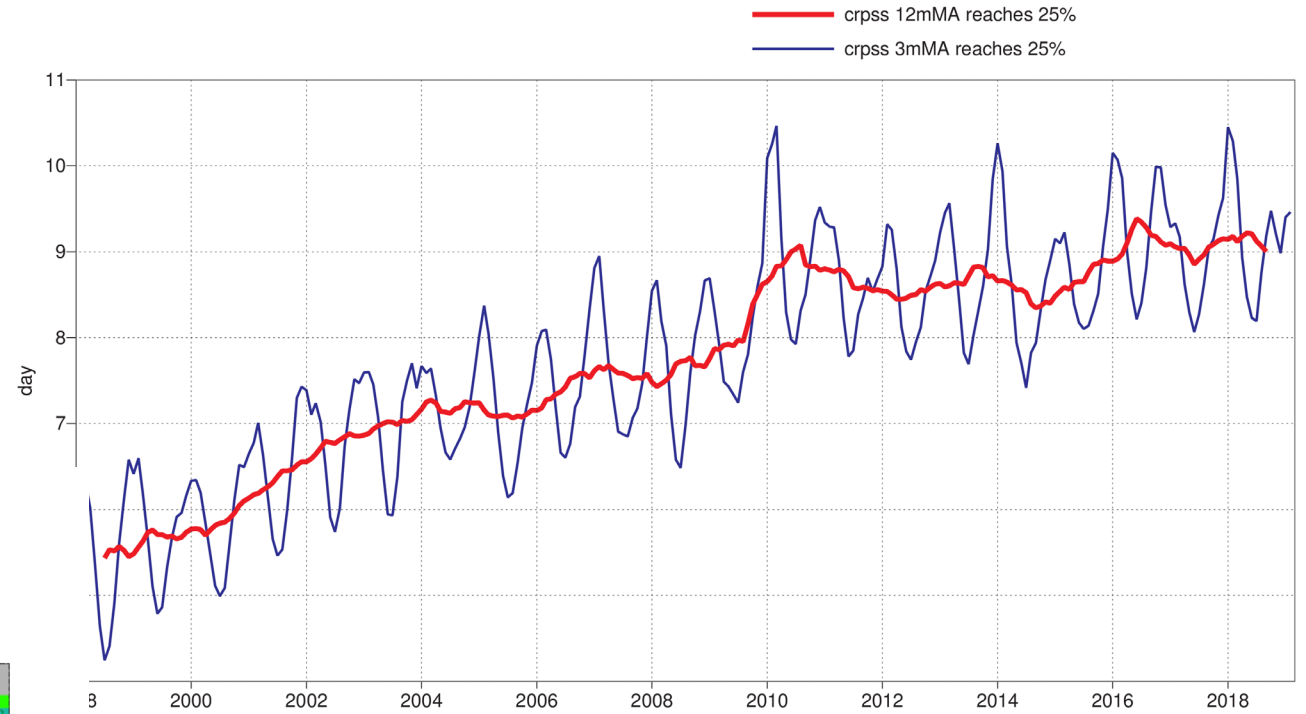
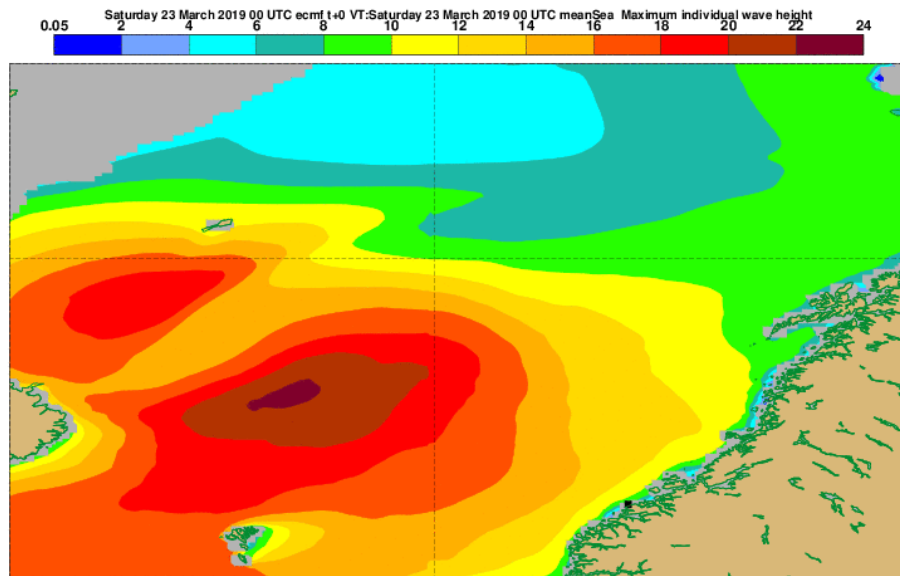
http://www.ecmwf.int/publications/maillist/d/subscribe/request/forecast_changes, enter your email address and click [Subscribe](#)

New IFS cycle 46r1 release candidate phase

- The **release candidate** phase has started on **15th May 12UTC**.
- There will be **no changes** that alter the model result from now on.
- **Implementation** of new cycle will be on **11th June 12UTC**
- **A full set of product services** (e.g. dissemination of test data, ecCharts) will be offered until the operational implementation of the new cycle.
- At this stage the test data sets can be used to acquire longer time series
- Test data in **dissemination** are **now available**. The test products are generated daily, shortly behind real-time from the high resolution and ensemble runs and based on the operational dissemination requirements.
- Graphical display of IFS cycle 46r1 test data using ecCharts should become available in a few days.

Presentation outline

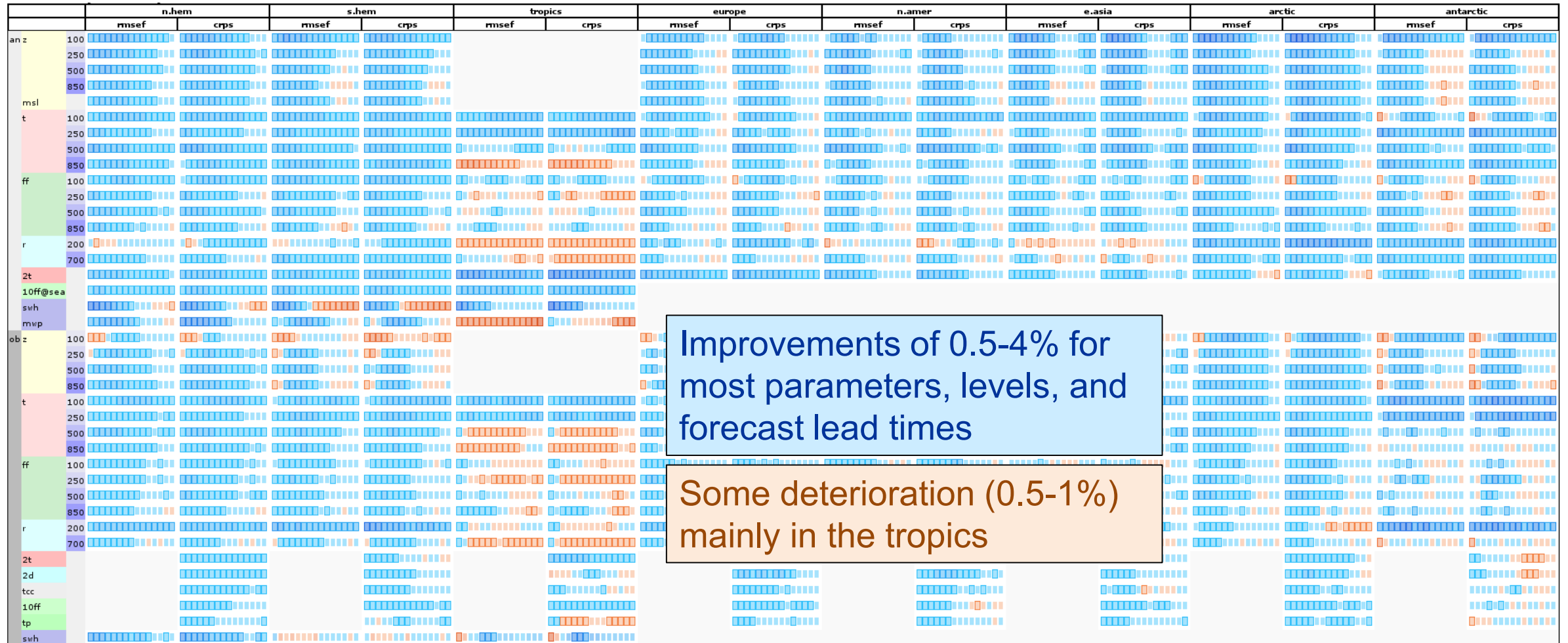
- Scores
- Products



Ensembles (ENS) improvements

46r1 ENS scorecard

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>



Improvements of 0.5-4% for most parameters, levels, and forecast lead times

Some deterioration (0.5-1%) mainly in the tropics

Based on about 240 model runs for verification against analysis and about 290 model runs for verification against observations

Better

Worse

46r1 ENS scorecard

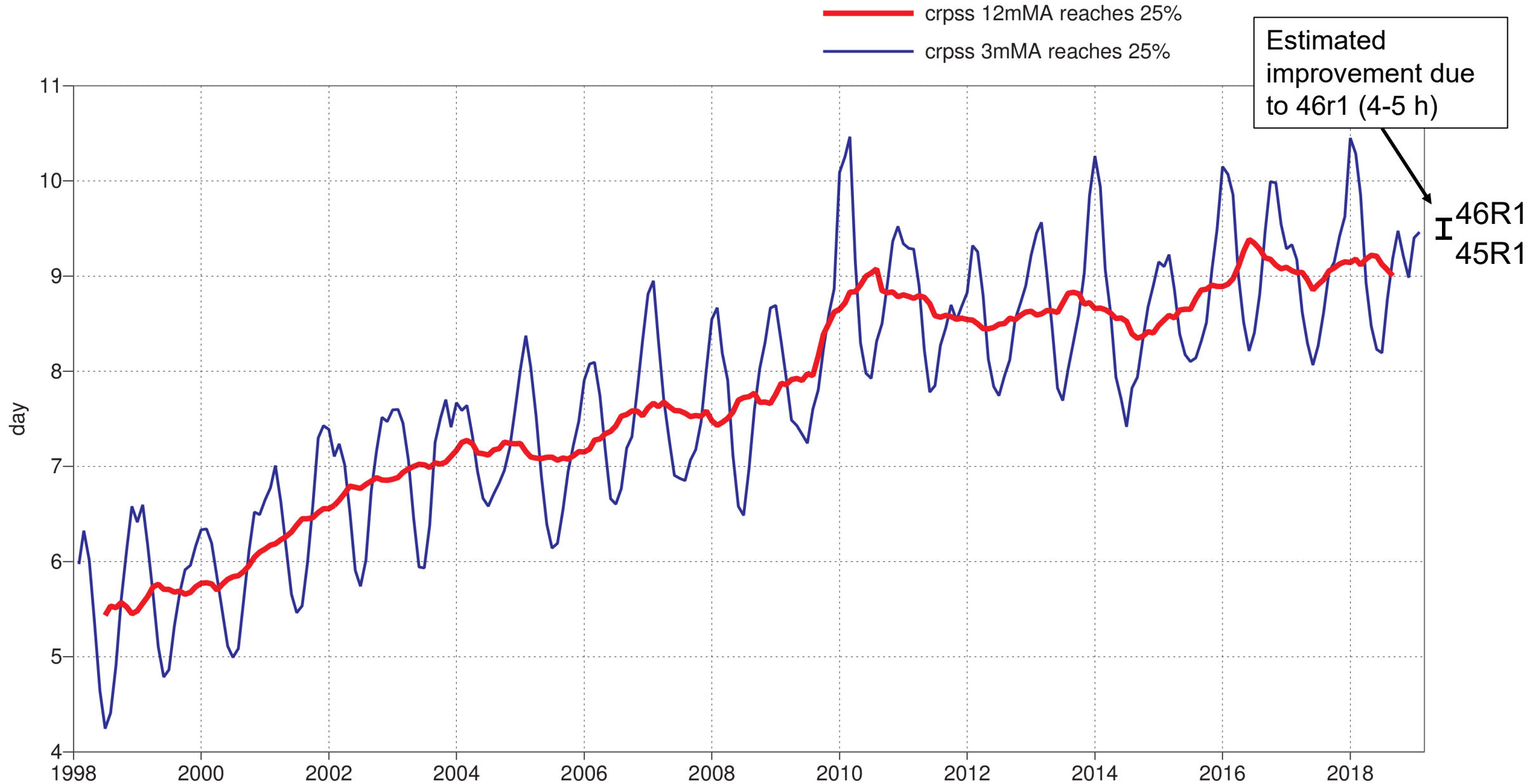


Based on about 240 model runs for verification against analysis and about 290 model runs for verification against observations

Better

Worse

CRPSS of 850 hPa temperature reaching 25%



46r1 ENS scorecard



Based on about 240 model runs for verification against analysis and about 290 model runs for verification against observations

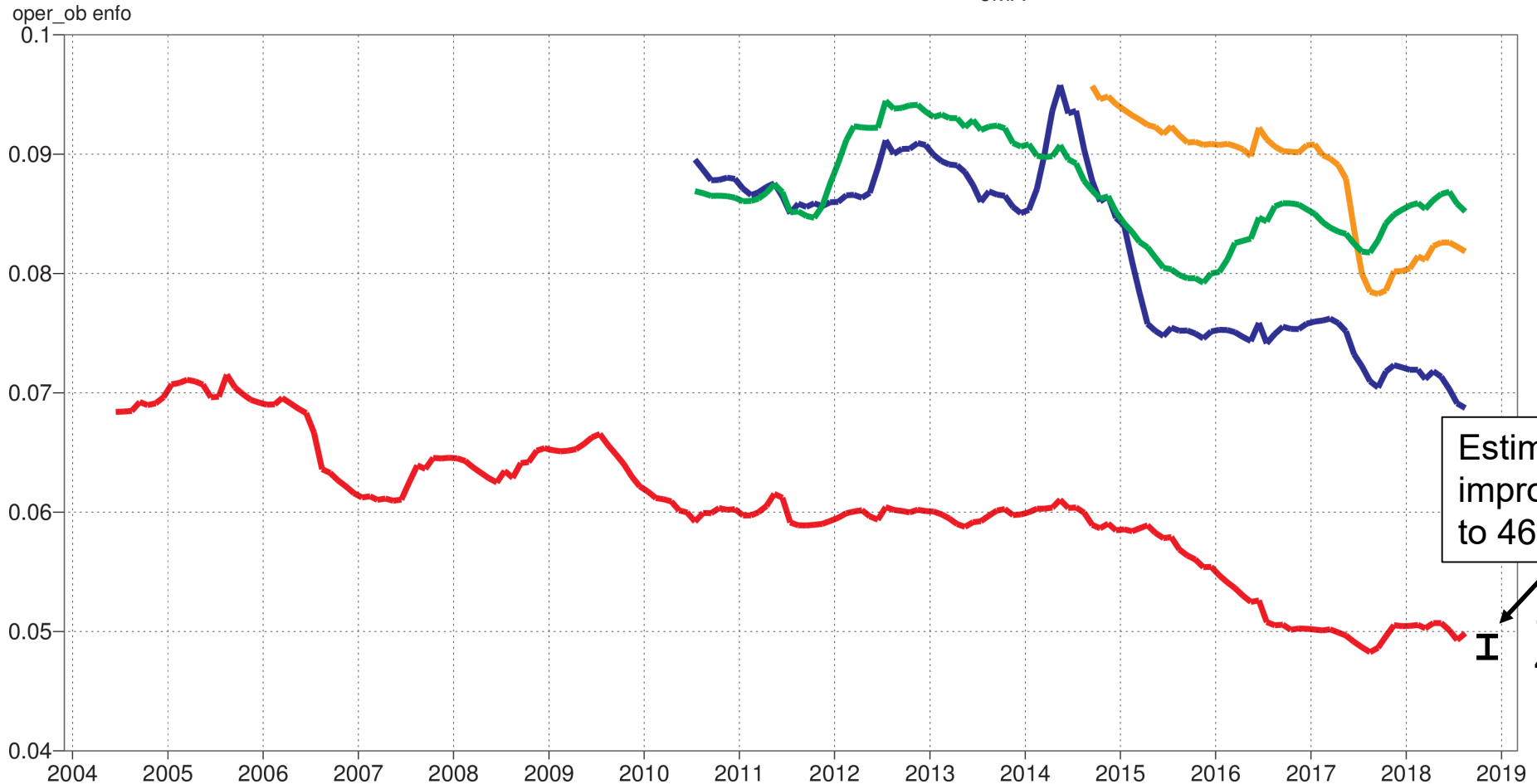
Better

Worse

Ensemble forecasts of 2m temperature (Day 5) – large errors

2 meter temperature
Fraction of large CRPS value >5.0
Extratropics (lat -90 to -30.0 and 30.0 to 90, lon -180.0 to 180.0)
T+120

— ECMWF
— NCEP
— UKMO
— JMA



Estimated improvement due to 46r1 (4%)
45R1
46R1

46r1 ENS scorecard

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>

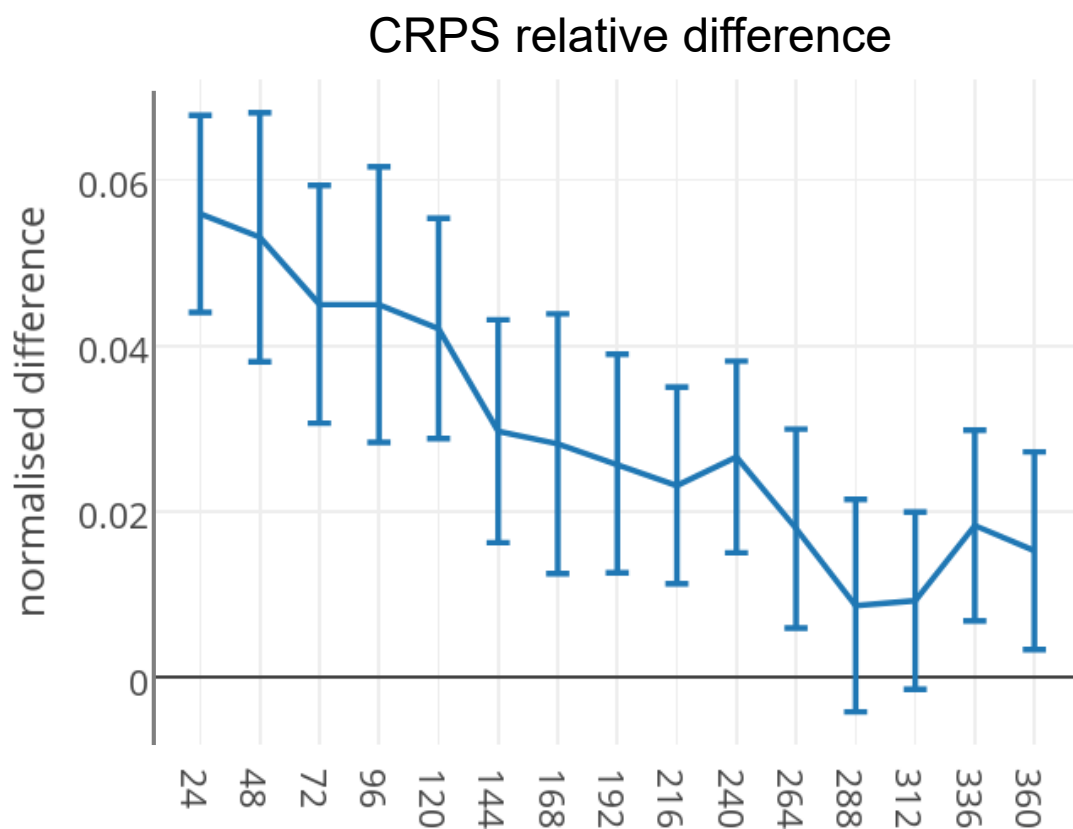
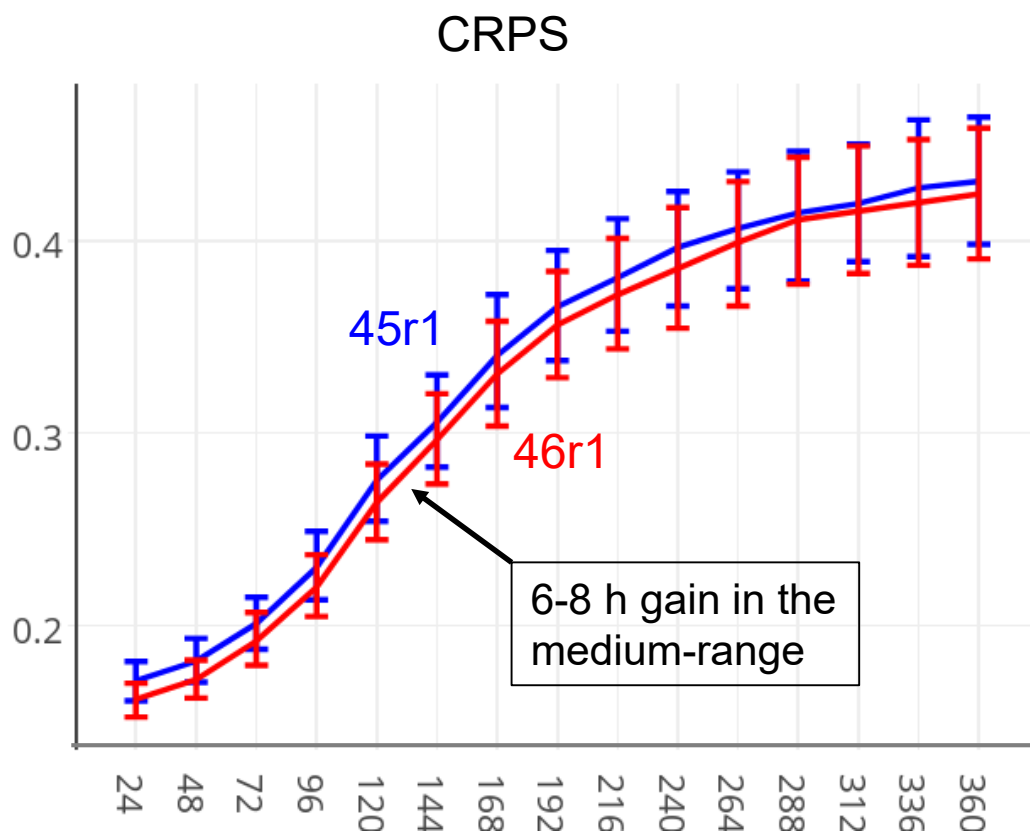


Based on about 240 model runs for verification against analysis and about 290 model runs for verification against observations

Better

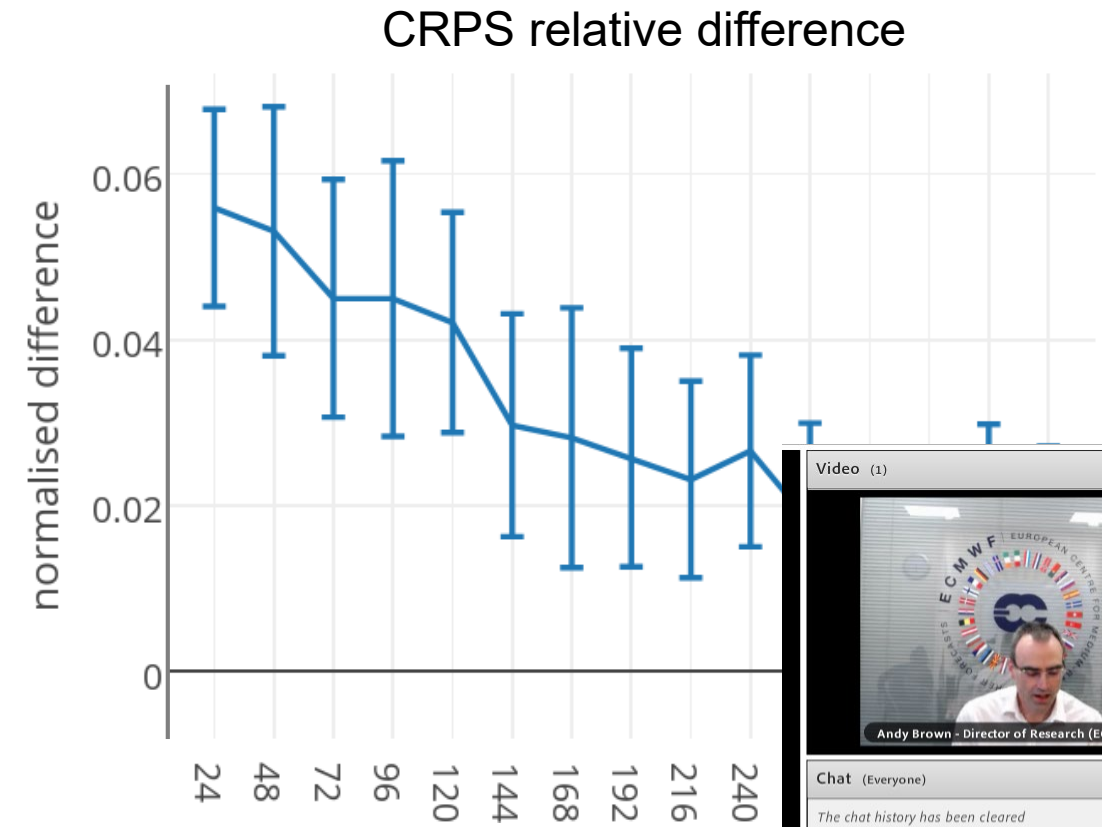
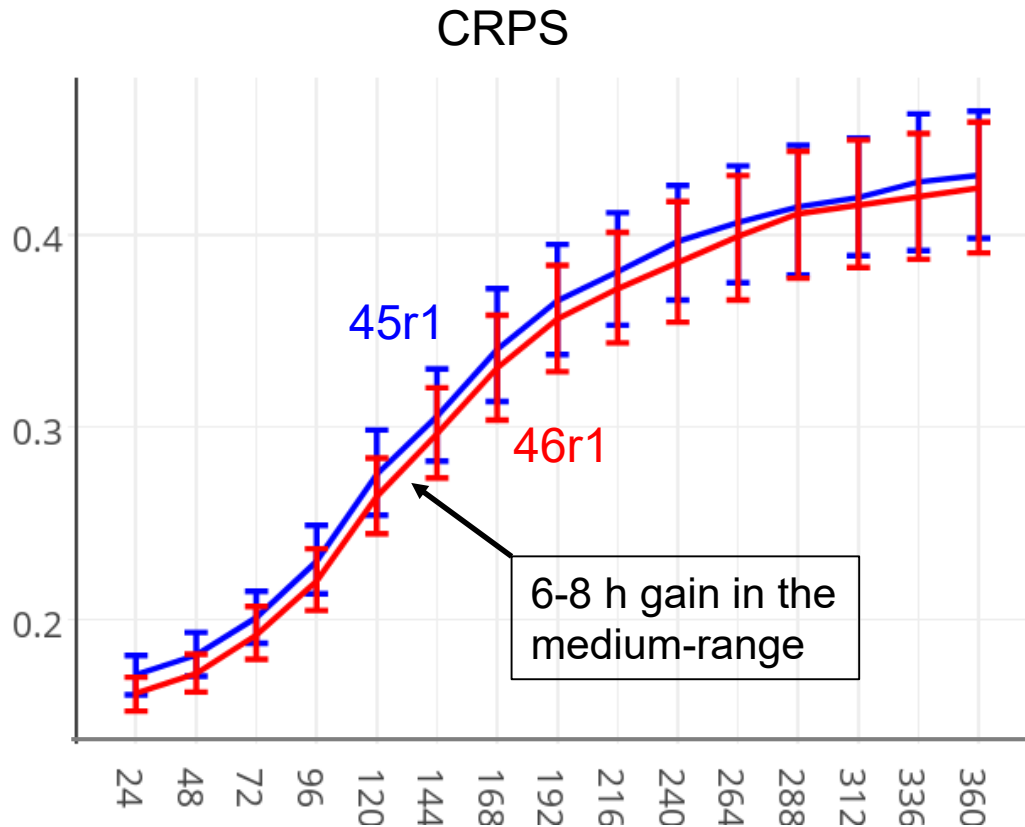
Worse

ENS significant wave height – verification against buoys



Substantial improvements in wave parameters due to new wave model

ENS significant wave height – verification against buoys



Video (1)

Andy Brown - Director of Research (ECMWF)

Chat (Everyone)

The chat history has been cleared

ECMWF - Technical Support: We will be starting in 5 minutes

ECMWF - Technical Support: We will open the microphone just before the webinar starts

Brian Ethernon: Greetings from the US: transmission looks good, I see the slides, and I see the Director of Research. All is well.

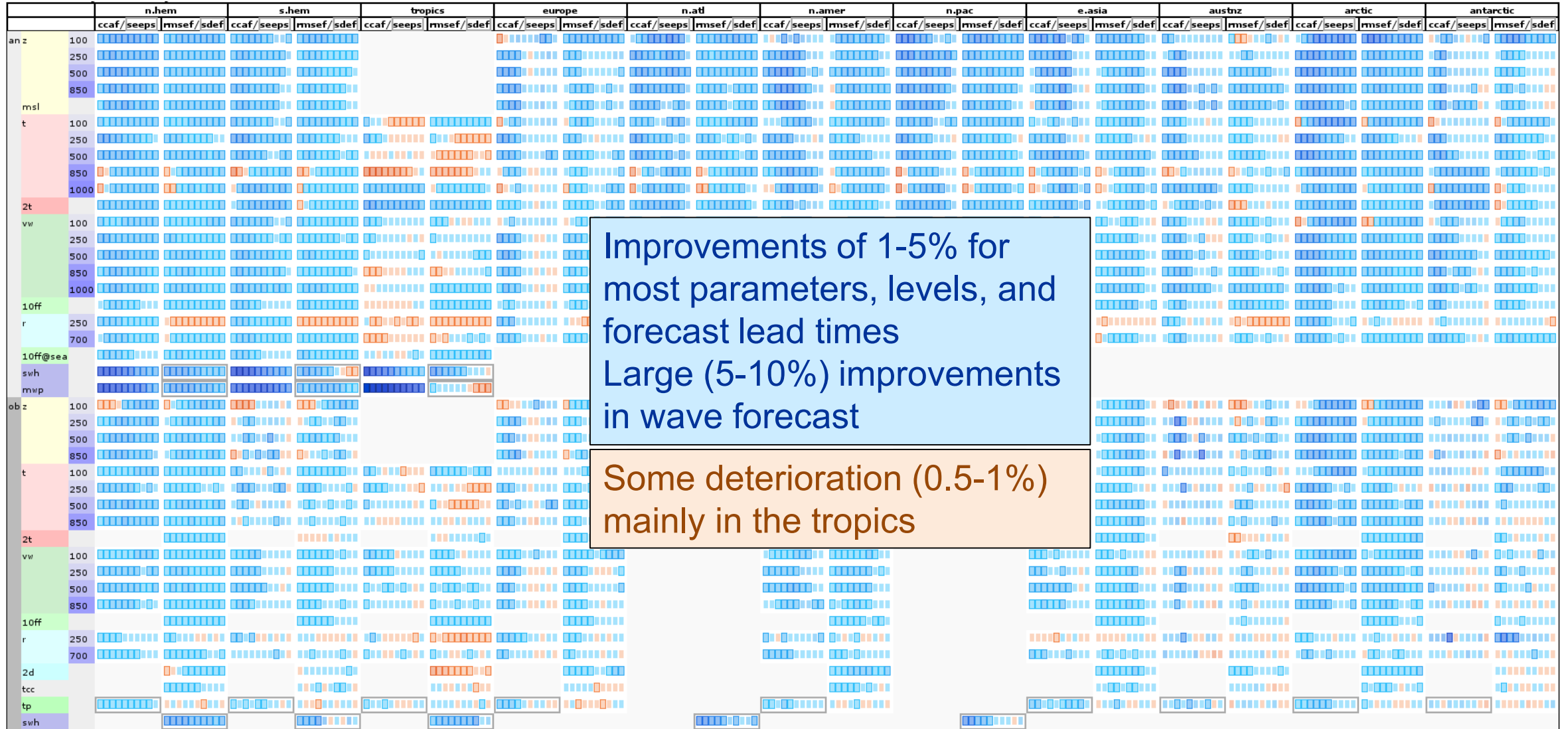
ECMWF - Technical Support: Thank you Brian!

Substantial improvements in wave parameters due to new wave model

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>

High resolution (HRES) improvements

46r1 HRES scorecard



Improvements of 1-5% for most parameters, levels, and forecast lead times
 Large (5-10%) improvements in wave forecast

Some deterioration (0.5-1%) mainly in the tropics

Based on about 610 model runs

Better

Worse

46r1 HRES scorecard

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>



HRES headline score:
Z500 anomaly correlation

Based on about 610 model runs

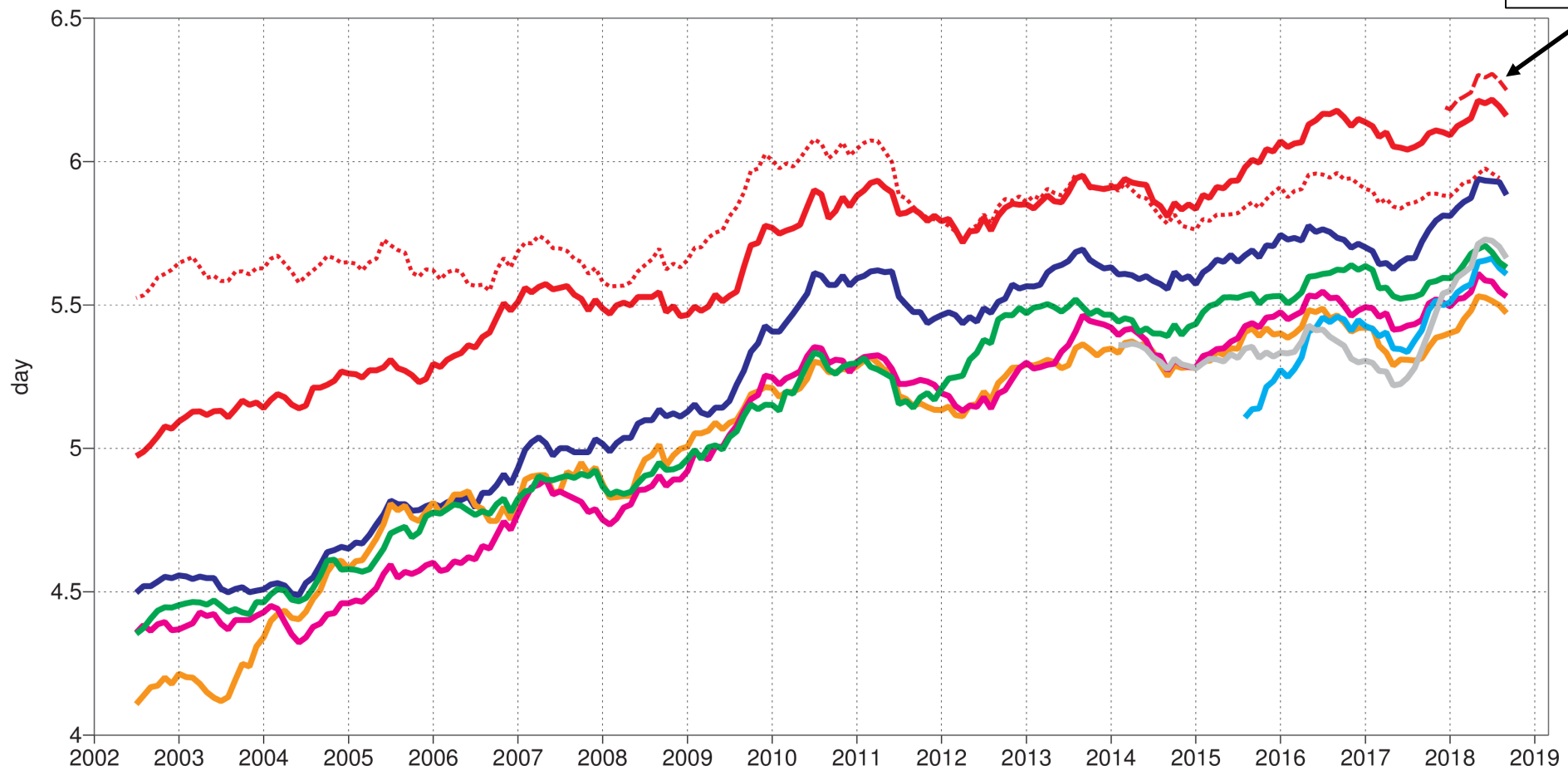
Better

Worse

Anomaly correlation of 500 hPa Geopotential reaching 85%

500hPa geopotential
Anomaly correlation

NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)



New Parameters & Outputs

New model output parameters

Extended output have been added in cycle 46r1, including a subset of ocean fields on the atmospheric grid.

paramId	shortName	name	Description	units	GRIB edition	Components	Test data available	Dissemination	ecCharts	Added to the Catalogue
Near-surface wind output										
228239	200u	200 metre U wind component	eastward component of the 200m wind.	m s ⁻¹	1	HRES / ENS	✓	TBC	TBC	TBC
228240	200v	200 metre V wind component	northward component of the 200m wind.	m s ⁻¹	1	HRES / ENS	✓	TBC	TBC	TBC
Wave model parameters										
140098	weta	Wave induced mean sea level correction	Wave induced mean sea level correction	m	1	HRES-WAM / HRES-SAW / ENS-WAM	✓	TBC	TBC	TBC
140099	wraf	Ratio of wave angular and frequency width	Ratio of wave angular and frequency width	dimensionless	1	HRES-WAM / HRES-SAW / ENS-WAM	✓	TBC	TBC	TBC
140100	wnslc	Number of events in freak waves statistics	Number of events in freak waves statistics	dimensionless	1	HRES-WAM / HRES-SAW / ENS-WAM	✓	TBC	TBC	TBC
140101	utaua	U-component of atmospheric surface	U-component of atmospheric surface momentum flux	N m ⁻²	1	HRES-WAM / HRES-SAW /	✓	TBC	TBC	TBC

Near-surface wind output

shortName	Description	GRIB edition	Components
200u	eastward component of the 200m wind.	1	HRES/ENS
200v	northward component of the 200m wind.	1	HRES/ENS



Ocean wave parameters

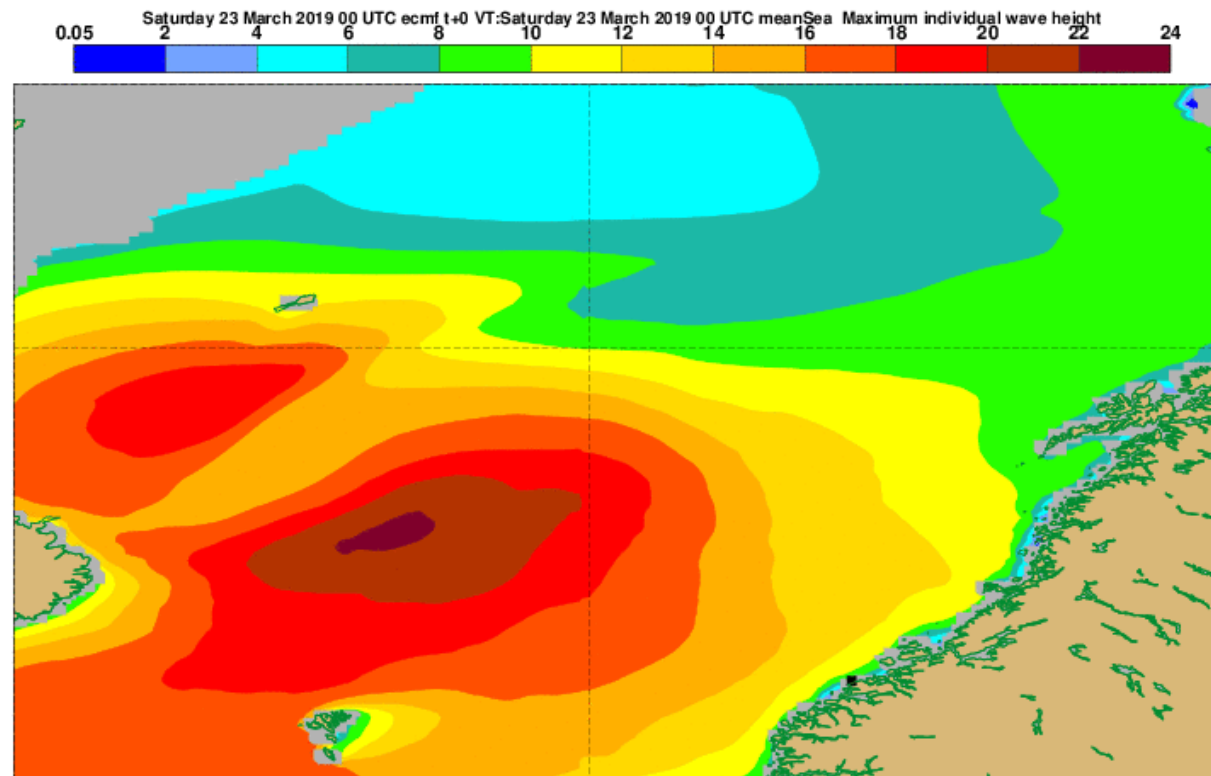


shortName	Description
weta	Wave induced mean sea level correction
wraf	Ratio of wave angular and frequency width
wnslc	Number of events in freak waves statistics
utaua	U-component of atmospheric surface momentum flux
vtaua	V-component of atmospheric surface momentum flux
utauo	U-component of surface momentum flux into ocean
vtauo	V-component of surface momentum flux into ocean
wphio	Wave turbulent energy flux into ocean

- All parameters are in GRIB edition 1
- Parameters available for:
 - HRES-WAVE Model
 - ENS-WAVE Model
 - HRES-High RESolution Stand Alone Wave model

Ocean Wind Waves:

Recent developments to the science behind nonlinear wave – wave interaction yield improved characterization of the tail of the wave heights distribution



Height of the largest single wave in metres during the incident involving cruise ship Viking Sky (23 March 2019)

Ocean parameters available at the surface, produced by the NEMO model.

shortName	Description
sithick	Sea-ice thickness
mld	Mixed layer depth
zos	Sea surface height
t20d	Depth of 20C isotherm
so	Sea water practical salinity
tav300	Average potential temperature in the upper 300m
sav300	Average salinity in the upper 300m

- All parameters are in GRIB edition 1
- Parameters available for HRES and ENS
- These fields are interpolated from the NEMO resolution (0.25 degree)

Animation of average 300m ocean temp from 46r1 during TC Fani



Parameters on Potential Vorticity levels (1.5 and 2 PVU)

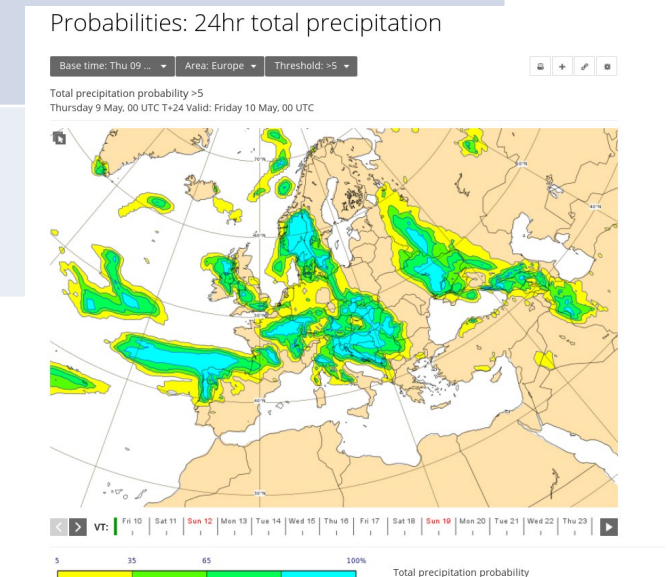
shortName	Description
z	Geopotential
o3	Ozone mass mixing ratio
pt	Potential Temperature
pres	Pressure
q	Specific humidity
u	U component of wind
v	V component of wind

- All parameters are in GRIB edition 1
- Parameters available for HRES and ENS

Event Probabilities, as part of ECMWF's role of World Meteorological Centre

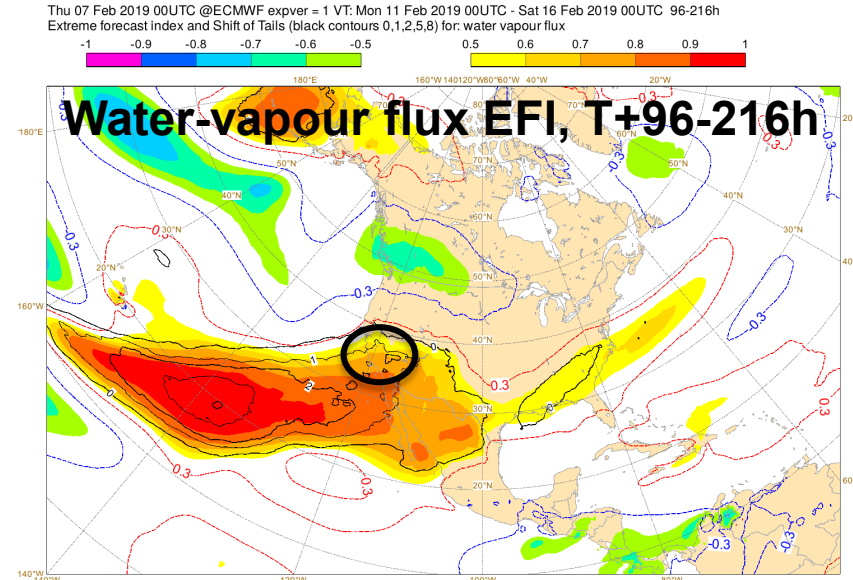
shortName	Description	threshold
tpg<threshold>	Total precipitation of at least <threshold> mm	25, 50, 100 mm
10fgg10	10 metre wind gust of at least 10 m/s	10 m/s
ptsa_gt_<threshold>stdev	Probability of 850hPa temperature standardized anomaly greater than <threshold> standard deviation	1, 1.5, 2 stdev
ptsa_lt_<threshold>stdev	Probability of 850hPa temperature standardized anomaly less than - <threshold> standard deviation	1, 1.5, 2 stdev

- All parameters are in GRIB edition 2
- Parameters available for ENS



Extreme Forecast Indices (EFI) – Shift of Tails (SOT)

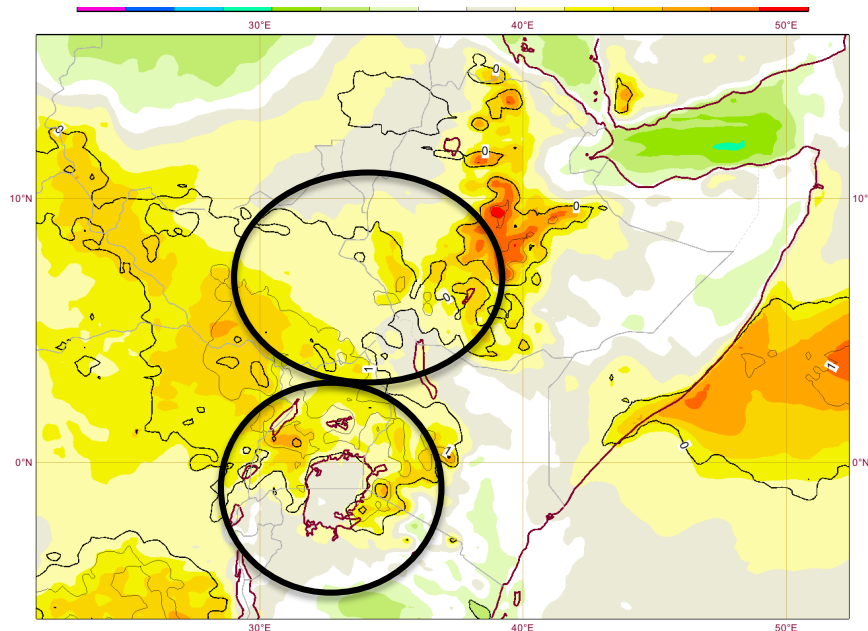
shortName	Description
wvfi	EFI and SOT for water vapour flux
2ti	EFI and SOT for weekly mean temperature for extended range (weeks 1-6)
tpi	EFI and SOT for 1 week total precipitation for extended range (weeks 1-6)



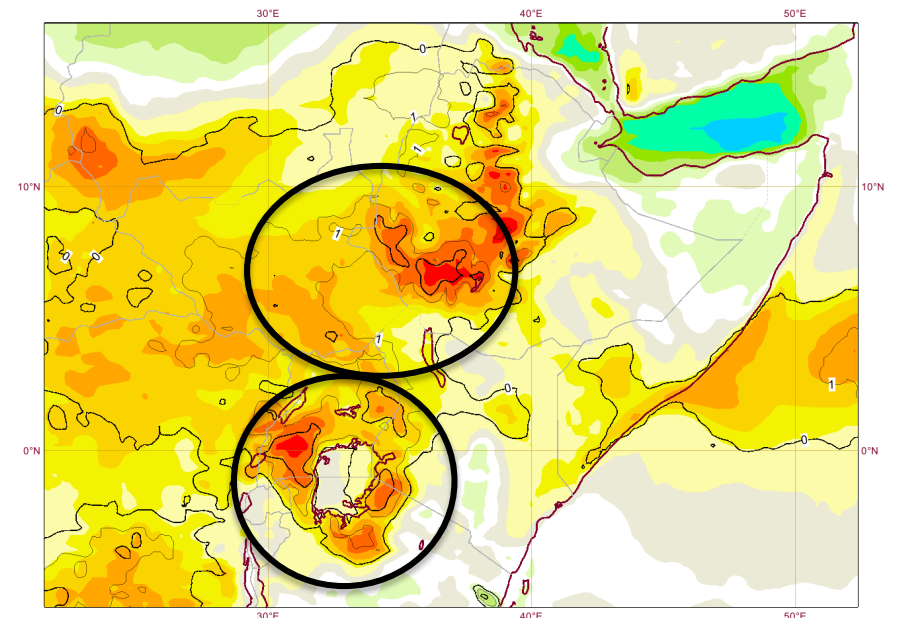
Watch out: New climatology

- The new IFS cycle 46r1 will use the ERA5 data to initialize the re-forecasts and also use ERA5 EDA to perturb the re-forecasts initial conditions.
- ERA5 is used for climatology of EFI and SOT

Mc
Ex 46r1 EFI with ERA-5 climate



N
E 46r1 EFI with ERA-Interim climate

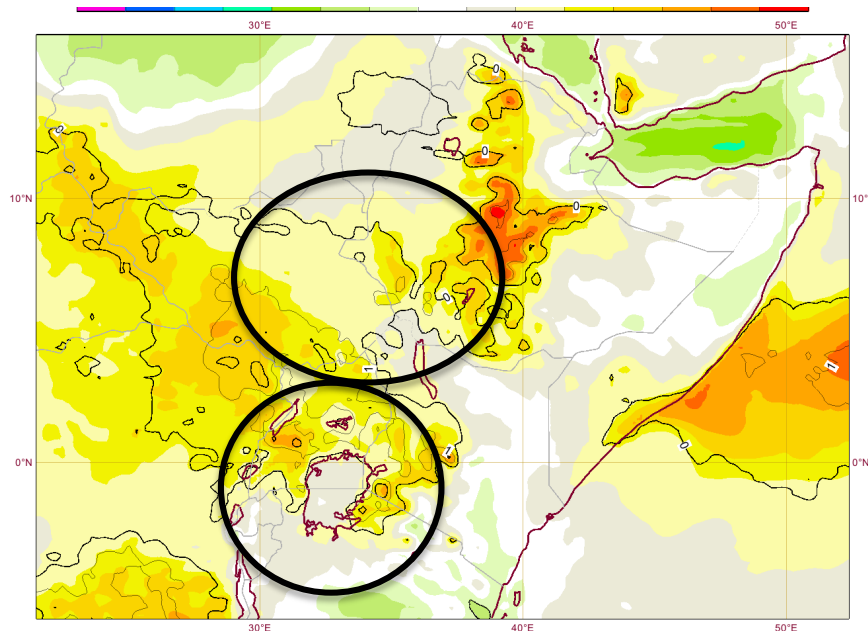


Watch out: New climatology

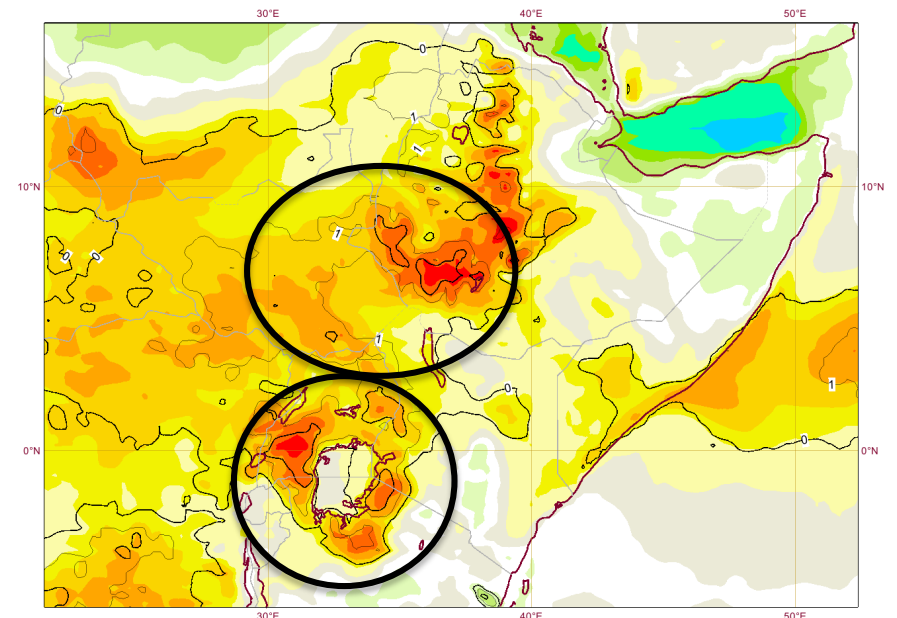
ERA Interim is being phased out. Users are strongly advised to migrate to ERA5. The last date to be made available in ERA Interim will be 31 August 2019

- The new IFS cycle 46r1 will use the ERA5 data to initialize the re-forecasts and also use ERA5 EDA to perturb the re-forecasts initial conditions.
- ERA5 is used for climatology of EFI and SOT

Mc
Ex 46r1 EFI with ERA-5 climate



N
E 46r1 EFI with ERA-Interim climate



46R1 – Key points

Florian Pappenberger
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- Implementation Date: **11th June** 12UTC
- There are a significant number of **new products**
- Improvements of **0.5-4% for most parameters**, levels, and forecast lead times
- **Some deterioration** (0.5-1%) mainly in the tropics

More Information:

<https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+cycle+46R1>