Recent changes to the ECMWF forecasting system

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Input from many ECMWF colleagues

ECMWF

ECMWF Integrated Forecasting System (IFS) upgrades

2018

- Cycle 45r1 — 6 Jun — **45r1**

  Consistent gains in the extended range. A key plank of the upgrade is enhanced dynamic coupling between the ocean, sea ice and the atmosphere. The upgrade extends this coupling to ECMWF's medium-range high-resolution forecasts (9 km horizontal resolution)

2019

- Cycle 46r1 — 11 Jun — **46r1**

  Continuous data assimilation and introduction of a 50-member Ensemble of Data Assimilations: weakly coupled data assimilation for sea-surface temperature in the tropics; improvements in the wave model, the convection scheme, the radiation scheme and the use of observations.

2020

- Cycle 47r1 — 30 Jun — **47r1**

  Improved treatment of observations. Improvements in the data assimilation and to the model. Quintic vertical interpolation in the semi-Lagrangian advection scheme has been introduced as well as the inclusion of a better surface albedo climatology making use of more data from the MODIS instrument.

2021

- Cycle 47r2 — 11 May — **47r2**

  Single precision and increased number of ENS model levels (91 to 137)

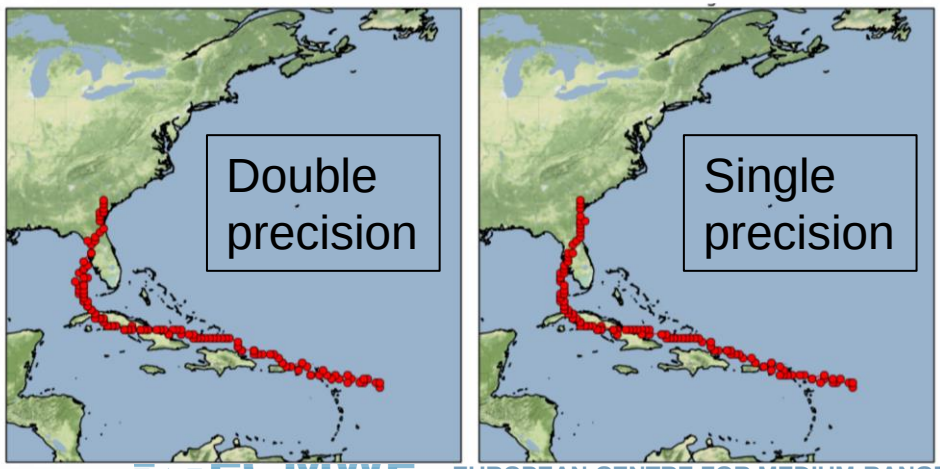
Cycle 47r2

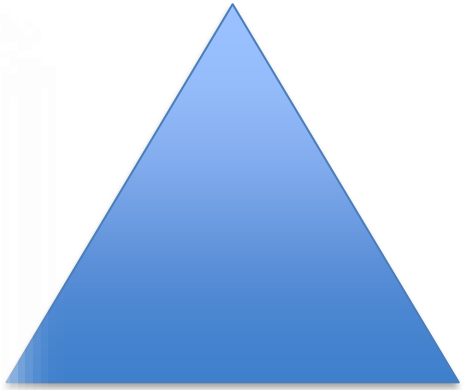
Neutral impact

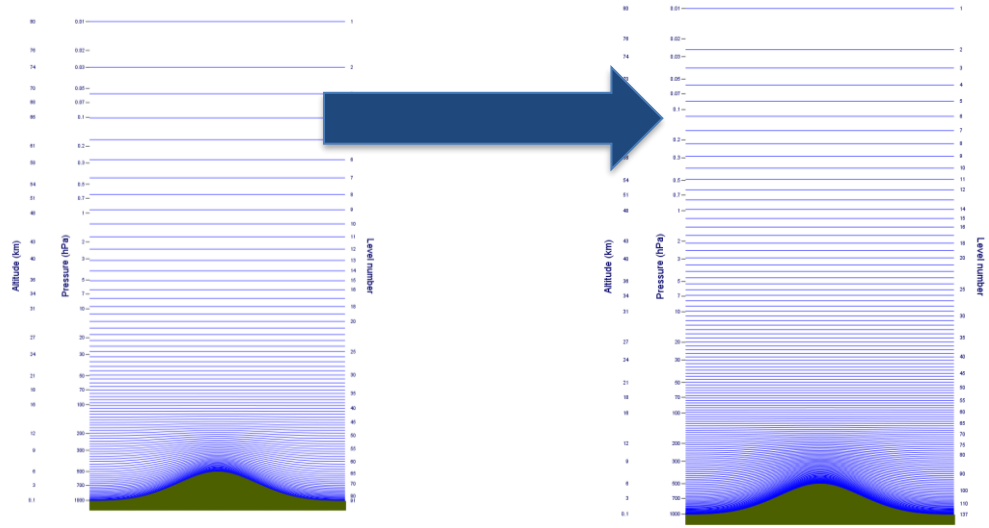
Saving of computational cost through implementation of single precision

Positive impact

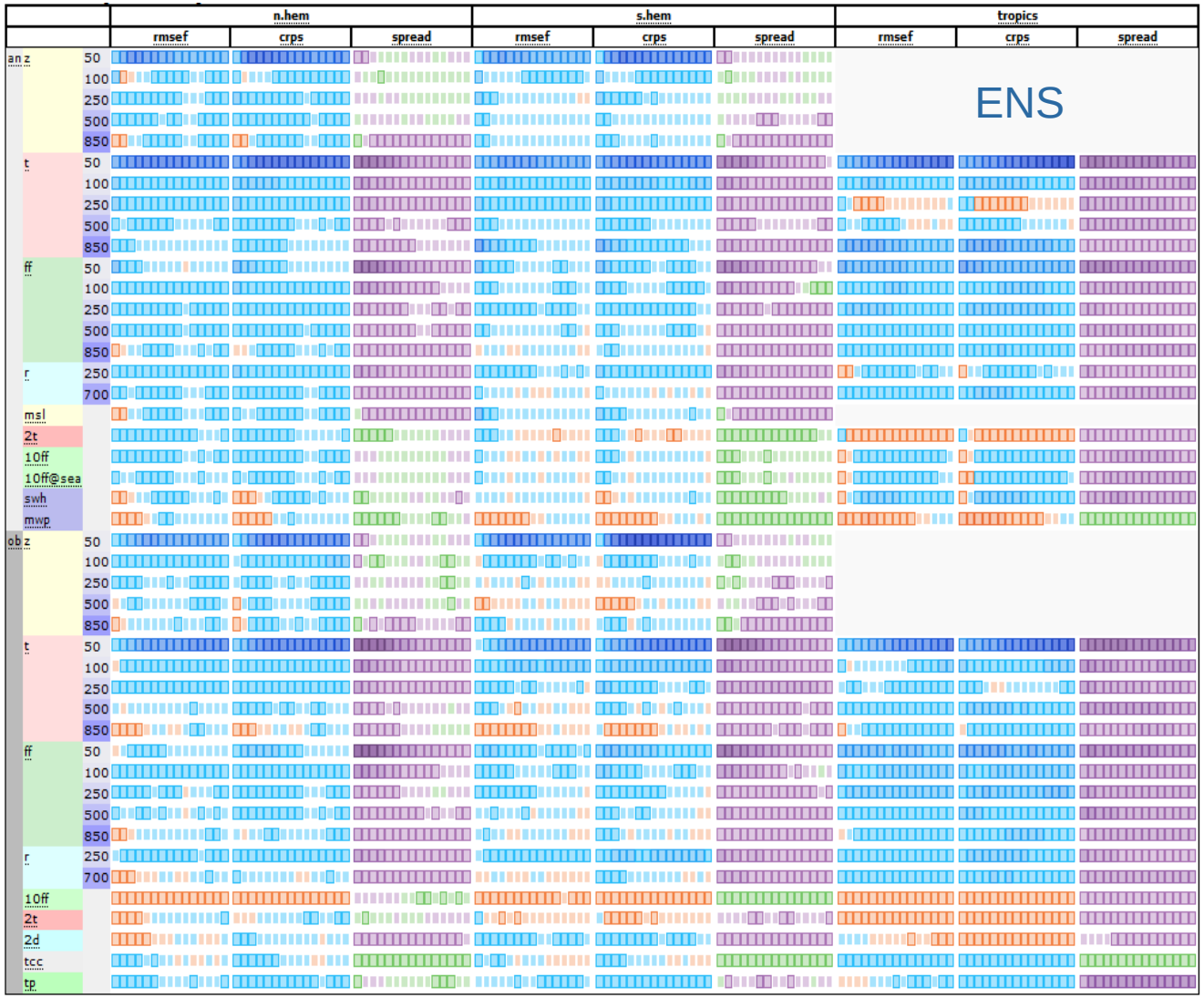
Investment to take ENS (medium and extended-range) from L91 to L137

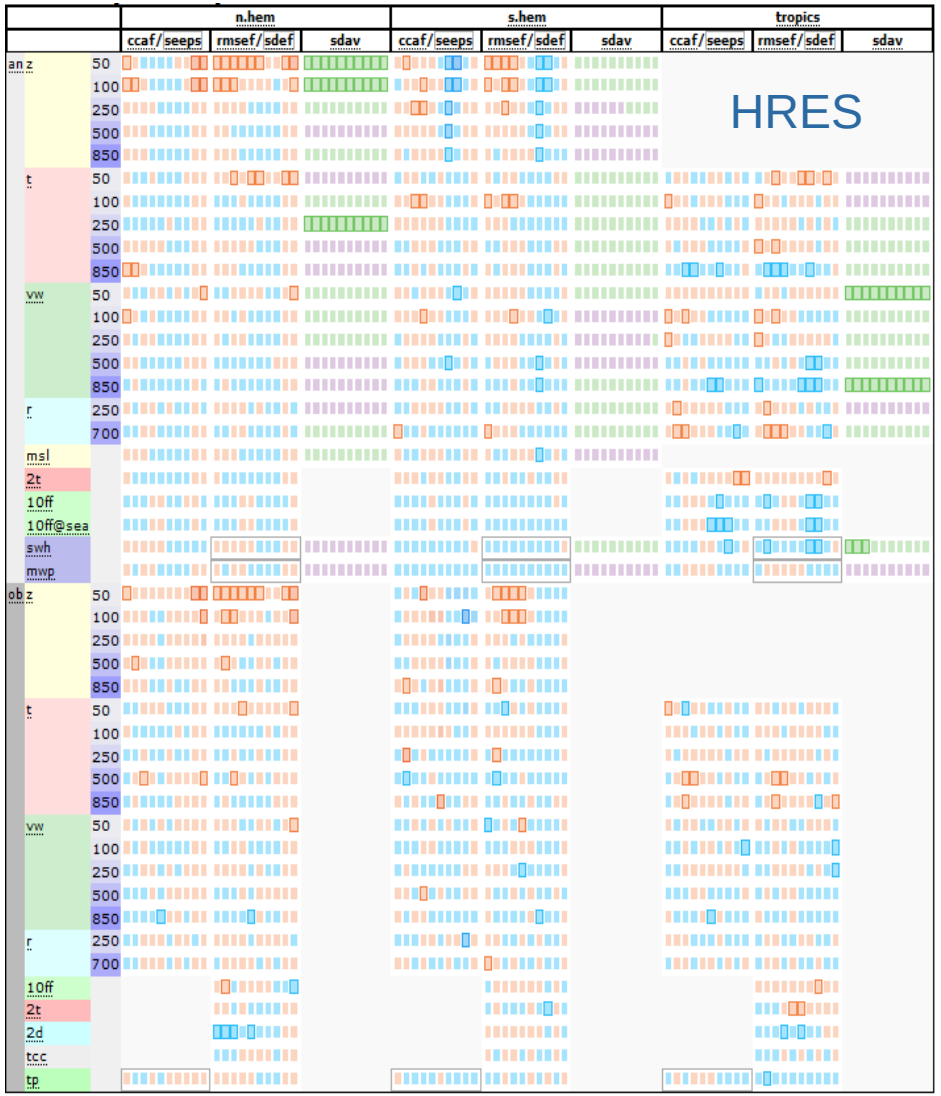






ENS and HRES scorecards

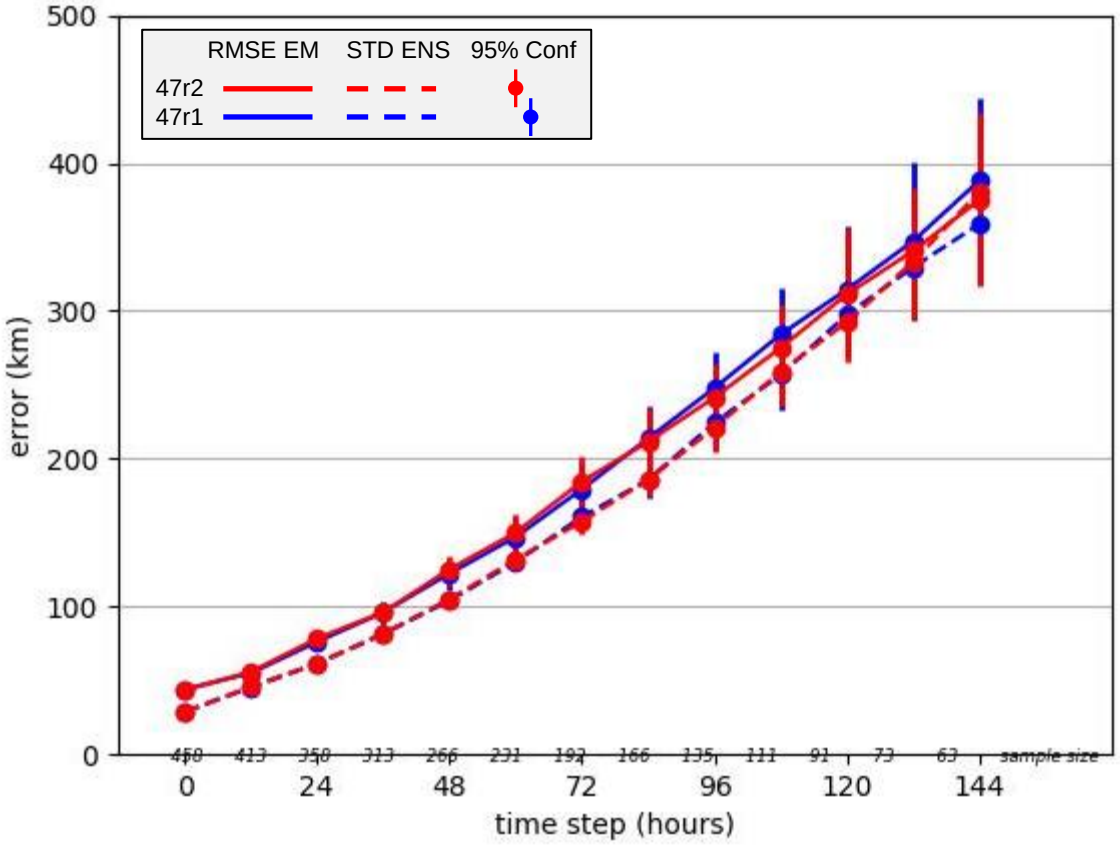




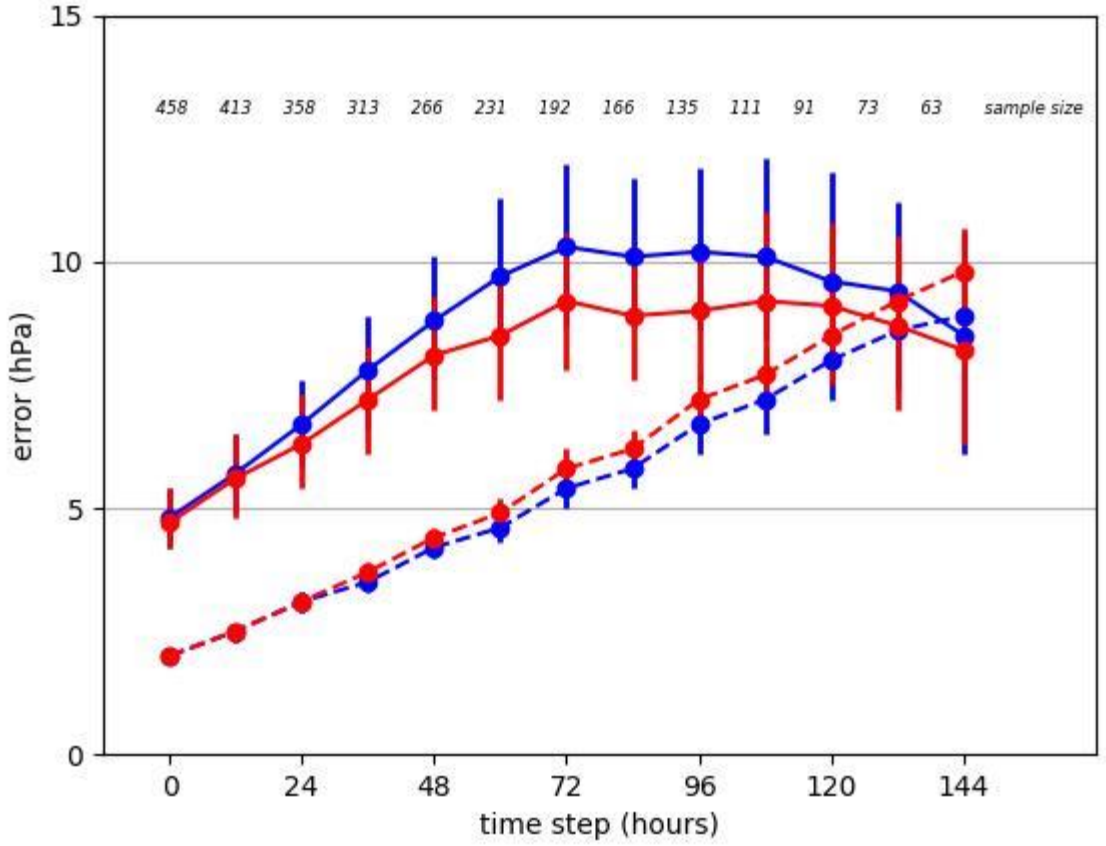
ENS: Tropical cyclone forecast

ENS mean error and ENS spread

Location

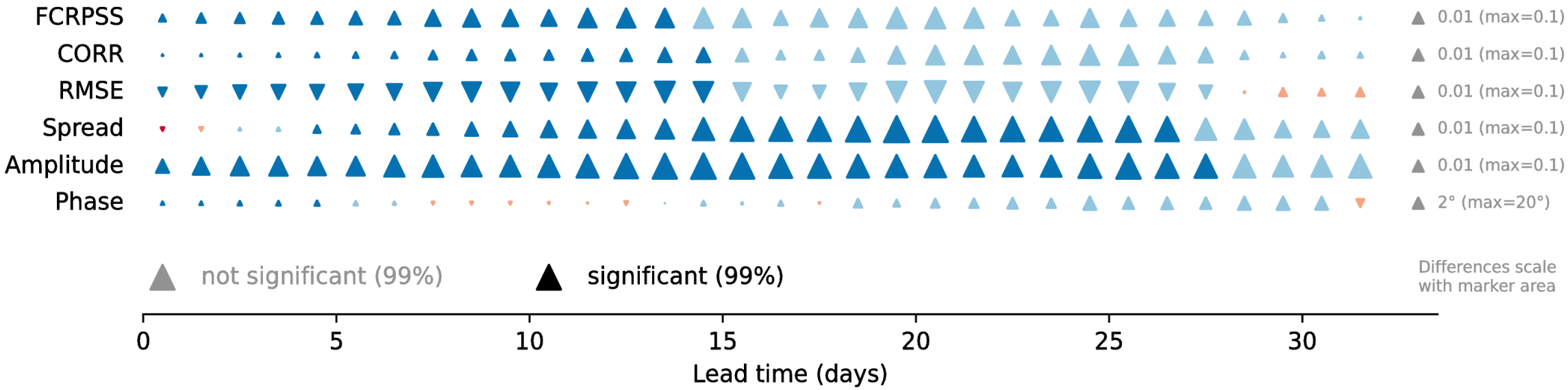


Intensity



Friday 9:45-10:50 UTC. Speakers corner (Tim)

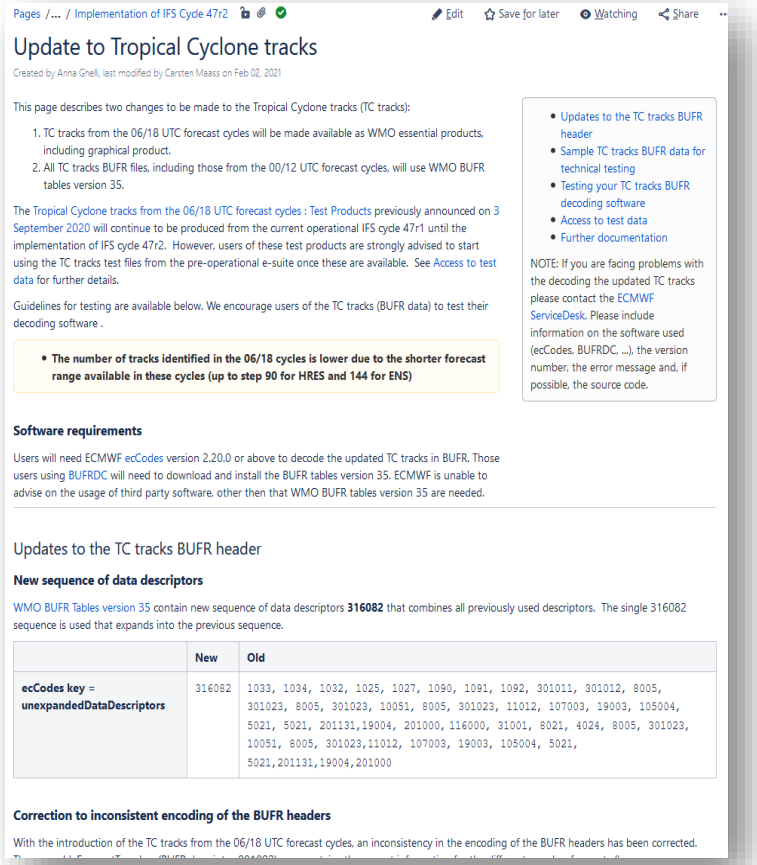
Performance of Madden-Julian Oscillation



- Amplitude of the Madden-Julian Oscillation (MJO) better sustained into the extended range (amplitude loss by day 15 is now ~15% rather than previously ~20%)
- Increased MJO spread and improved scores
- Changes come mostly from improvements in tropical zonal winds at 200hPa

Update to Tropical Cyclone tracks in HRES and ENS

Obstype	Name	BUFR edition
32	Tropical Cyclone track	3/4



Pages /... / Implementation of IFS Cycle 47r2 — Edit — Save for later — Watching — Share

Update to Tropical Cyclone tracks

Created by Anna Ghelli, last modified by Carsten Maass on Feb 02, 2021

This page describes two changes to be made to the Tropical Cyclone tracks (TC tracks):

1. TC tracks from the 06/18 UTC forecast cycles will be made available as WMO essential products, including graphical product.
2. All TC tracks BUFR files, including those from the 00/12 UTC forecast cycles, will use WMO BUFR tables version 35.

The Tropical Cyclone tracks from the 06/18 UTC forecast cycles : Test Products previously announced on 3 September 2020 will continue to be produced from the current operational IFS cycle 47r1 until the implementation of IFS cycle 47r2. However, users of these test products are strongly advised to start using the TC tracks test files from the pre-operational e-suite once these are available. See Access to test data for further details.

Guidelines for testing are available below. We encourage users of the TC tracks (BUFR data) to test their decoding software .

- **The number of tracks identified in the 06/18 cycles is lower due to the shorter forecast range available in these cycles (up to step 90 for HRES and 144 for ENS)**

- Updates to the TC tracks BUFR header
- Sample TC tracks BUFR data for technical testing
- Testing your TC tracks BUFR decoding software
- Access to test data
- Further documentation

NOTE: If you are facing problems with the decoding the updated TC tracks please contact the ECMWF ServiceDesk. Please include information on the software used (ecCodes, BUFRDC, ...), the version number, the error message and, if possible, the source code.

Software requirements

Users will need ECMWF ecCodes version 2.20.0 or above to decode the updated TC tracks in BUFR. Those users using BUFRDC will need to download and install the BUFR tables version 35. ECMWF is unable to advise on the usage of third party software, other then that WMO BUFR tables version 35 are needed.

Updates to the TC tracks BUFR header

New sequence of data descriptors

WMO BUFR Tables version 35 contain new sequence of data descriptors **316082** that combines all previously used descriptors. The single 316082 sequence is used that expands into the previous sequence.

	New	Old
ecCodes key = unexpandedDataDescriptors	316082	1033, 1034, 1032, 1025, 1027, 1090, 1091, 1092, 301011, 301012, 8005, 301023, 8005, 301023, 10051, 8005, 301023, 11012, 107003, 19003, 105004, 5021, 5021, 201131,19004, 201000, 116000, 31001, 8021, 4024, 8005, 301023, 10051, 8005, 301023,11012, 107003, 19003, 105004, 5021, 5021,201131,19004,201000

Correction to inconsistent encoding of the BUFR headers

With the introduction of the TC tracks from the 06/18 UTC forecast cycles, an inconsistency in the encoding of the BUFR headers has been corrected.

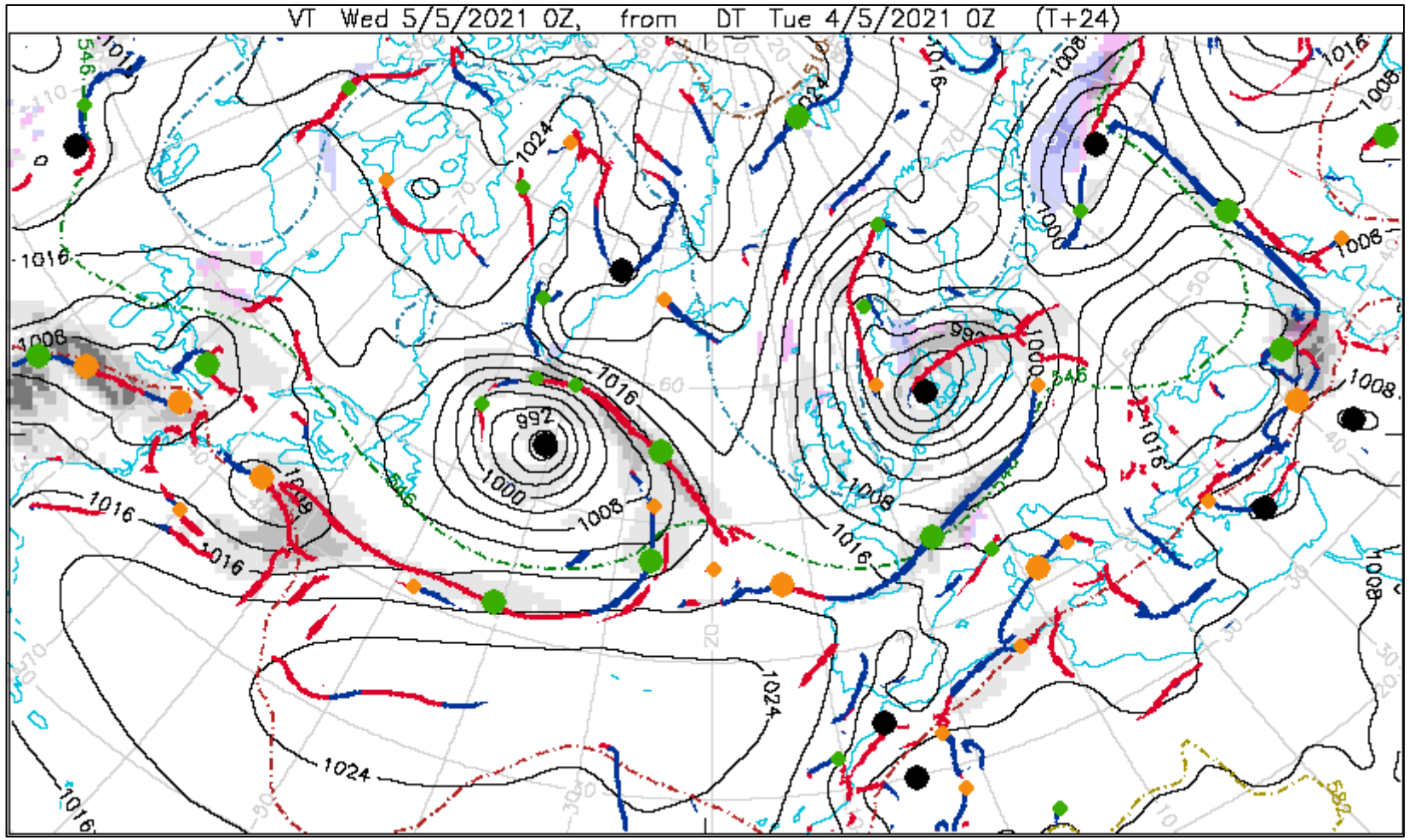
1. TC tracks from the 06/18 UTC forecast cycles now available as WMO essential products, including graphical product

2. All TC tracks BUFR files, including those from the 00/12 UTC forecast cycles, use WMO BUFR tables version 35

For details see

https://confluence.ecmwf.int/display/FCST/Update+to+Tropical+Cyclone+tracks

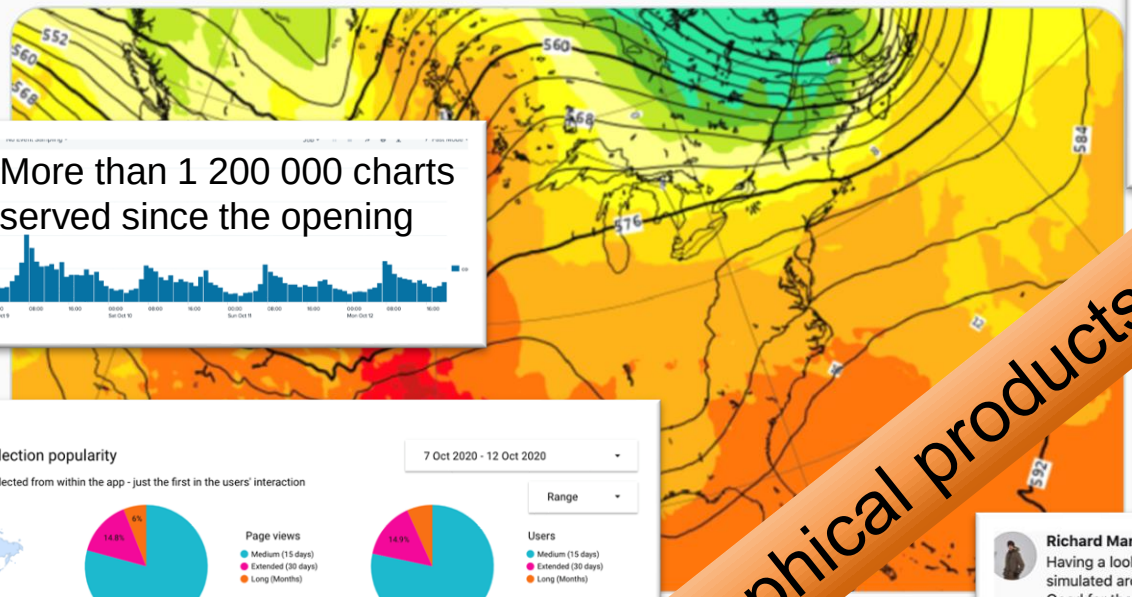
Cyclone Database (CDB) Products upgraded



- Based on a collaboration with the Met Office
- Uses Python now (previously PV-Wave)
- Products are now cleaner, clearer, less costly, more supportable and more future-proof
- Bug related to strike prob charts removed
- Opens door to further enhancements (e.g. front density plots)
- Also opens door to being able to import into ecCharts (but that will need further work)

ECMWF web charts

the Weatherboy @theWeatherboy · 19h
Great news from the EU and **@ECMWF** & @CopernicusECMWF: data & maps that were once under lock & key are now becoming available to the public around the world for free!



When it comes to two global compu… models, the Am…
GFS and the European ECMWF … as the gold standard
weatherbov.com

	Title	Page Views	Users
1.	Rain and mean sea level pressure	5,017	3,540
2.	Mean sea level pressure and wind speed at 850 hPa	3,681	2,921
3.	Geopotential 500 hPa and temperature at 850 hPa	2,045	1,542

Open graphical products #freethecharts

英吉利物屋 (いぎりすもんや) @igirisumonya · Oct 11
ECMWF天気予報、10日先の10/21まで、やってくる台風はない模様。今季はこれで終了か？
ameblo.jp/igirisumonya/e...
台風への関心はそろそろ終わりで、次の関心は北極地方の寒気が降りてくるでしょうか。
実況高層天気図

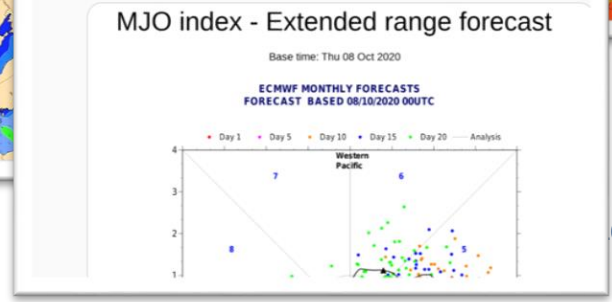
MeteoGib @MeteoGib · 2h
#Gibraltar - 12/10 - as flagged up last week - models continue to steer towards the possibility of some more unsettled weather next week - here is the latest Meteogram from the **ECMWF** model up to Thursday 22nd October.

RAM Revista del Aficionado a la Meteorología @RAM_m… · Oct 11
Mapas probabilísticos diarios de que se superen precipitaciones acumuladas de 1 , 5, 10 y 20 mm en 24 horas basados en modelo EPS **ECMWF**
Probabilities: 24hr total precipitation

Mehmet Eren @mehmeterenwx
eplying to @mehmeterenwx
ıma ecmwf umut vermiyor
akin daha çok erken
anslate Tweet
850 hPa temperature - SEAS5
Precipitation - SEAS5

Richard Martin-Barton @RMBwx · 4h
Having a look through the amazing **@ECMWF** chart repositary... big waves simulated around W Europe next week as significant troughing develops. Good for the surfers!

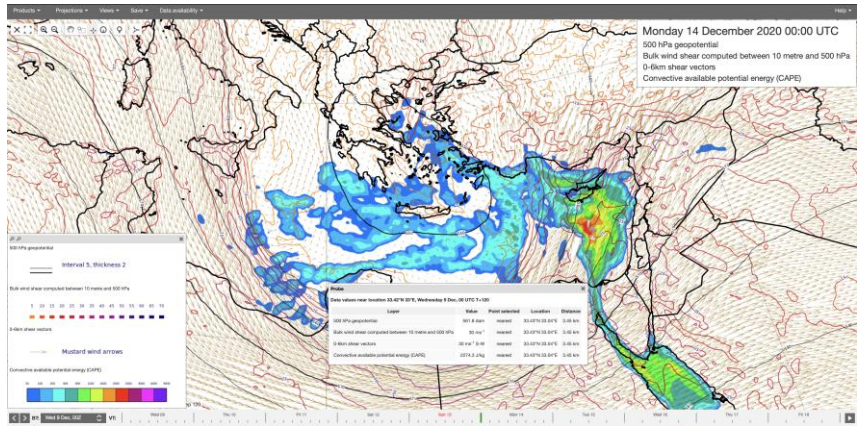
Nick Silkstone @Silkstiniho · 9h
Replying to @Silkstiniho and @GarnettJoe7
I wonder if the MJO moves moves into Phase 6 and weakens the trade winds (some support late October in **ECMWF**), this may precipitate the generation of a downwelling oceanic KW crossing the Pacific during the following 2 months. This may make a strong La Nina less likely in Nov/Dec

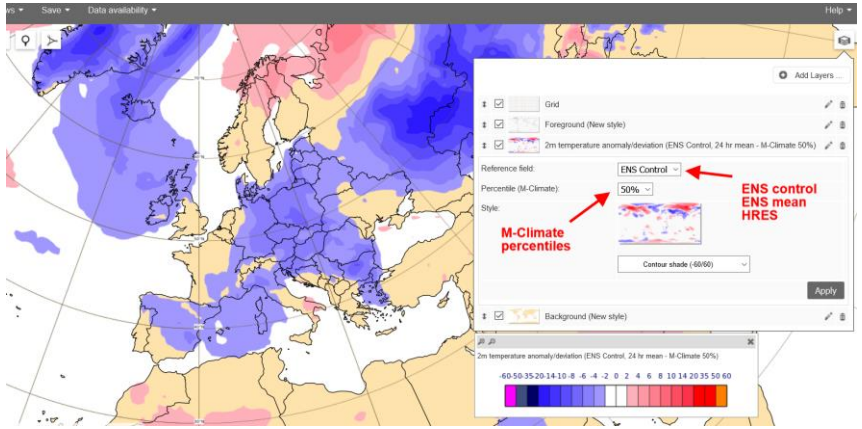


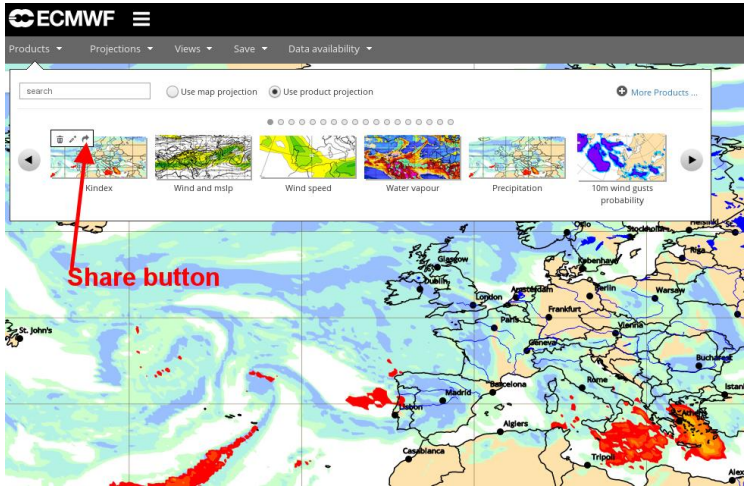
ecCharts updates

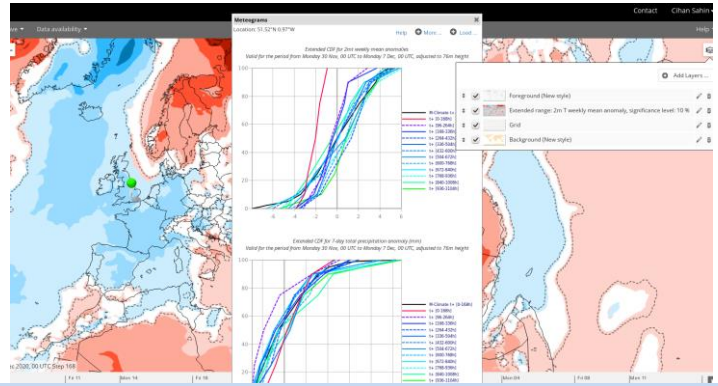
- New layers
  - Bulk wind shear
  - EM, spread for 10m, 100m wind, 2m T
  - EFI for water vapour flux
  - Deviations/anomalies
- Extended range forecast

  EFI, CDF for 2 m temperature, total precipitation
- ecCharts sharing functionality





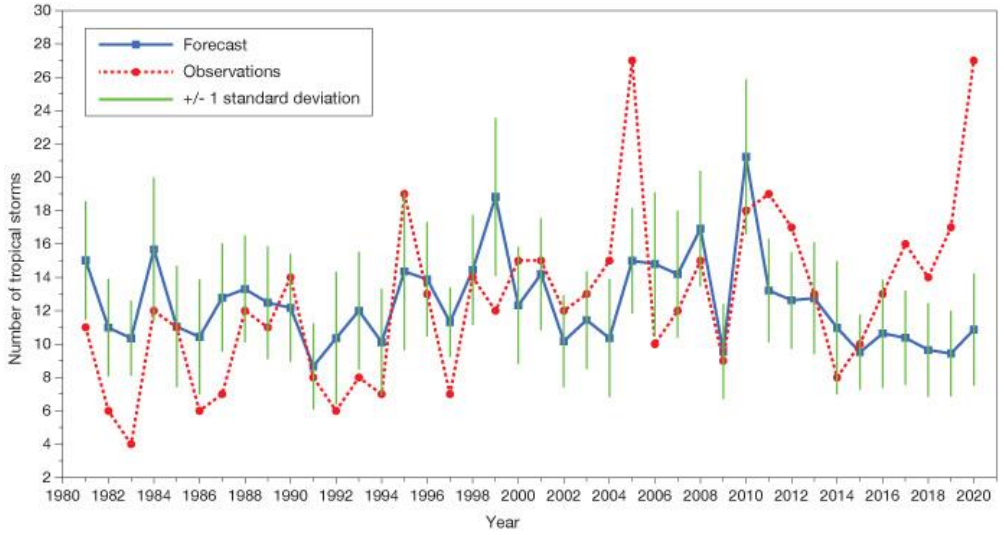


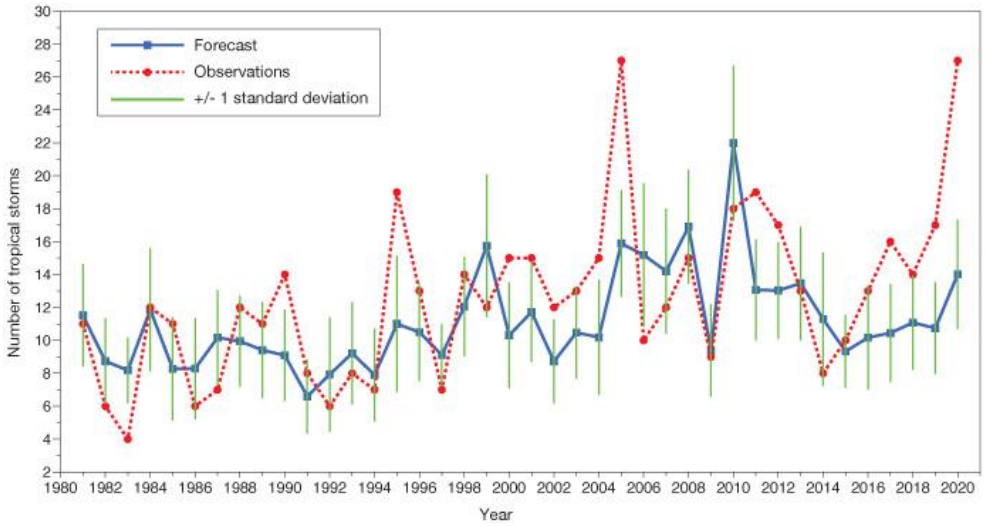


Friday 9:45-10:50 UTC. Speakers corner (Cihan)

Seasonal forecast: recalibration of Tropical Cyclone activity

- Recent ECMWF seasonal forecasts strongly underestimate the number of tropical storms and accumulated cyclone energy (ACE) in the Atlantic basin
- Number of tropical storms has, on average, gradually gone up over the years, while the predictions provided by ECMWF's seasonal system have not
- calibration was performed by comparing the observed and predicted number of tropical storms over the fixed period 1993–2016
- Revised to compute calibration coefficient over a 10-year running period preceding the year of the forecast
  - (all N hemisphere basins; S hemisphere still uses 1993-2016)



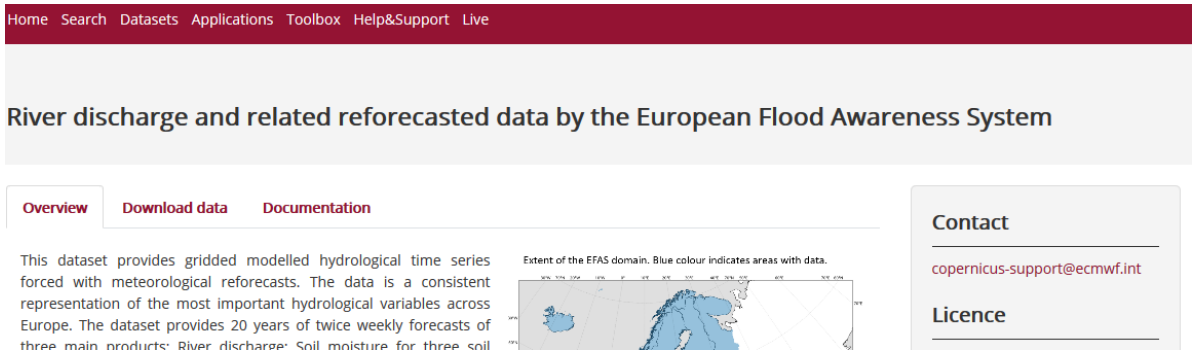


Emergency Management Service

CEMS-Flood & CEMS-Fire

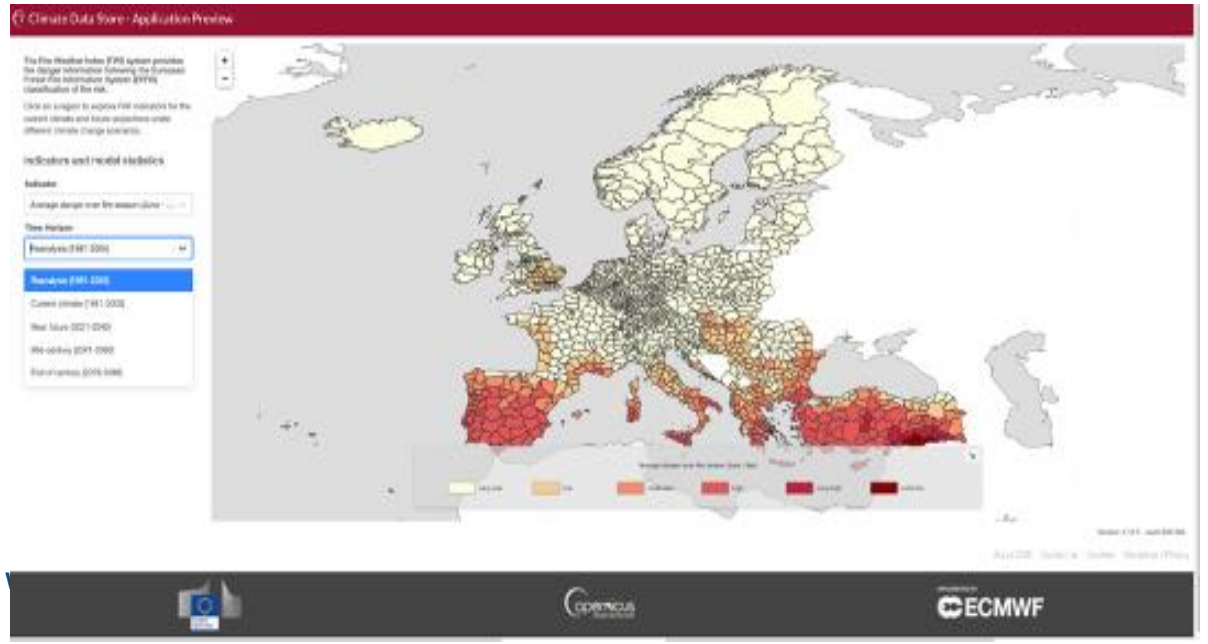
Increased CEMS offering from C3S/CDS (as part of EFAS4.0 cycle release)

- 3 terrestrial ECVs: river discharge, Soil Moisture, SWE
- Ensemble reforecasts (20yrs, twice weekly, daily timestep, up to 46 days)
- Seasonal forecast (SEAS5, daily, up to 215 days) updated with C3S-Seasonal
- Ensemble seasonal reforecasts (27yrs, monthly, daily timestep, up to 215 days)



First release of global fire danger indices reanalysis dataset based on ERA5: available on the CDS

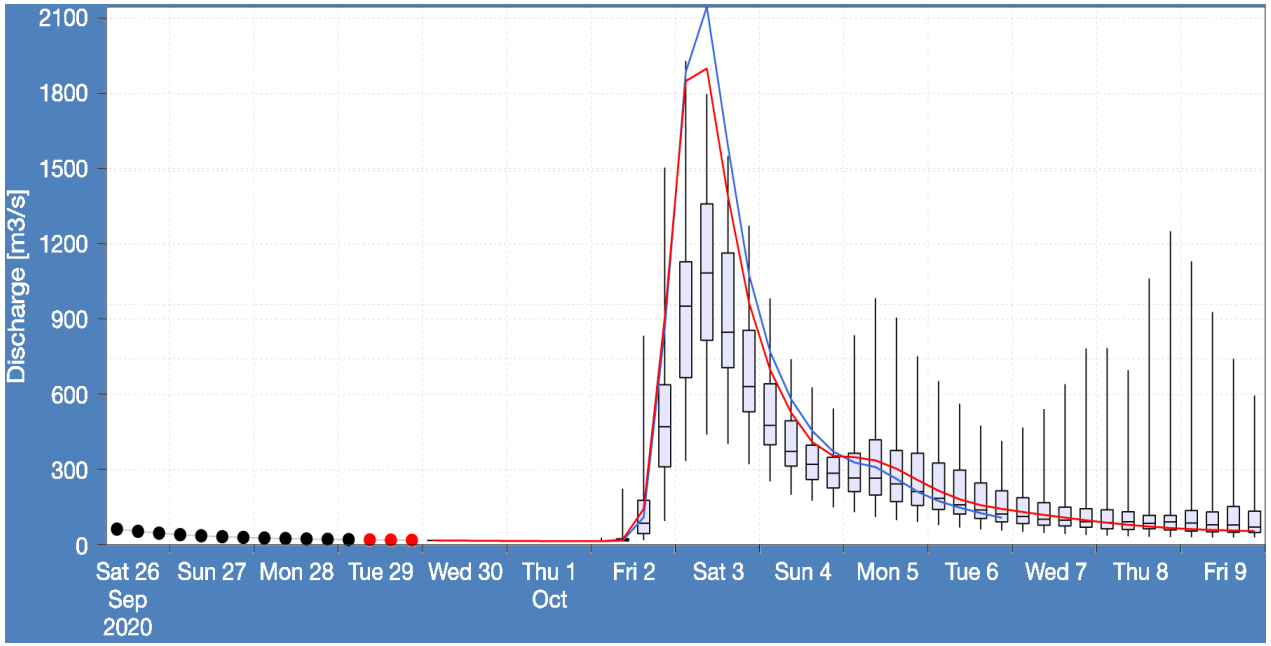
- Used as a benchmark by other applications
- Designed to understand the change in fire danger in Europe and its impact on tourism.
- ERA5 is useful to understand the state of present climate as compared to future scenarios.
- Data are reorganised as average over NUTS3 regions



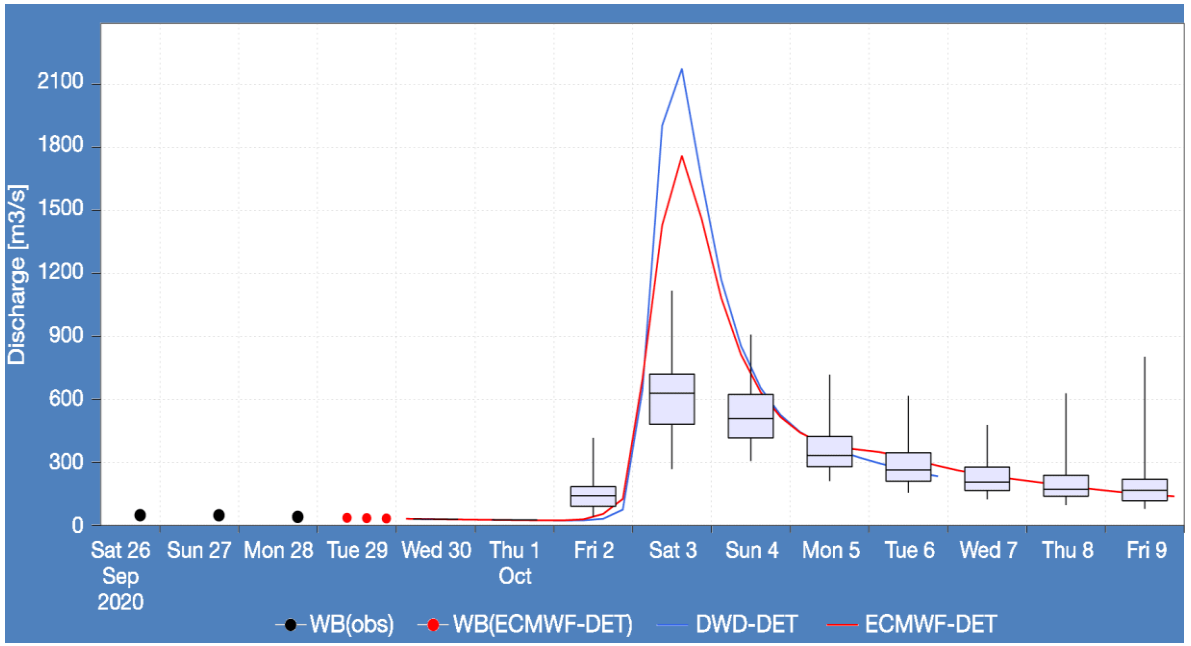
Improving flood prediction: EFAS model upgrade

EFAS 4.0 operational October 2020

6-hourly output from EFAS 4.0



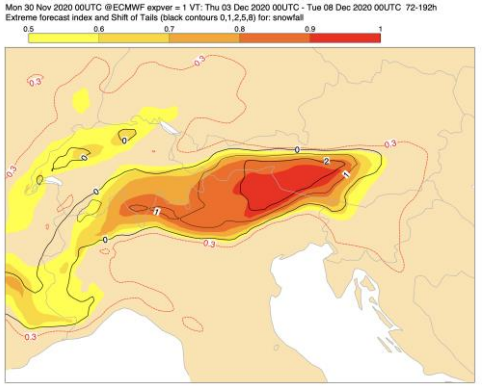
output from previous version of EFAS

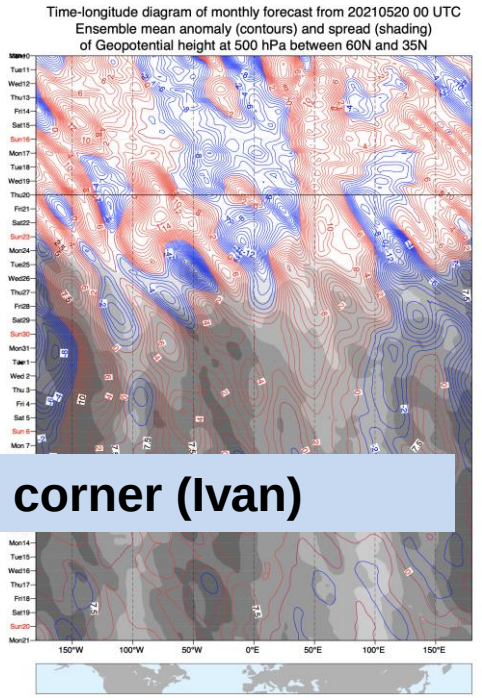


Thursday 10:05-10:25 UTC. Shaun Harrigan

Other product developments

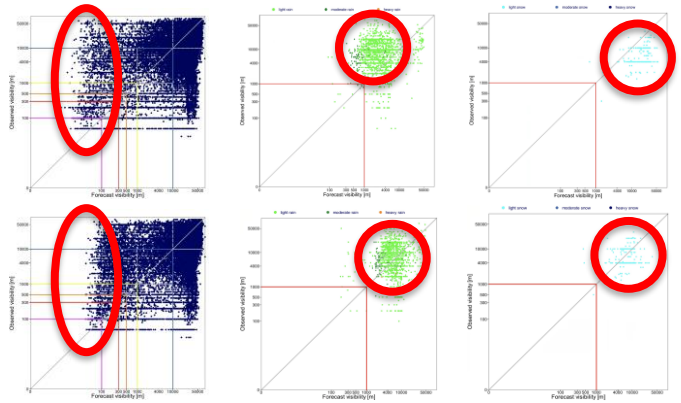
- EFI/SOT for snowfall – more forecast ranges
- Hovmoller diagram from the extended-range forecast
- Improving visibility forecasts in the IFS





Friday 10:45-11:50 UTC. Speakers corner (Ivan)

- Model cycle 47r3
  - Improved visibility forecasts
  - Clear air turbulence (CAT - will be article in summer newsletter)
  - most-unstable cape (MUCAPE)



User guide to ECMWF forecast products

- https://software.ecmwf.int/wiki/display/FUG/Forecast+User+Guide

ECMWF Spaces Calendars Create Search

Forecast User Guide

SPACE SHORTCUTS

Forecast User Home

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- 3 Availability and Interpolation of NWP output
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- 7 ENS Products - Dealing with Uncertainty
- 8 ENS Products - What they are and how to use them
- 9 Physical Considerations when Interpreting Model Output
- 10 Interfaces for displaying Model Output
- 11 Conclusion
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Space tools

Pages

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Forecast User Guide

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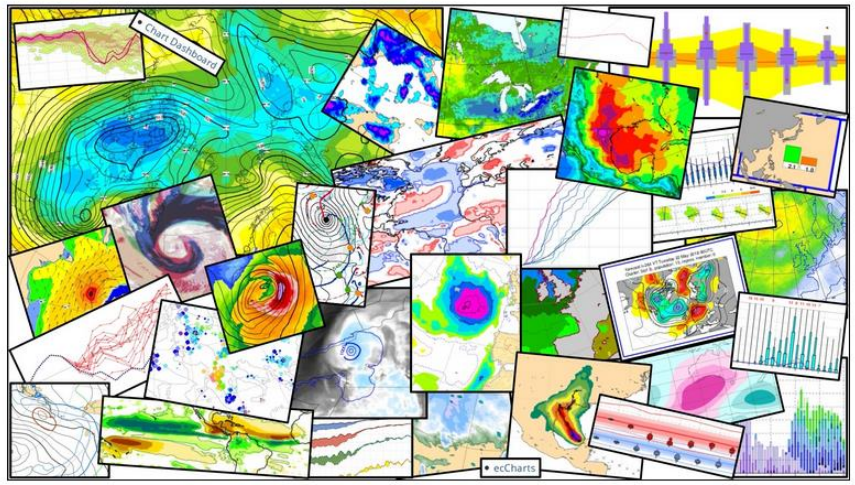
"Behind good forecast practices are often hidden good theories; equally, good theories should provide a basis for good forecast practices." Professor Tor Bergeron, personal communication, 1974



The aim of this User 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 new demands. The 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 forecast. The emphasis is on the medium-range forecast products, as this is ECMWF's primary goal, and because medium-range NWP output generally differs significantly from dealing with short-range or seasonal NWP.

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 to more detailed descriptions of processes are given, mainly at the end of each section, whilst separate online ECMWF training resources are also available to explain aspects of the ECMWF IFS more visually. Education is a key component of the work at ECMWF and further educational material is available through the web site (e.g. Webinars (recordings), Slidecasts (slides and audio recordings), Tutorials, Training lectures (presentations in PDF))


ECMWF
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