

# ECMWF Products for WMO countries



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User Support

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**Estíbaliz Gascón**

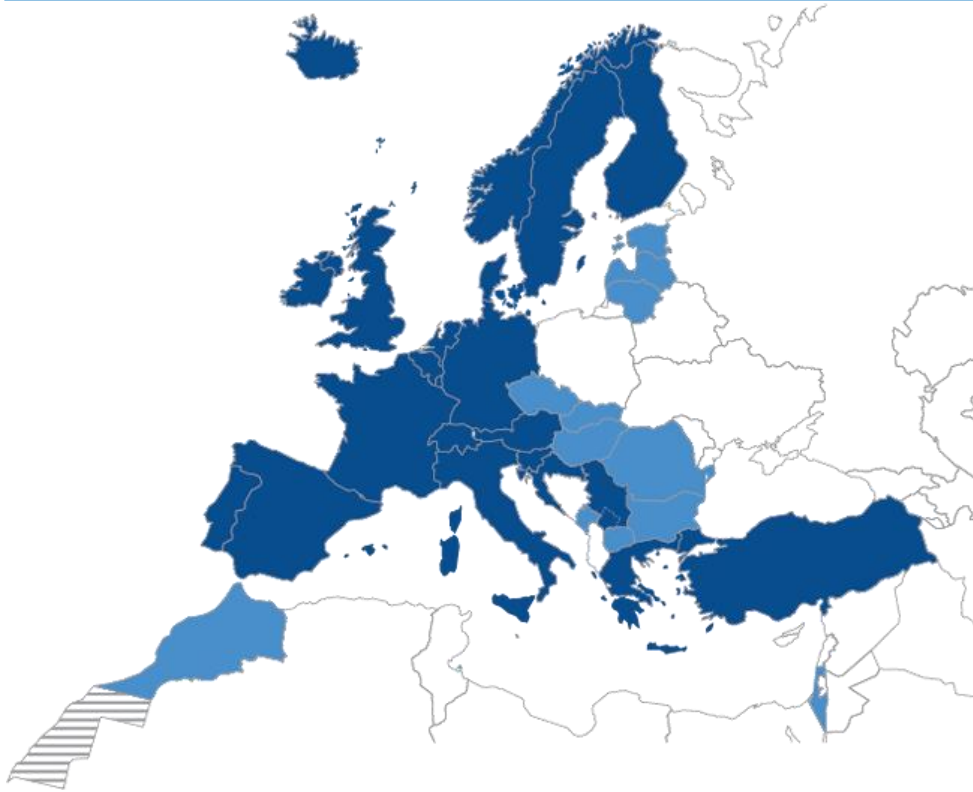
Forecast Performance and Products

Estibaliz.Gascon@ecmwf.int

# Who we are

## ECMWF

An independent intergovernmental organisation established in 1975 With 22 Member States 12 Co-operating States



- *Over 300 employees from more than 30 countries.*
- *Commercial licenses in more than 29 countries*
- *Research agreements with institutions all over the world*
- *Cooperation agreement with WMO*

## **ECMWF** is a:

- World Meteorological Centre (WMC)
- Lead centre for deterministic NWP and wave forecast verification
- Regional Specialized Meteorological Centre (RSMC) for medium-range forecasts
- Global Producing Centre for Long-range Forecasts (GPC)

# The operational forecasting system

## High resolution forecast (HRES) :

- twice per day **9 km** 137 levels, to 10 days ahead

## Ensemble forecast (ENS):

- twice per day 51 members, **18 km** 91 levels, to 15 days ahead
- Monday/Thursday 00 UTC extended to 1 month ahead (**Monthly Forecast, 18/36 km** )

## Ocean waves: twice per day

- **HRES-WAM**: 10 days ahead at **14 km** (coupled)
- **ENS-WAM**: 15 days ahead at **28 km** (coupled)

## Seasonal forecast: once a month

- 51-members, **~35 km** 91 levels, to 7 months ahead
- sub-set of 15 members is run for 13 months every quarter (**30 years of hindcasts**)

# Graphical products

- Main website

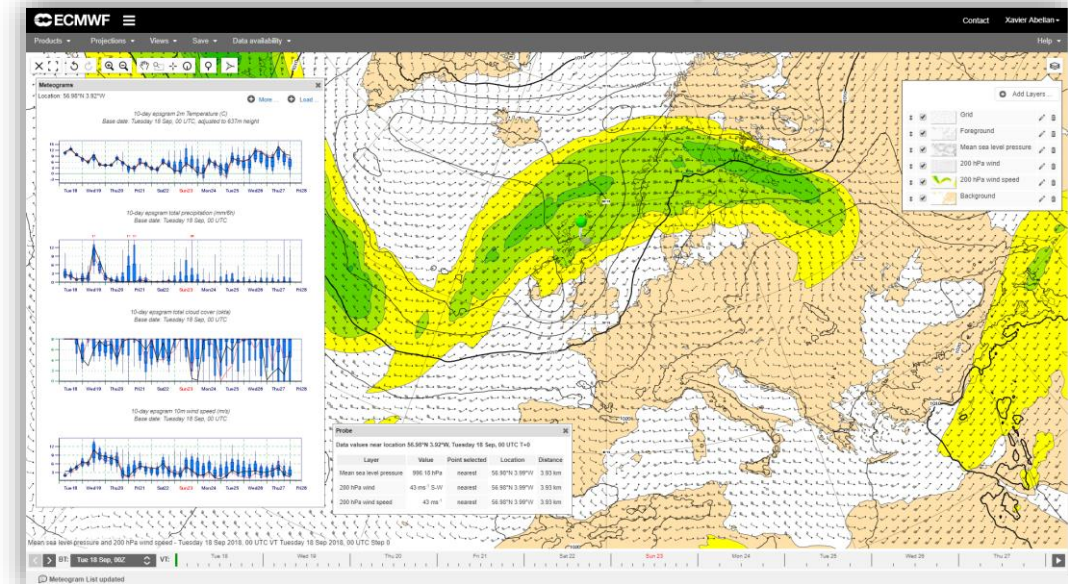
<https://www.ecmwf.int/en/forecasts/charts>

- Fixed set of products
- Integrated view and browsing of graphical products
- customisable dashboard

- ecCharts

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

- Restricted access (license required)
- Interactive web application to visualise and customise medium-range products
- Accessible through WMS protocol (Web Map Services)



# Binary products

- WMO essential
  - Publicly accessible
  - Set of basic global fields at low resolution
- WMO additional
  - Restricted access to WMO NMHS's
  - Wider catalogue global of fields
- Data formats:
  - GRIB-2 on a 0.5°/0.5° grid (standard fields)
  - BUFR (Tropical Cyclones)
- Accessible through FTP:
  - <ftp://dissemination.ecmwf.int>

<https://www.ecmwf.int/en/forecasts/datasets/wmo-and-acmad-datasets>

# Open Datasets

- Multi-model real-time (TIGGE)
- Sub-seasonal to seasonal (S2S)
- Atmospheric composition (Copernicus Atmosphere Monitoring Service - CAMS) <https://atmosphere.copernicus.eu>
- Reanalysis ERA5 (Copernicus Climate Change Service – C3S) <https://climate.copernicus.eu>
- Global Floods: GloFAS (Copernicus Emergency Monitoring Service – CEMS) <http://www.globalfloods.eu>



# ECMWF Production Data Store

- Data Dissemination: Automatic distribution of meteorological products to our Member States and other end-users.
- A total of 1163 Destinations across 79 countries:



# WMO accounts

Every WMO country has an account

- wmo\_<country\_code>
- Associated to the nominated contact person

It gives access to all static charts on our web site

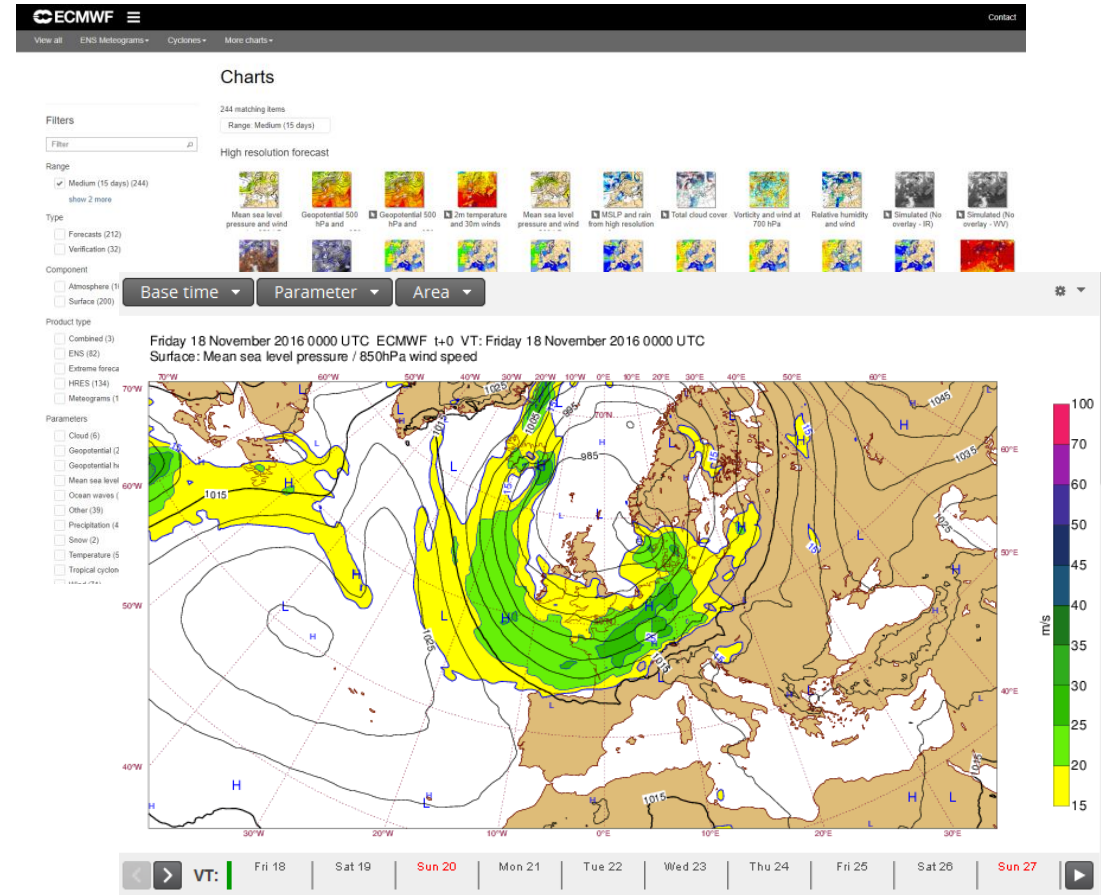
How to access:

- Log in [www.ecmwf.int/auth/login](http://www.ecmwf.int/auth/login)

Contact [servicedesk@ecmwf.int](mailto:servicedesk@ecmwf.int) if:

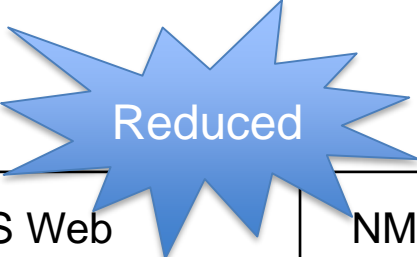
- You need to change the contact associated
- You have any problem accessing the account

**Our aim is to keep our contacts database as up to date as possible,  
so all WMO members can access all available services**





# Licenses for WMO NMHSs



License	NMHS Web Non-commercial	NMHS Standard Non-commercial	NMHS Full Non-commercial
ecCharts	✓	✓	✓
Archived Data	✗	✗	✓
Customised real-time products dissemination	✗	Will become available	✓
Official duties	✓	✓	✓
Academic / research	✓	✓	✓
Commercial	✗	✗	✗
Annual fee	€ 1000	custom fee	€ 42000
Annual fee with High Frequency Products			€ 44400

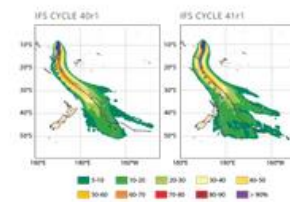
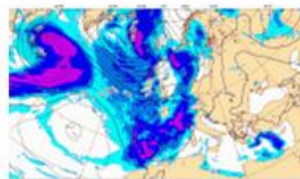
<http://www.ecmwf.int/en/forecasts/accessing-forecasts/licences-available>

# Products available for WMO countries

[www.ecmwf.int](http://www.ecmwf.int)

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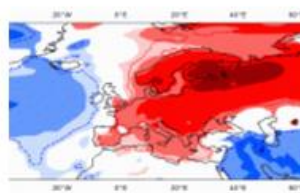
### → Medium range

Up to 10/15 days ahead

Overview

Forecast charts

Verification



### Extended range

Up to 32 days ahead

Overview

Forecast charts

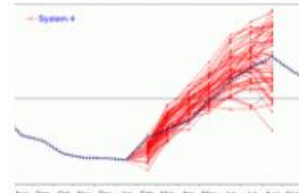
Verification

### Meteograms

Up to 10/15 days ahead

ENS meteograms

ENS meteograms for WMO member states



### Long range

Up to 13 months ahead

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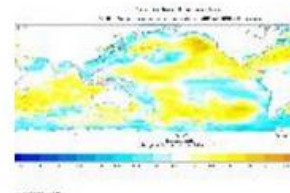
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Up to 10/15 days ahead

Latest tropical cyclones

Tropical cyclone activity

Extra-tropical cyclones



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Archived EUROSIP Multi-model system

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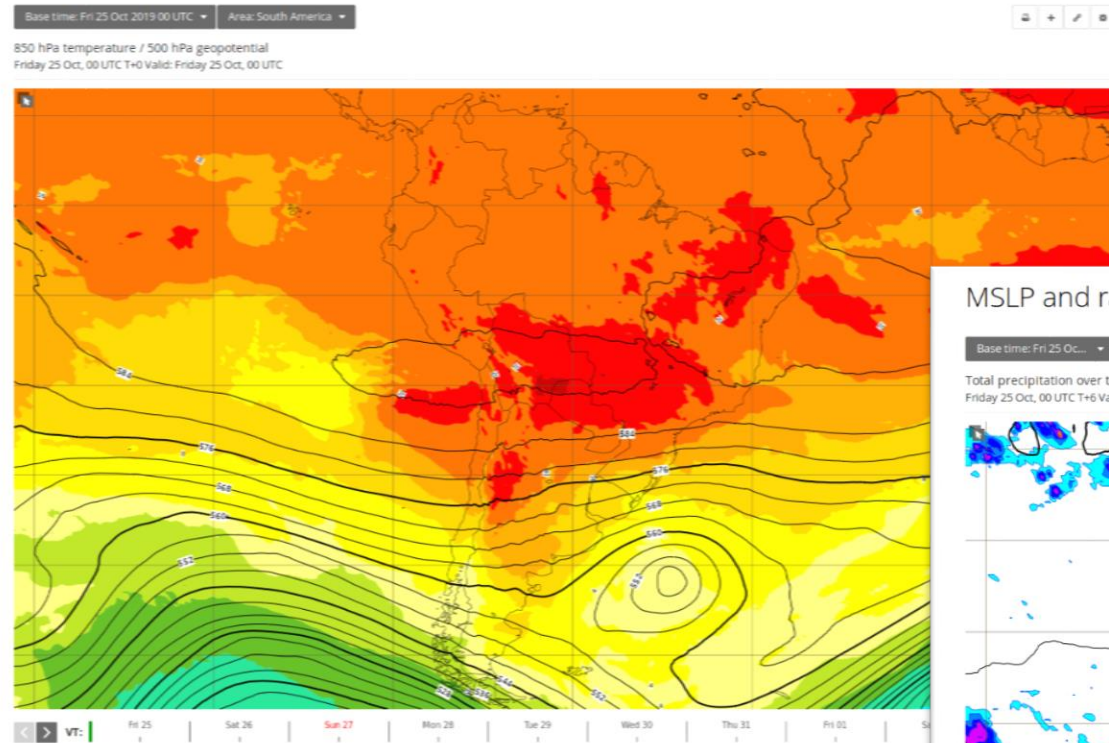
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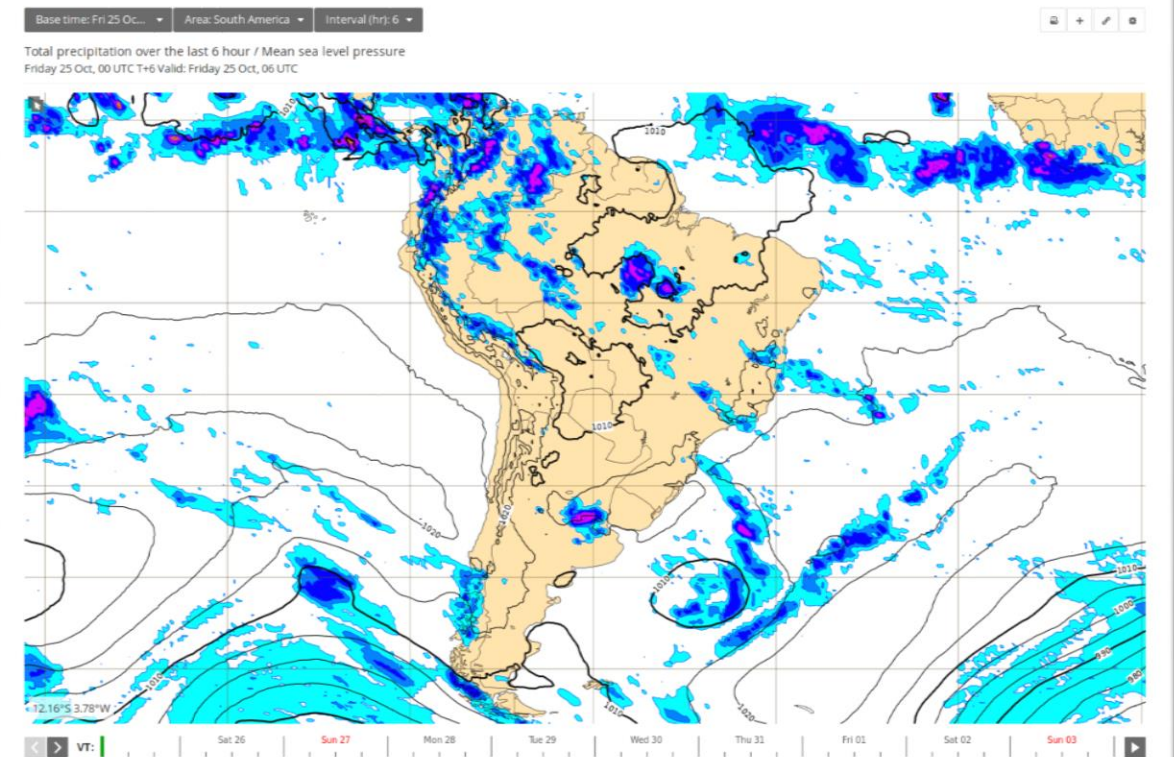
# High-resolution forecast

- 30 different areas to select
- Different base times (5 days)
- Two runs available (00 and 12 UTC)
- Lead time: 10 days

## Geopotential 500 hPa and temperature at 850 hPa



## MSLP and rain from high resolution forecast

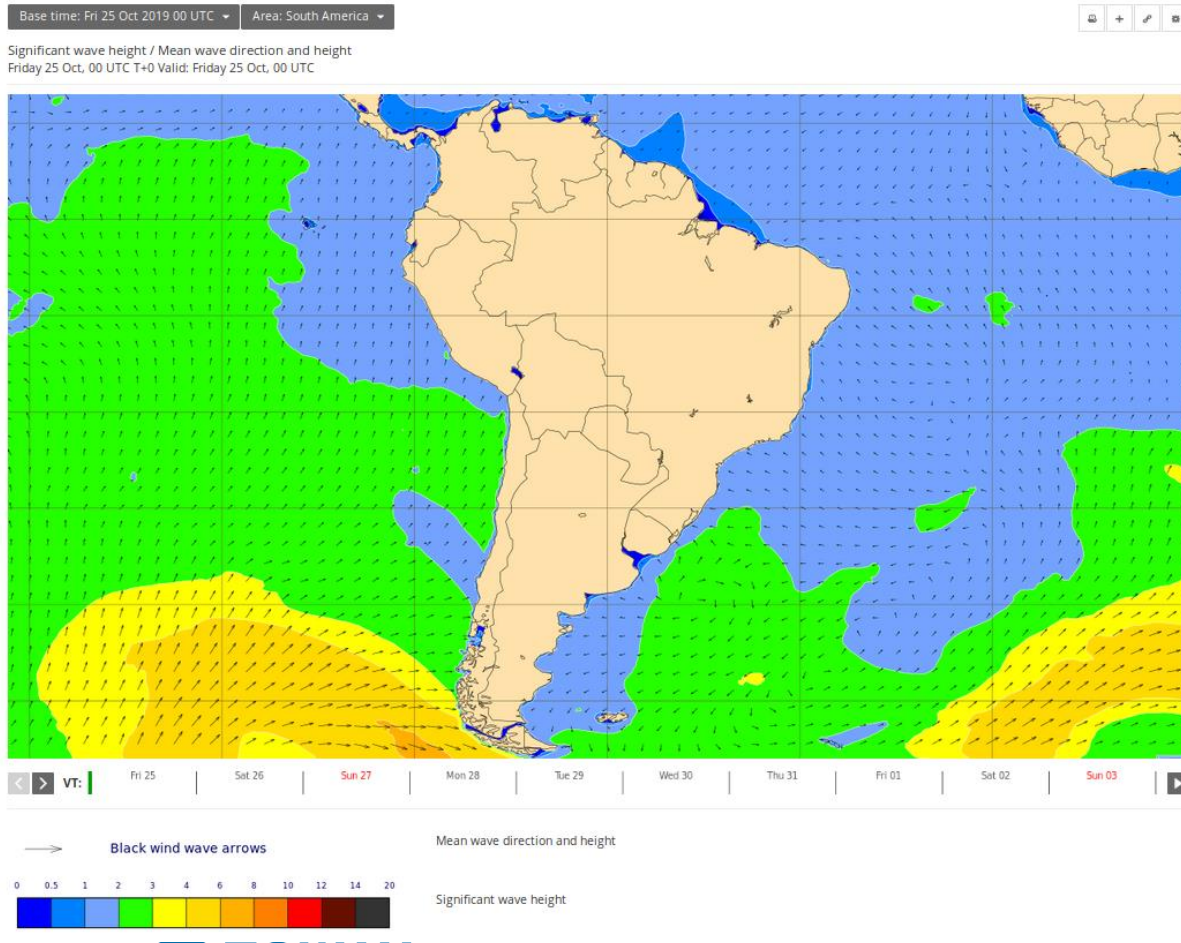


- Rainfall accumulations: 6h and 12h

# High-resolution forecast

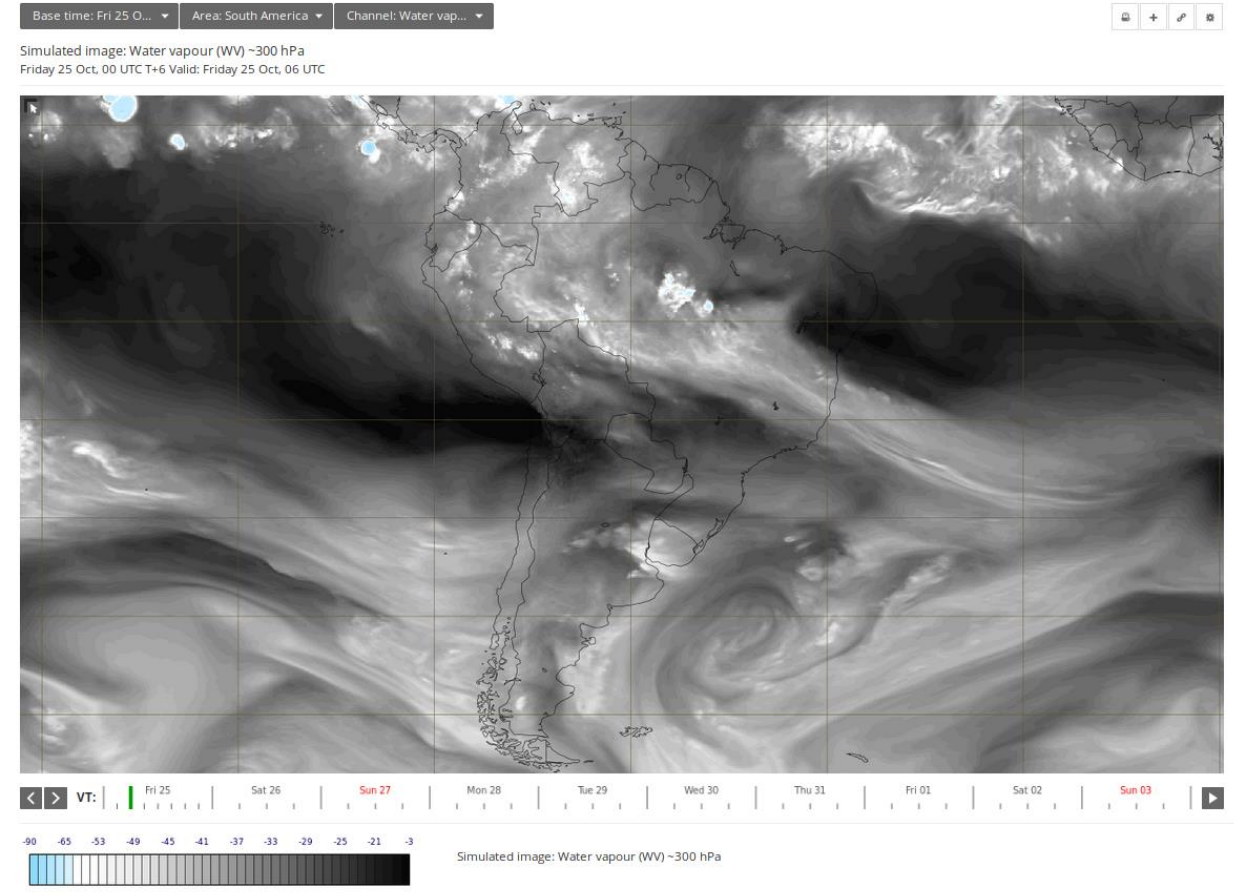
## Wave forecast products

Significant wave height and mean direction (WMO)



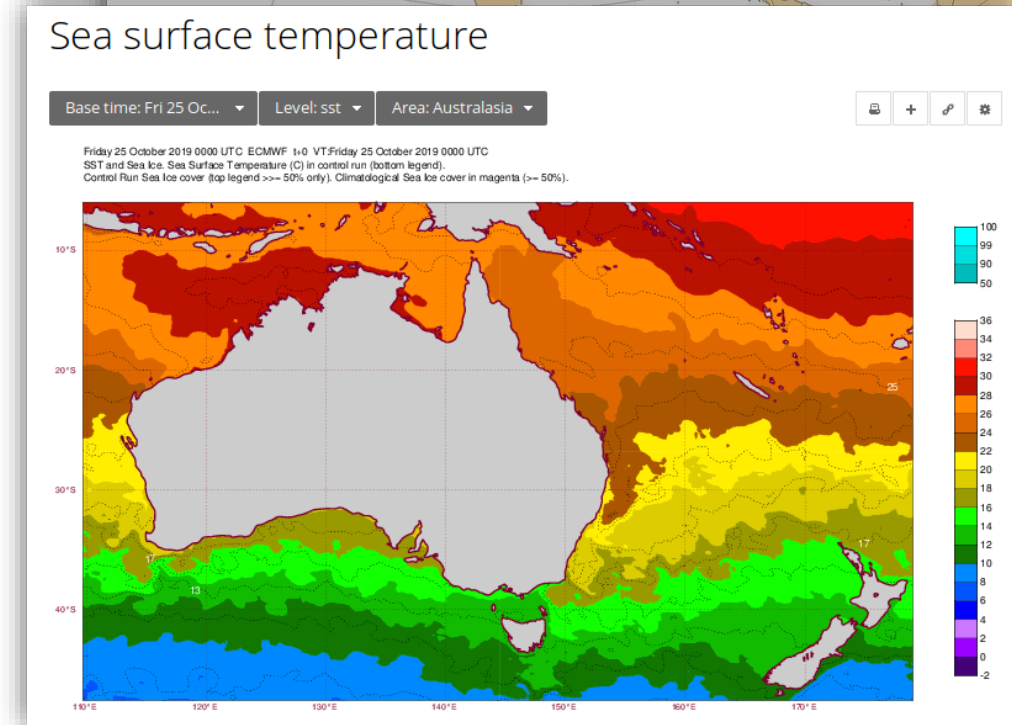
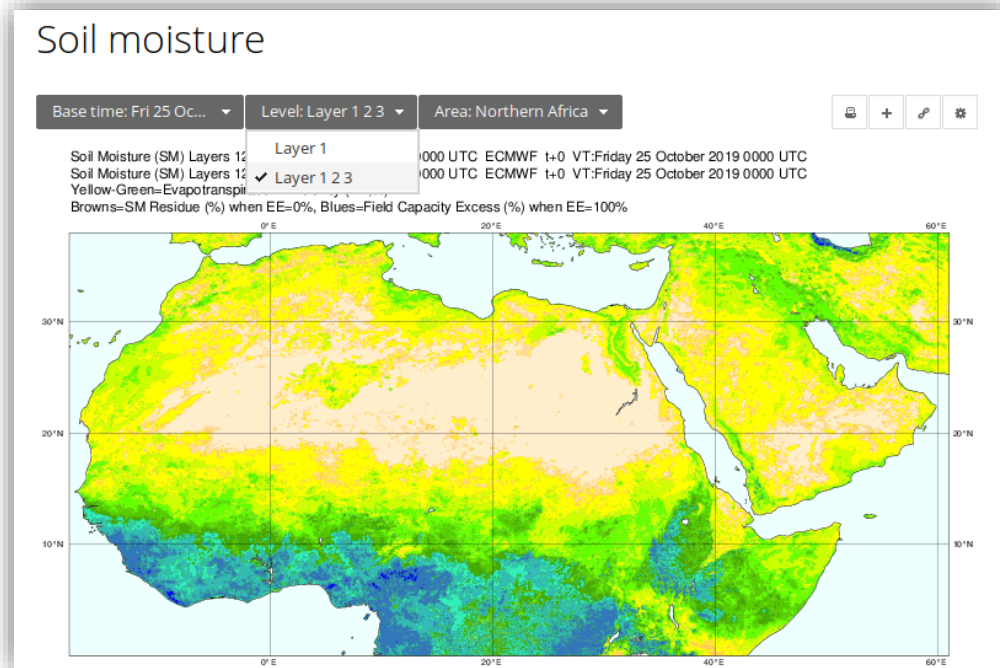
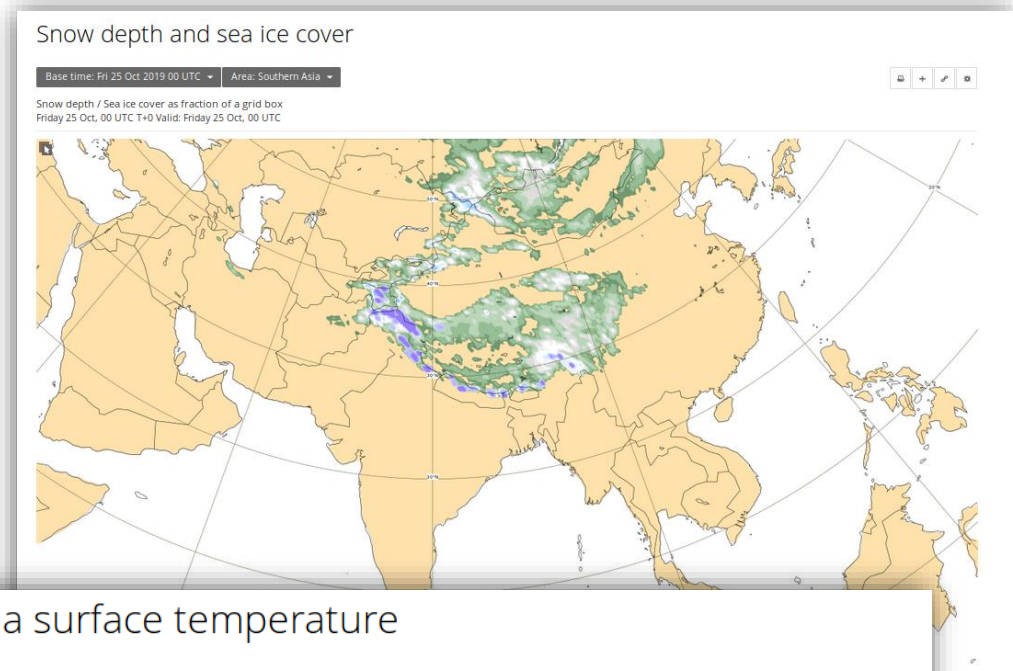
## Simulated satellite products

Simulated (No overlay - WV)



# Surface parameters

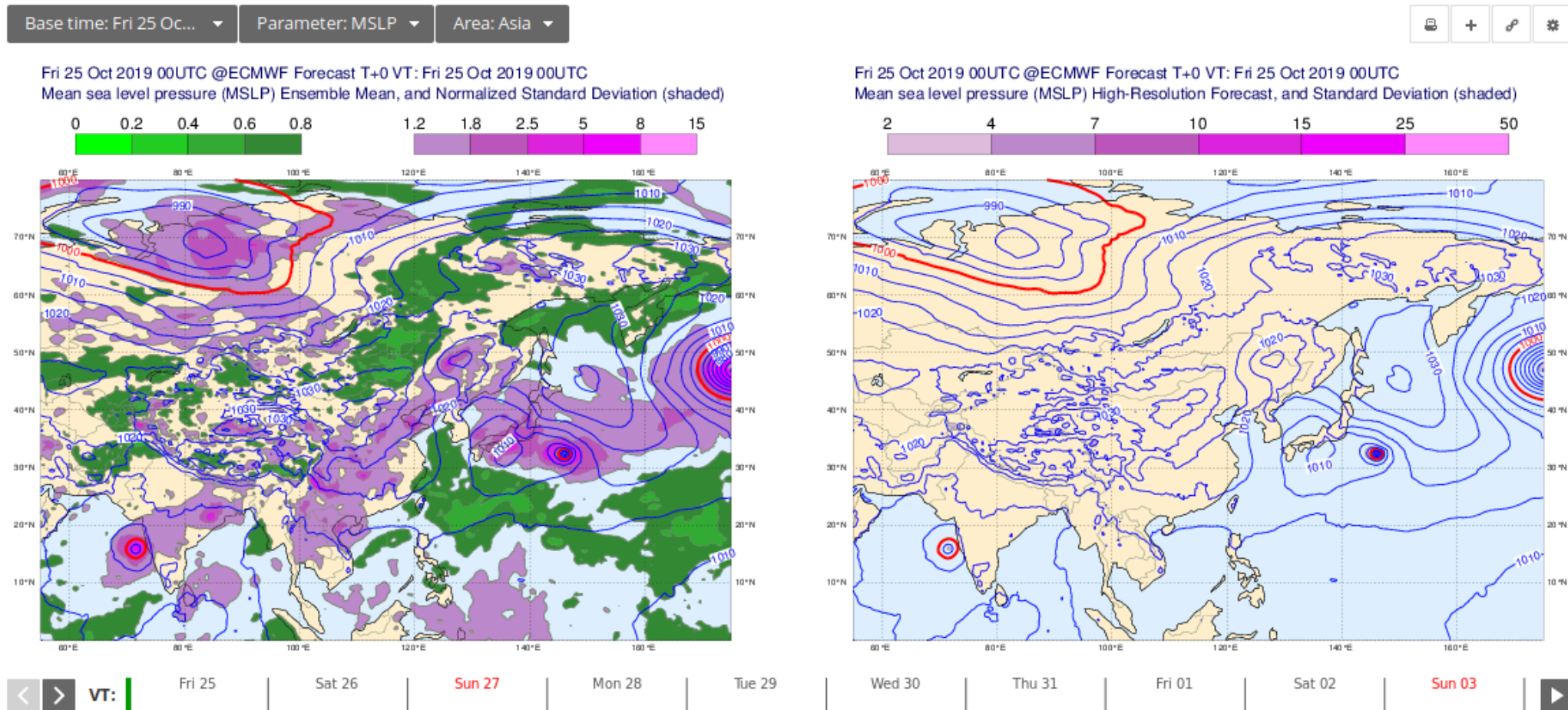
- Soil moisture
- Albedo
- Orography and sea depth
- Sea surface temperature (SST)
- Snow depth and sea ice cover .....



# Ensemble mean and spread products

**PARAMETERS:** mslp, temperature and wind 850 hPa and geopotential 500 hPa

Ensemble mean and spread: four standard parameters



# Extreme Forecast Index (EFI)

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**Extreme Forecast Index (EFI)** is designed to measure how extreme a given ensemble forecast is.

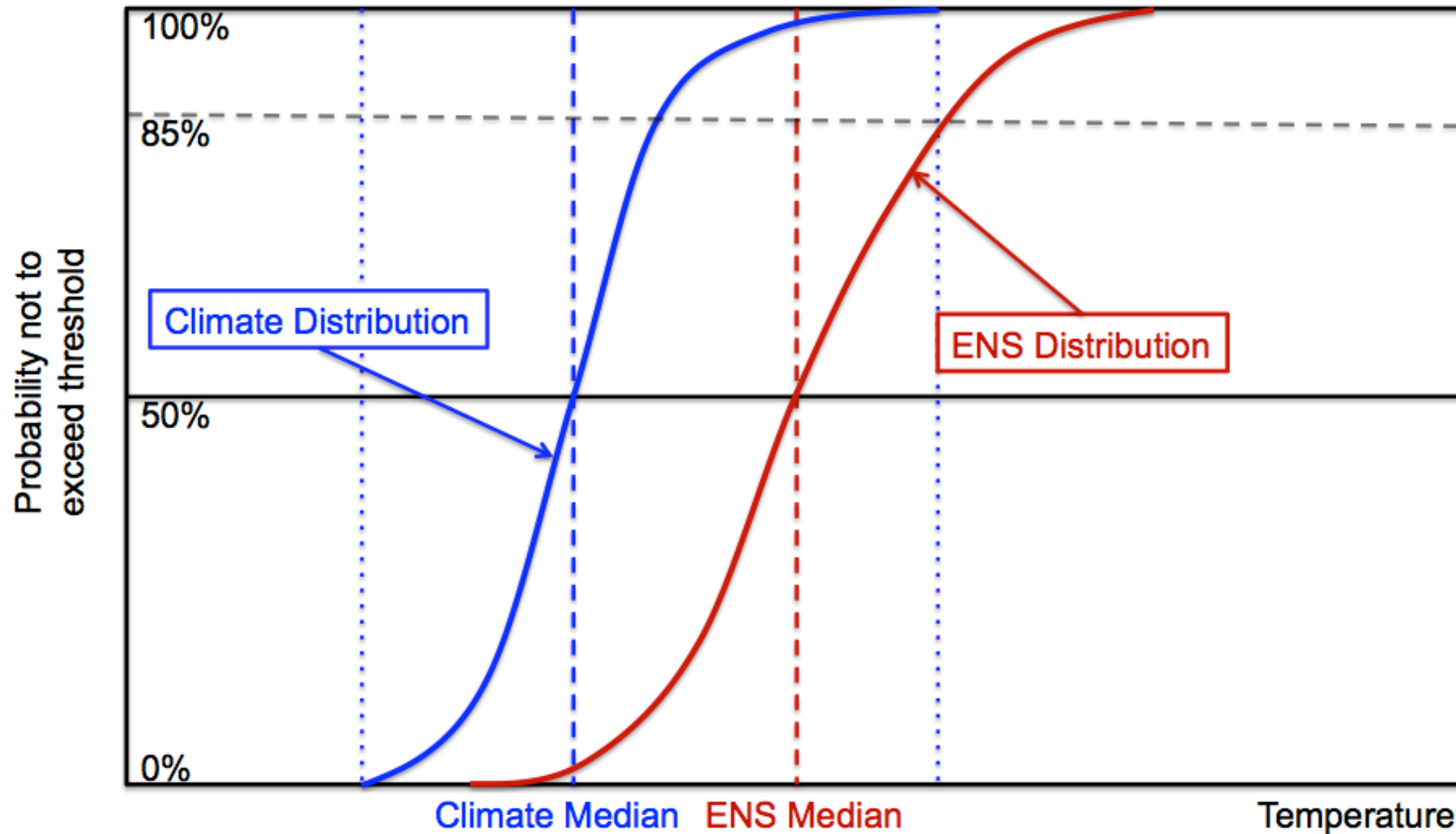
EFI is a measure of the difference between the ensemble forecast distribution and a reference distribution - **model climate (M-climate)**.

EFI delivers model-climate-related information, therefore it can be used as an “**alarm bell**” for extreme weather situations over any area without defining different space- and time-dependent thresholds.

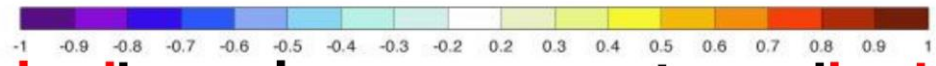
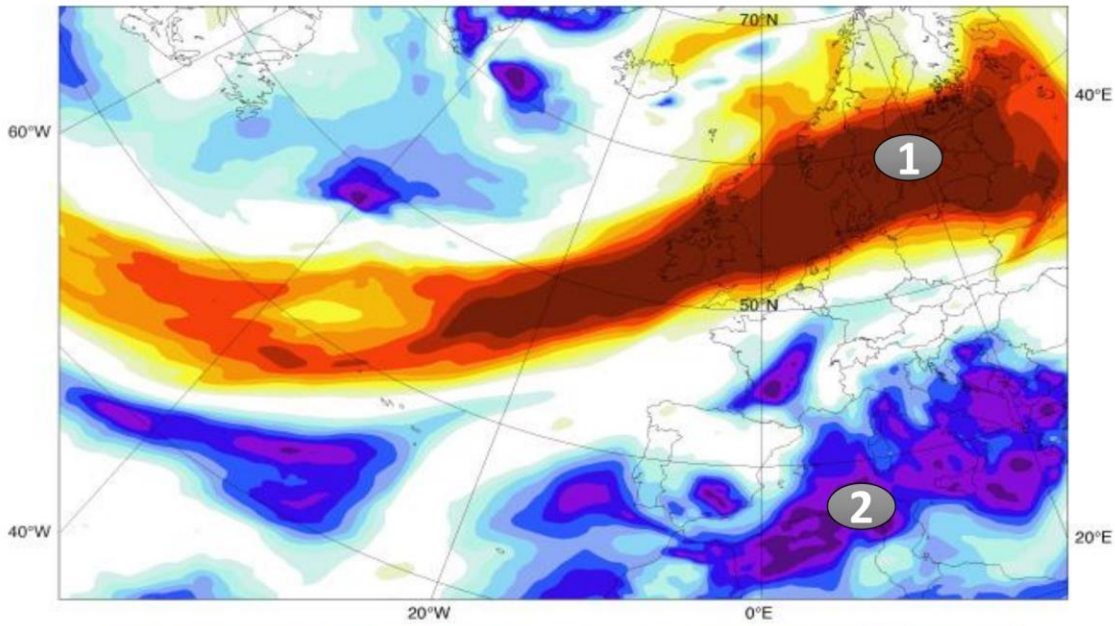


# Cumulative Distribution

Medians And Percentiles are clearly shown



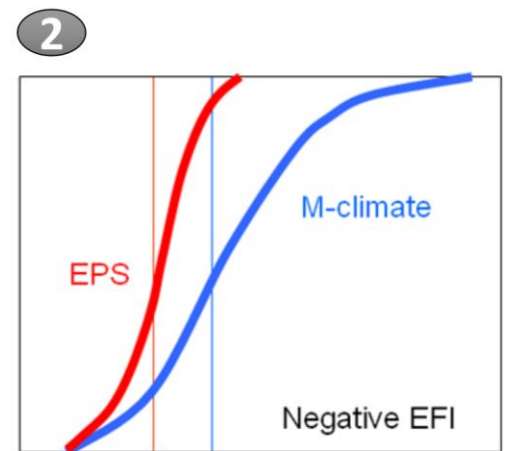
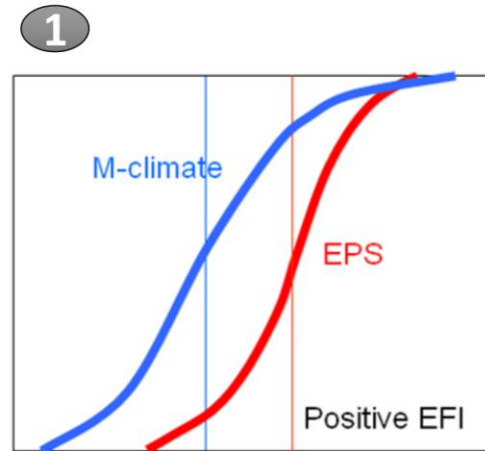
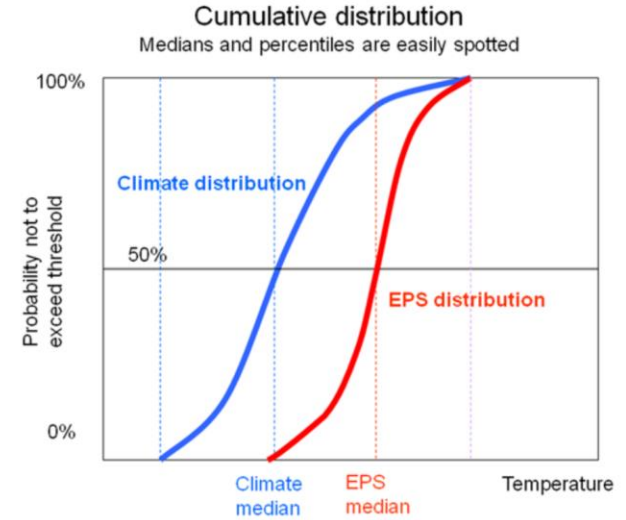
The **EFI** is an integral measure of the difference between the ensemble forecast (ENS) distribution and the model climate distribution.



"unusual" weather is likely

"very unusual" weather is likely

EFI for 2m temperature



# Operationally available EFI fields

## EFI and SOT parameters:

2-metre mean temperature index

24-h total precipitation index

10-metre mean wind speed index

10-metre maximum wind gusts index

2-metre minimum temperature index

2-metre maximum temperature index

total snowfall index

maximum significant wave height index

CAPE

capeshear

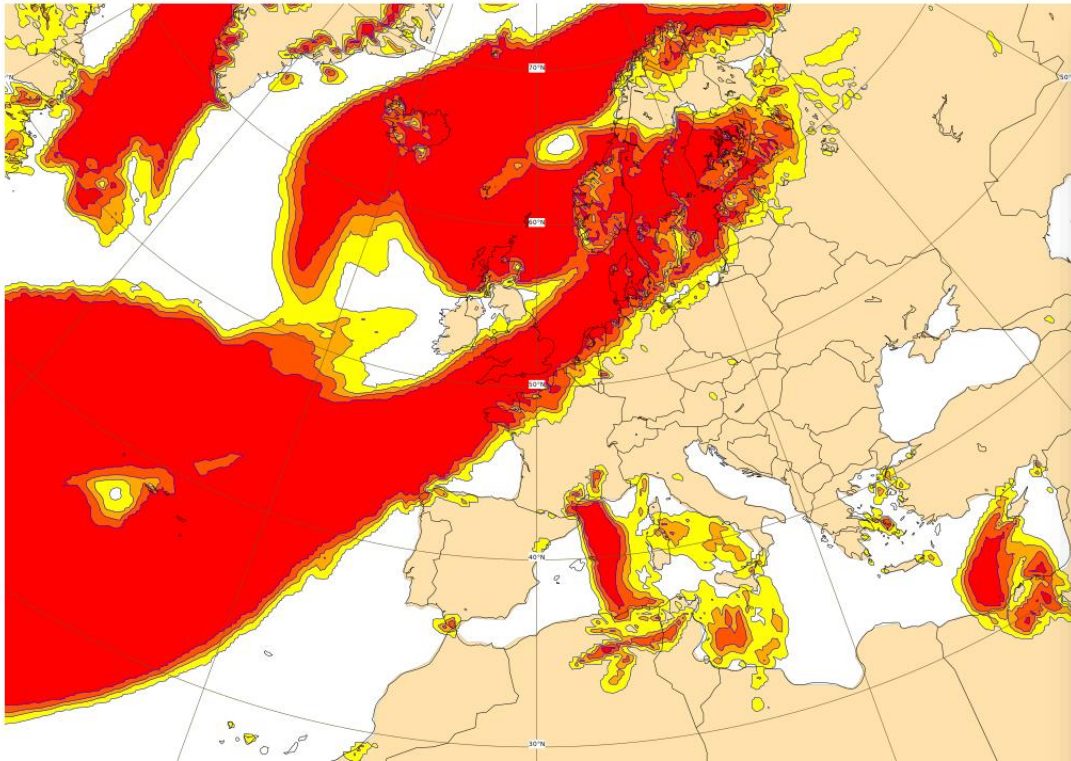
Water Vapor Flux

# Ensemble probabilities

Probabilities (WMO): 24h max of 10m wind gust

Base time: Fri 25 Oct... Area: Europe Threshold: >15 m/s

10m wind gust probability >15 m/s  
Friday 25 Oct, 00 UTC+24 Valid: Saturday 26 Oct, 00 UTC

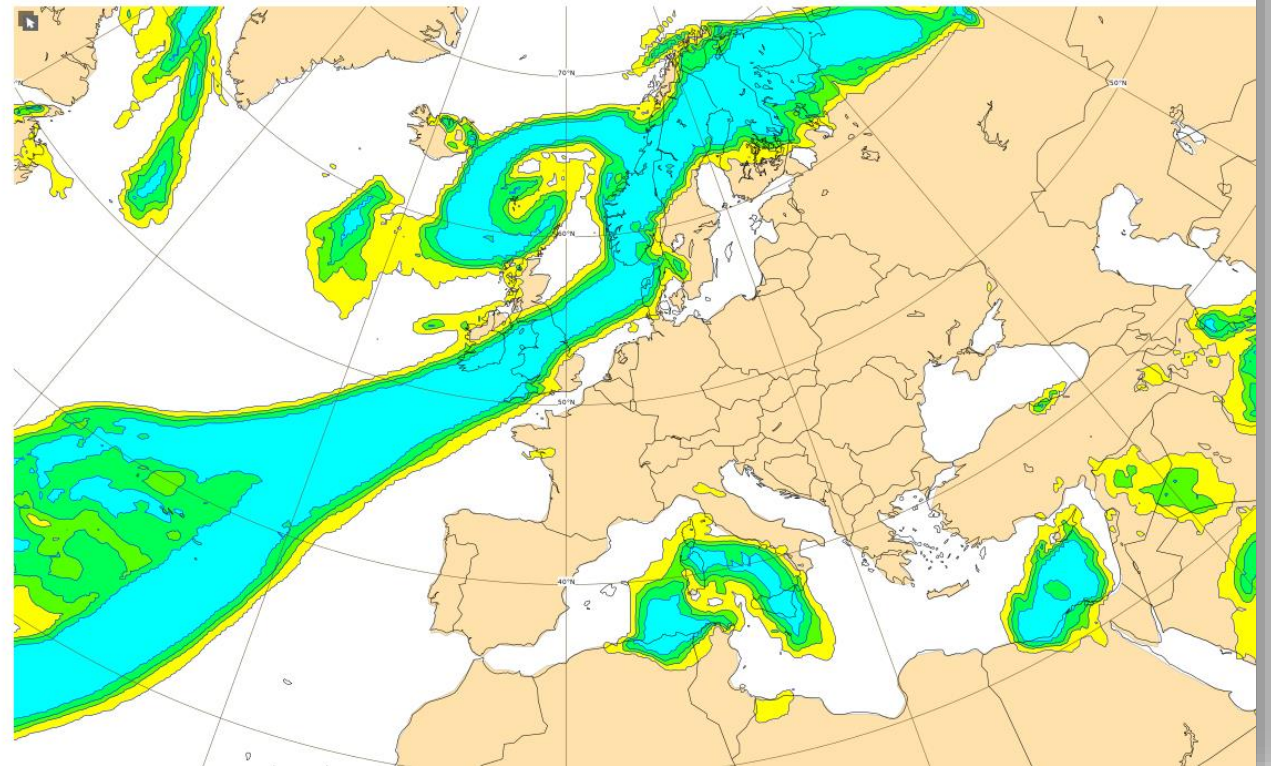


- Different thresholds
- Different variables

Probabilities: 24hr total precipitation

Base time: Fri 25 Oct... Area: Europe Threshold: >5

Total precipitation probability >5  
Friday 25 Oct, 00 UTC T+24 Valid: Saturday 26 Oct, 00 UTC



# Static products

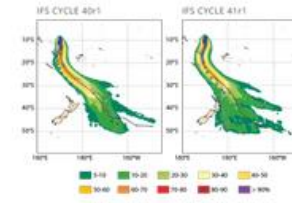
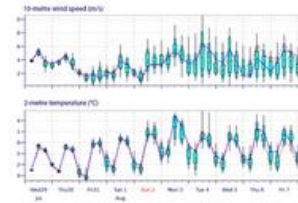
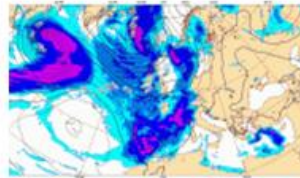
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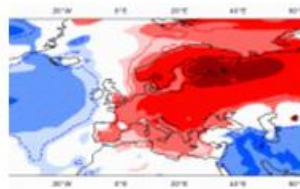
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Up to 10/15 days ahead

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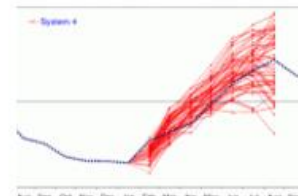


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Up to 10/15 days ahead

ENS meteograms

ENS meteograms for WMO member states



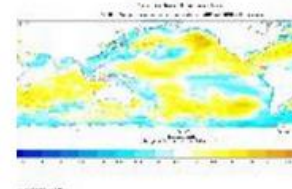
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### → Extended range

Up to 32 days ahead

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# Extended-Range forecast (up to 4 weeks)

Weekly **anomalies** for different areas and parameters, related to the **Model Climate**

ECMWF EPS-Monthly Forecasting System

Precipitation anomaly

Forecast start reference is 24-10-2019  
ensemble size = 51 ,climate size = 660

Day 5-11

28-10-2019/TO/03-11-2019

Shaded areas significant at 10% level  
Contours at 1% level

ECMWF EPS-Monthly Forecasting System

2-meter Temperature anomaly

Forecast start reference is 24-10-2019  
ensemble size = 51 ,climate size = 660

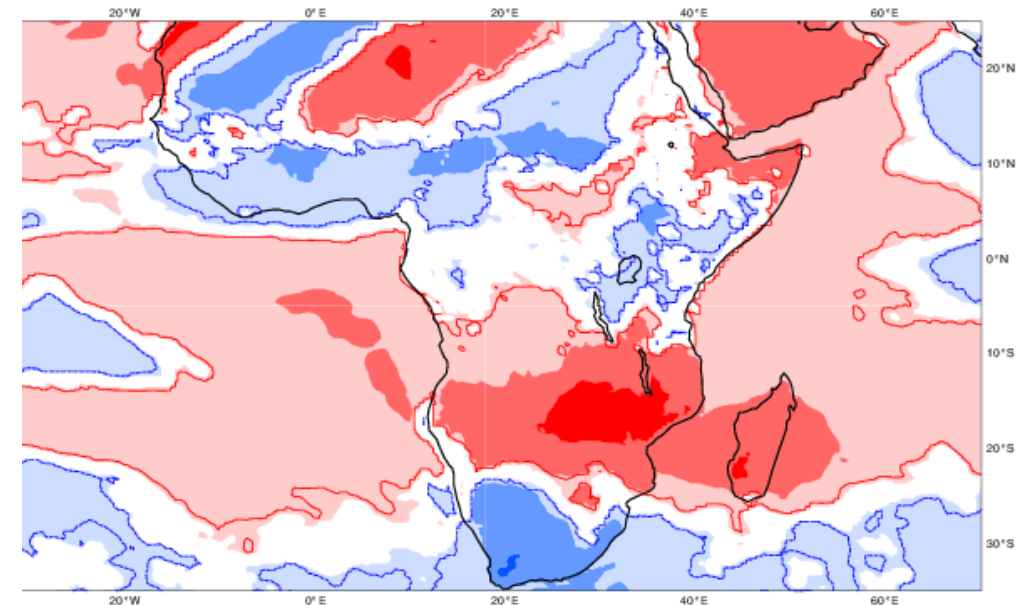
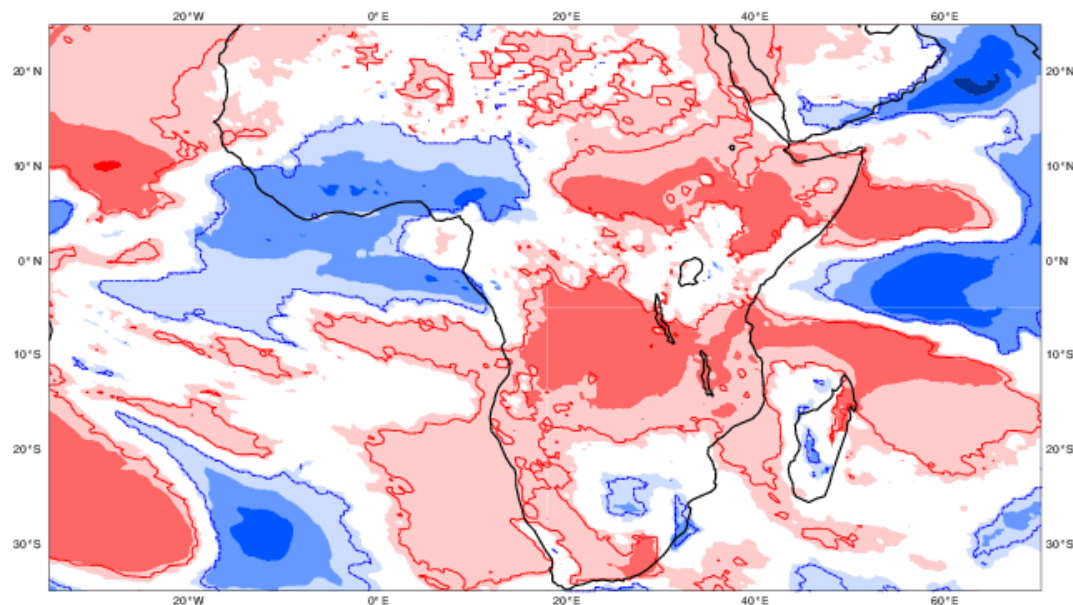
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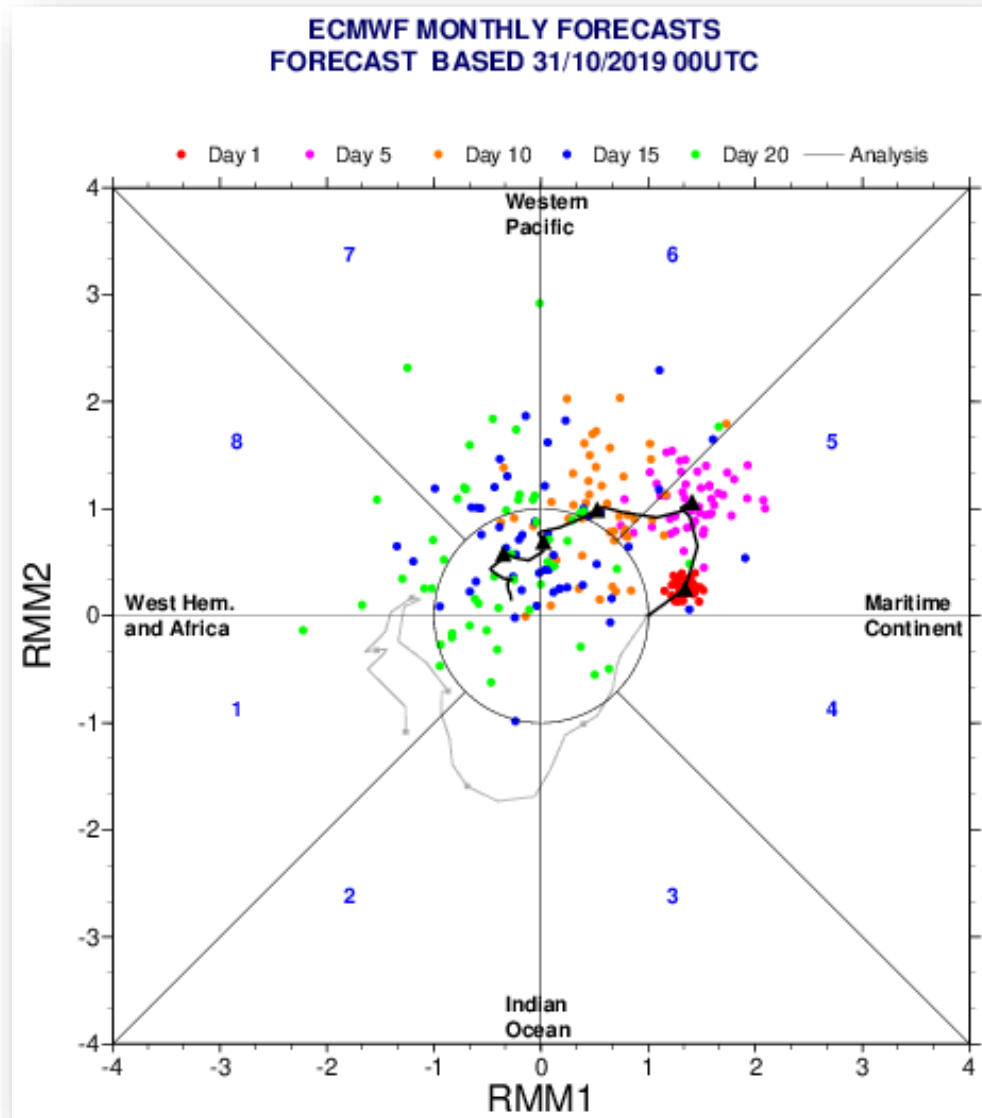
<-90mm -90..-60 -60..-30 -30..-10 -10.. 0 0.. 10 10..30 30.. 60 60.. 90 > 90mm

<-10deg -10.. -6 -6.. -3 -3.. -1 -1.. 0 0.. 1 1.. 3 3.. 6 6.. 10 > 10deg

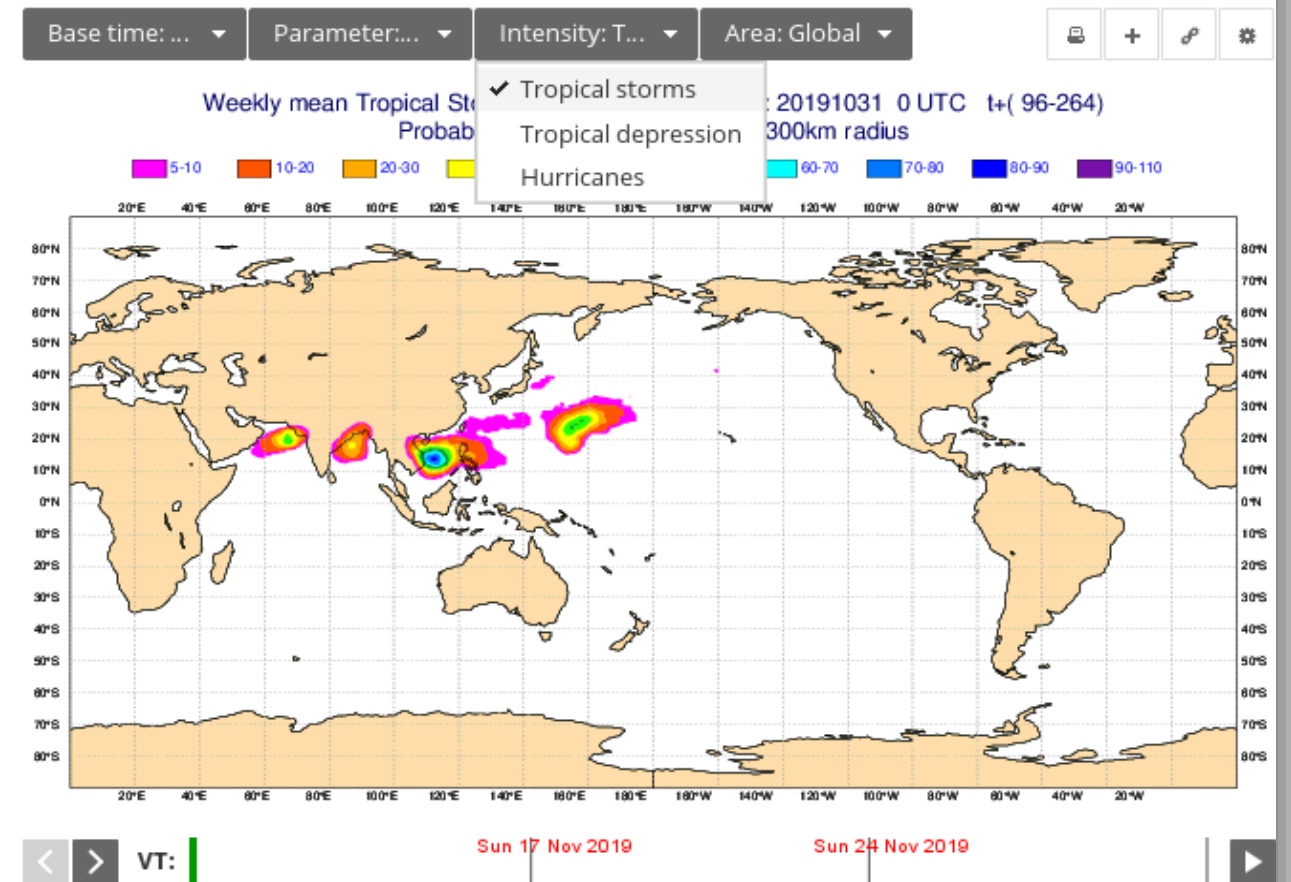


# Maiden-Julian Oscillation forecast

and much much more....



# Tropical storm probabilities - Extended range



# Static products

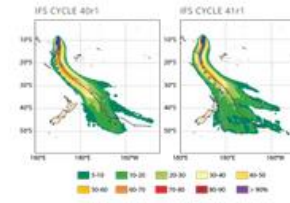
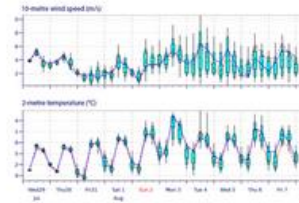
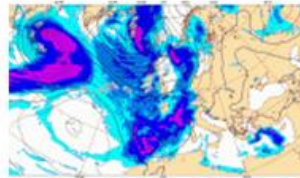
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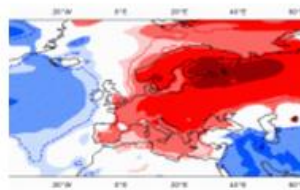
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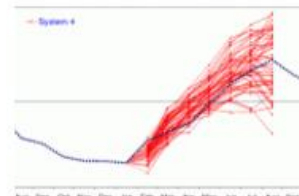


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ENS meteograms for WMO member states



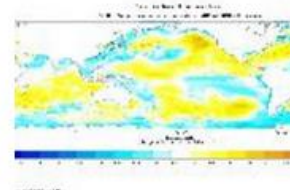
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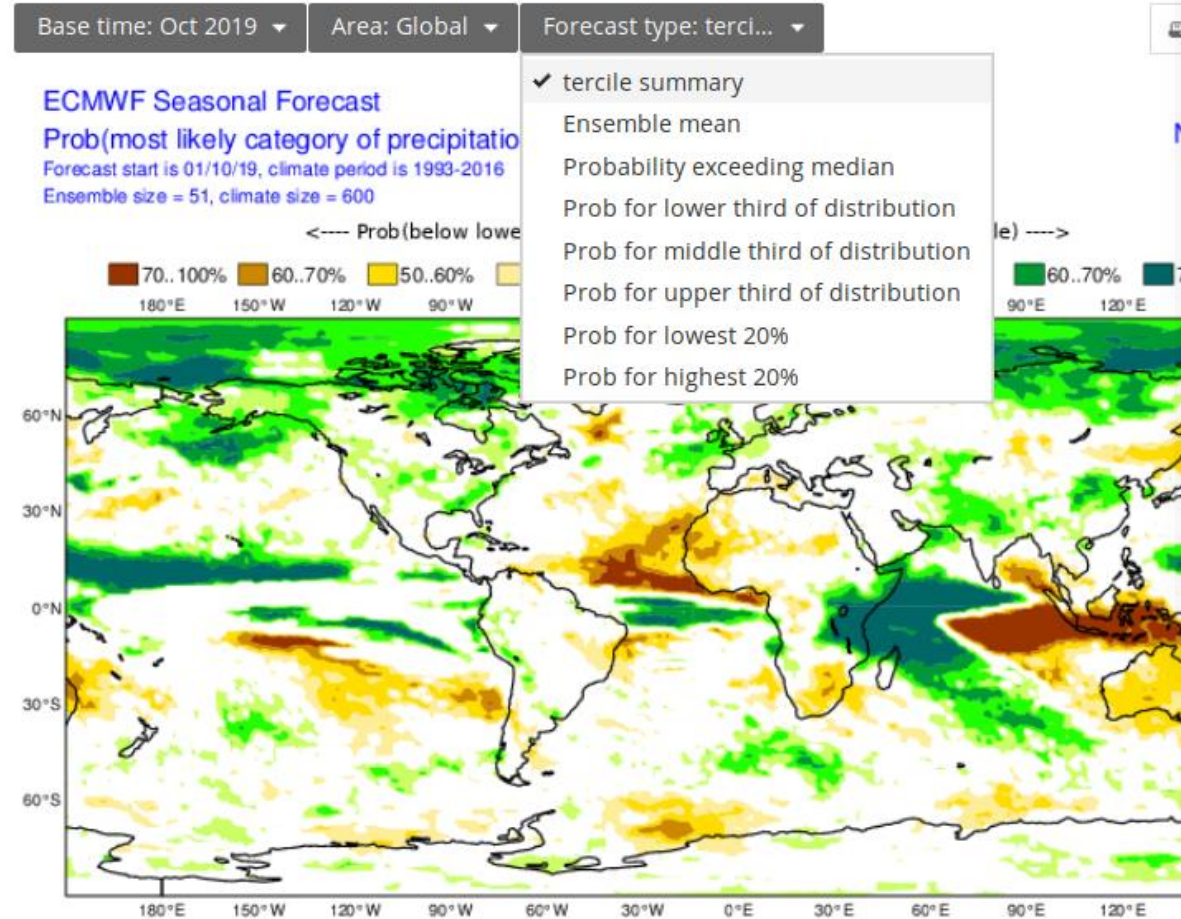
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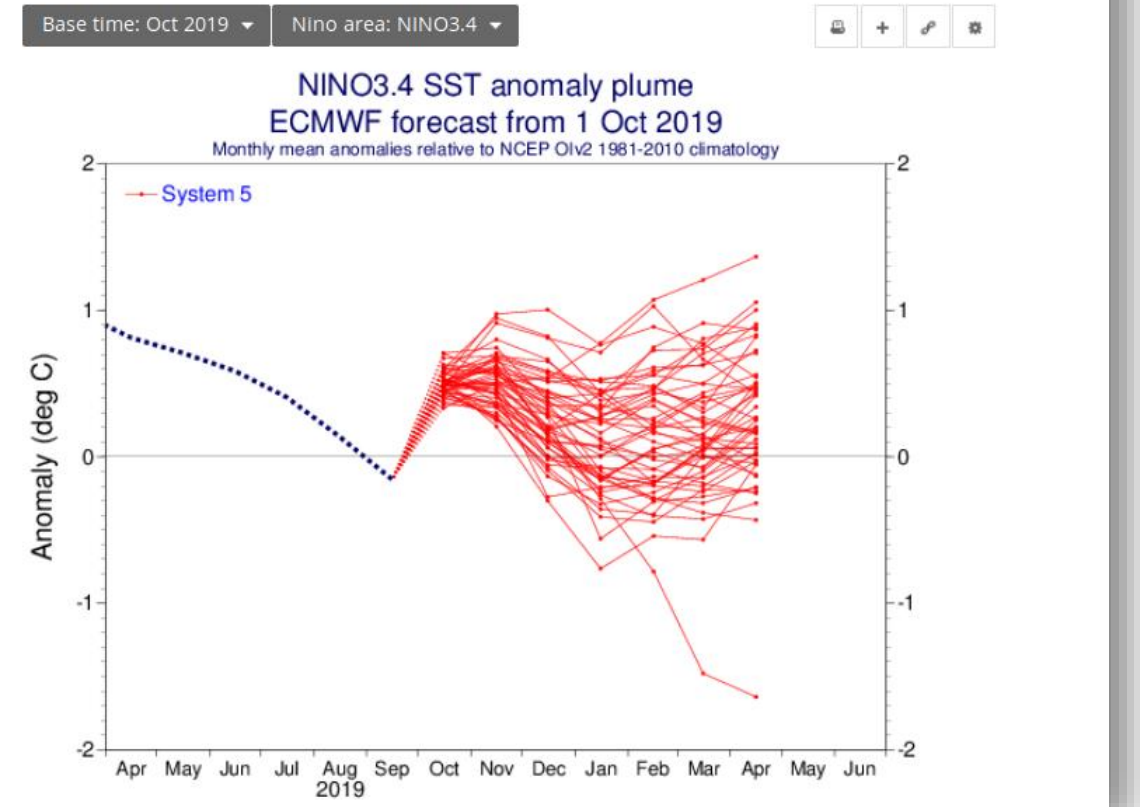


# Seasonal forecast

## Precipitation - SEAS5

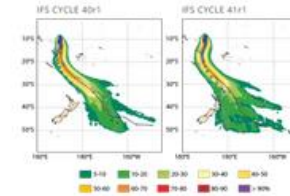
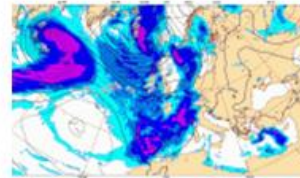


## Nino plumes (Public charts) - Long range forecast



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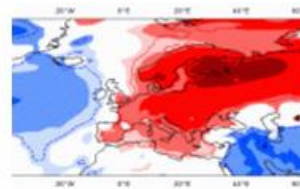
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Up to 10/15 days ahead

[Overview](#)

[Forecast charts](#) 🔒

[Verification](#)



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Up to 32 days ahead

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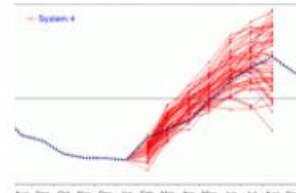
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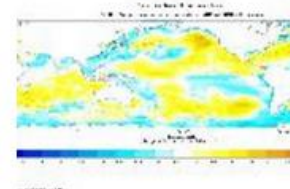
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[Tropical cyclone activity](#) 🔒

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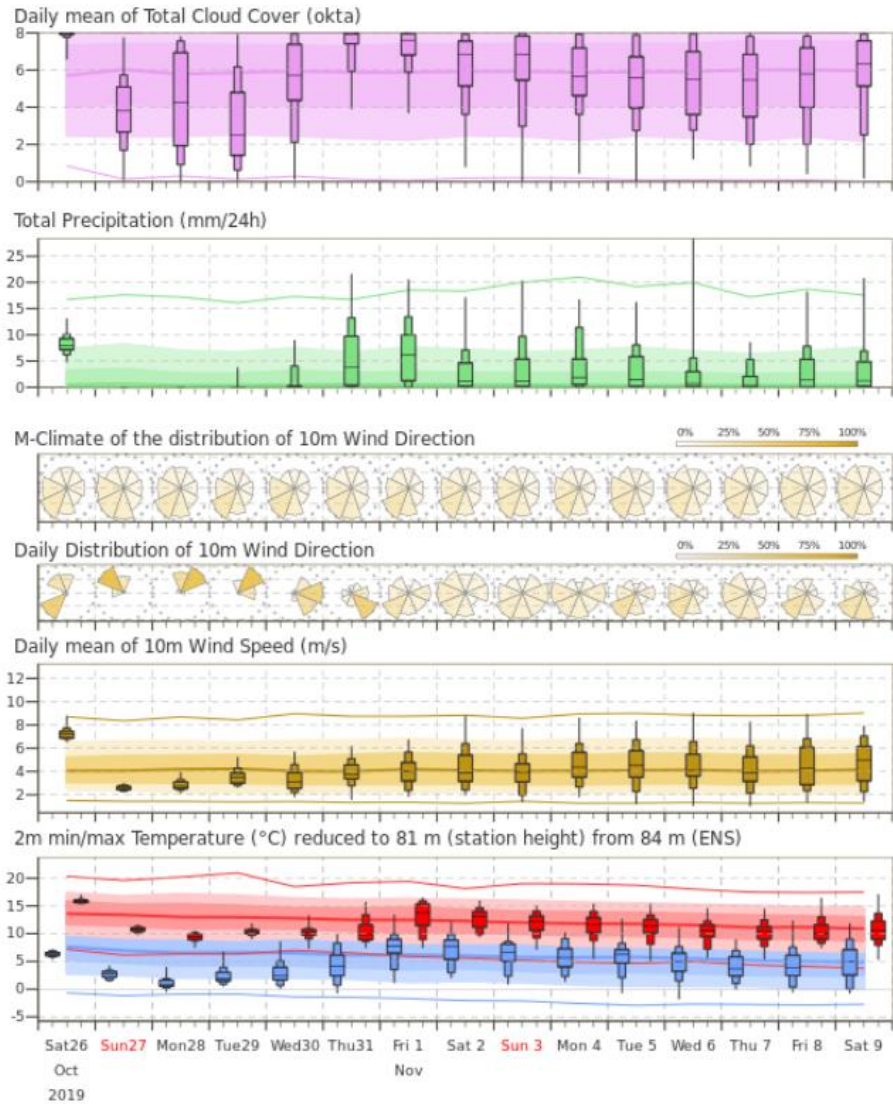
# WMO countries

# www.ecmwf.int

# Meteograms

## ENS Meteogram

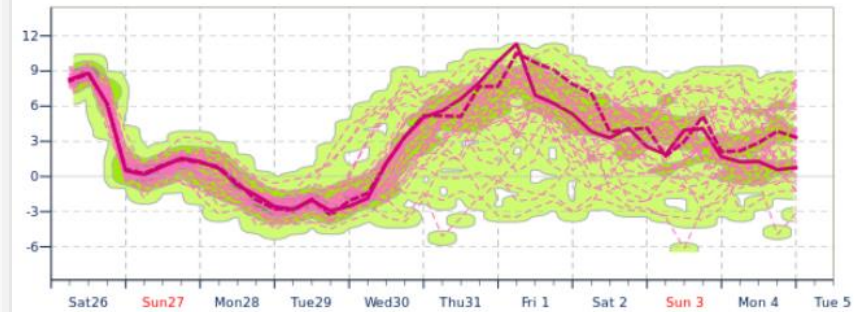
Reading, United Kingdom 51.52°N 0.97°W (ENS land point) 81 m  
 Extended Range Forecast based on ENS distribution Saturday 26 October 2019 00 UTC



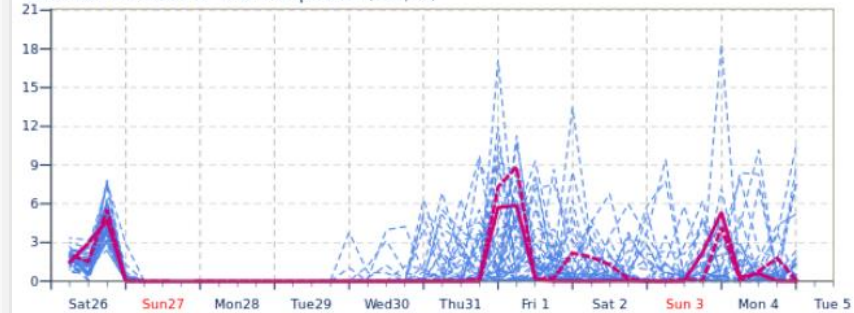
Reading, United Kingdom 51.52°N 0.97°W (ENS land point) 81 m  
 High Resolution Forecast and ENS Distribution  
 Saturday 26 October 2019 00 UTC



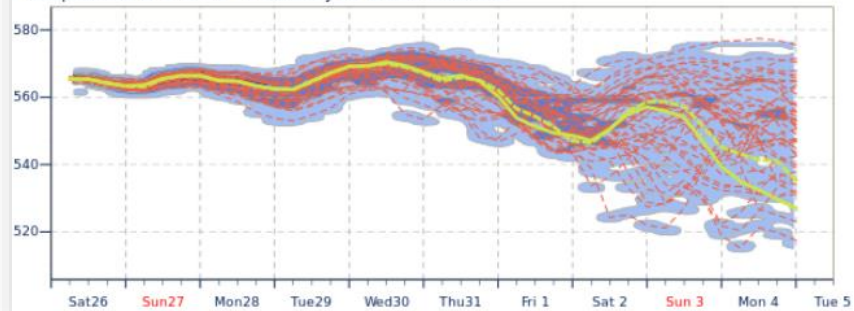
Temperature at 850 hPa - Probability for 1°C intervals



Ensemble members of Total Precipitation (mm/6h)



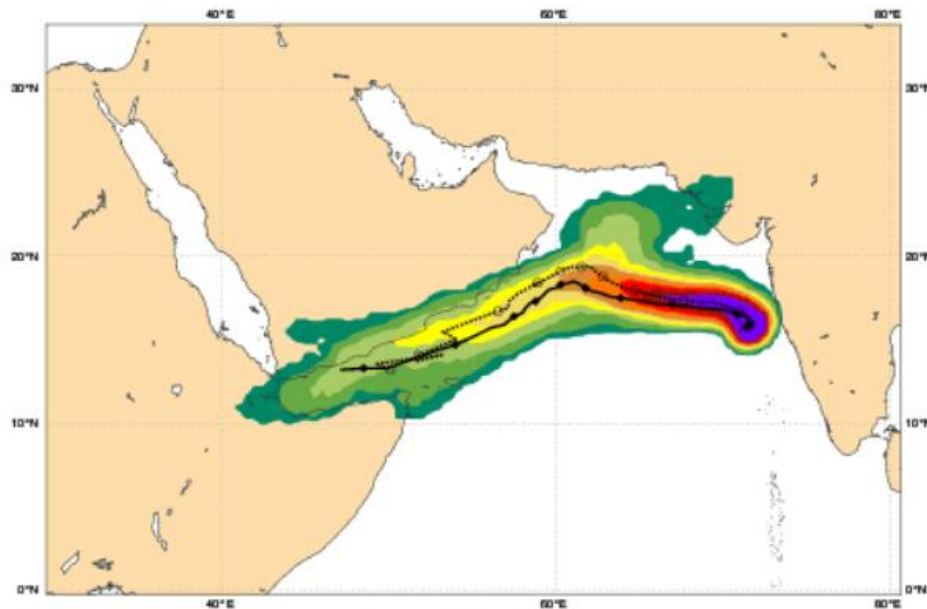
Geopotential at 500 hPa -- Probability for 2.5dam intervals



# Tropical cyclones

Date 20191025 00 UTC @ECMWF  
 Probability that **04A** will pass within 120 km radius during the next 240 hours  
 tracks: **solid**=HRES; **dot**=Ens Mean [reported minimum central pressure (hPa) **996** ]

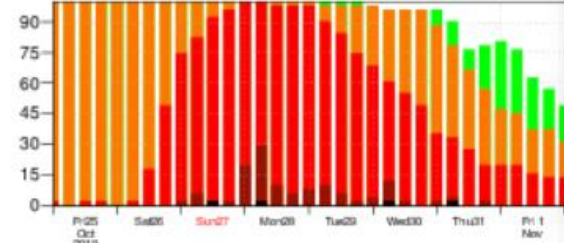
5-10 10-20 20-30 30-40 40-50 50-60 60-70 70-80 80-90 > 90%



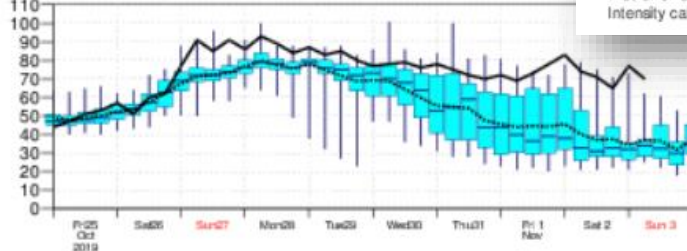
List of ensemble members numbers forecast Tropical Cyclone  
 Intensity category in colours: **TD**[up to 33] **TS**[34-63] **HR1**[64-82] **HR2**[83-95] **HR3**[> 95 kt]

+024 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+048 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+072 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+096 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+120 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+144 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+168 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+192 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+216 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+240 h	hr	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

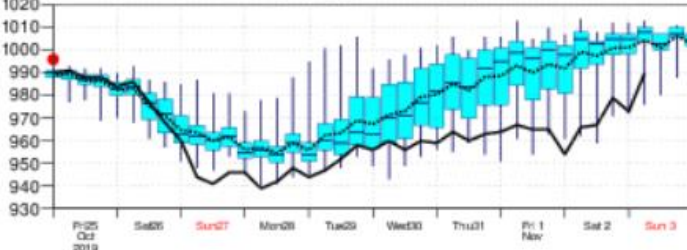
Probability (%) of Tropical Cyclone Intensity falling in each  
**TD**[up to 33] **TS** [34-63] **HR1**[64-82] **HR2** [83-95] **HR3** [ > 95 kt]



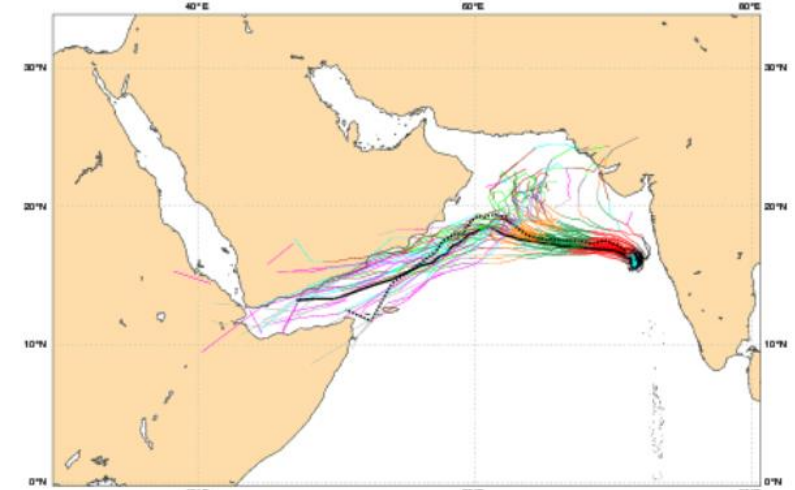
10m Wind Speed (kt) **solid**=HRES; **dot**=Ens Mean



Mean Sea Level Pressure in Tropical Cyclone Centre (hPa) **solid**=HRES; **dot**=Ens Mean



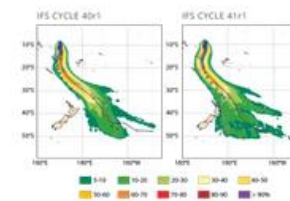
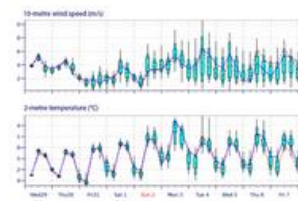
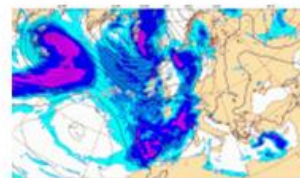
Date 20191025 00 UTC @ECMWF  
 Individual trajectories for **04A** during the next 240 hours  
 tracks: **thick solid**=HRES; **thick dot**=CTRL; **thin solid**=EPS members [coloured]  
**0-24h** **24-48h** **48-72h** **72-96h** **96-120h** **120-144h** **144-168h** **168-192h** **192-216h** **216-240h**



List of ensemble members numbers forecast Tropical Cyclone  
 Intensity category in colours: **TD**[up to 33] **TS**[34-63] **HR1**[64-82] **HR2**[83-95] **HR3**[> 95 kt]

### Here you will find forecasts and associated verification

Our Integrated Forecasting System (IFS) provides forecasts for multiple time ranges. Our range of forecast products present key aspects of the forecast evolution and the associated uncertainty to address different user requirements.



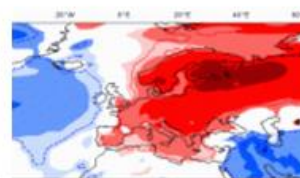
#### Medium range

Up to 10/15 days ahead

[Overview](#)

[Forecast charts](#) 🔒

[Verification](#)



#### Extended range

Up to 32 days ahead

[Overview](#)

[Forecast charts](#) 🔒

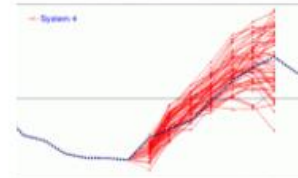
[Verification](#)

#### Meteograms

Up to 10/15 days ahead

[ENS meteograms](#) 🔒

[ENS meteograms for WMO member states](#) 🔒



#### Long range

Up to 13 months ahead

[Overview](#)

[Forecast charts](#) 🔒

[Verification](#)

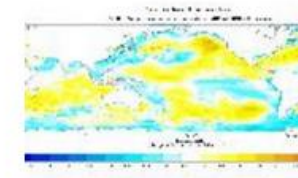
#### Tropical Cyclones

Up to 10/15 days ahead

[Latest tropical cyclones](#)

[Tropical cyclone activity](#) 🔒

[Extra-tropical cyclones](#) 🔒



#### Additional charts

[Ocean Reanalysis](#)

[Archived EUROSIP Multi-model system](#) 🔒

### Quick links

- [ecCharts](#) 🔒
- [ecCharts 2 beta\\*](#) 🔒
- [Chart Dashboard](#) 🔒

\*We are currently testing the next version of ecCharts. Try it and [let us have your feedback!](#)

### See also

- [Monitoring of the observing system](#)

### Information and updates

- [Forecasting Issues](#)
- [Product News](#)
- [Model Changes](#)
- [Past Severe Events](#)

### Guides

- [Forecast User Guide](#)
- [Guide to Dashboard](#)

# Static products

# available for

# WMO countries

# www.ecmwf.int

# Forecast performance in focus: VERIFICATION PLOTS

## Forecast performance: headline scores

### 2 primary scores

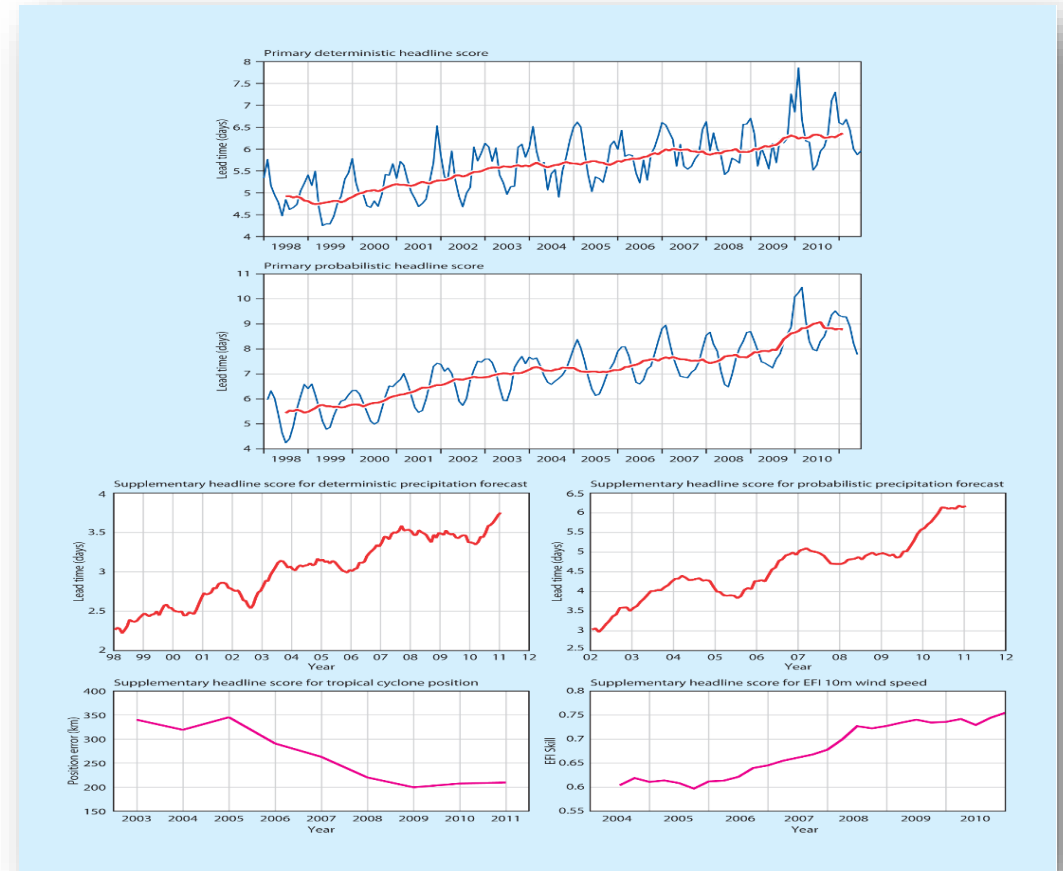
- HRES upper-air skill
- ENS upper-air skill

### 6 supplementary scores

- Precipitation
  - HRES skill
  - ENS skill
- Percentage of large temperature errors
- Weekly mean 2m temperature (terciles)

### Severe weather

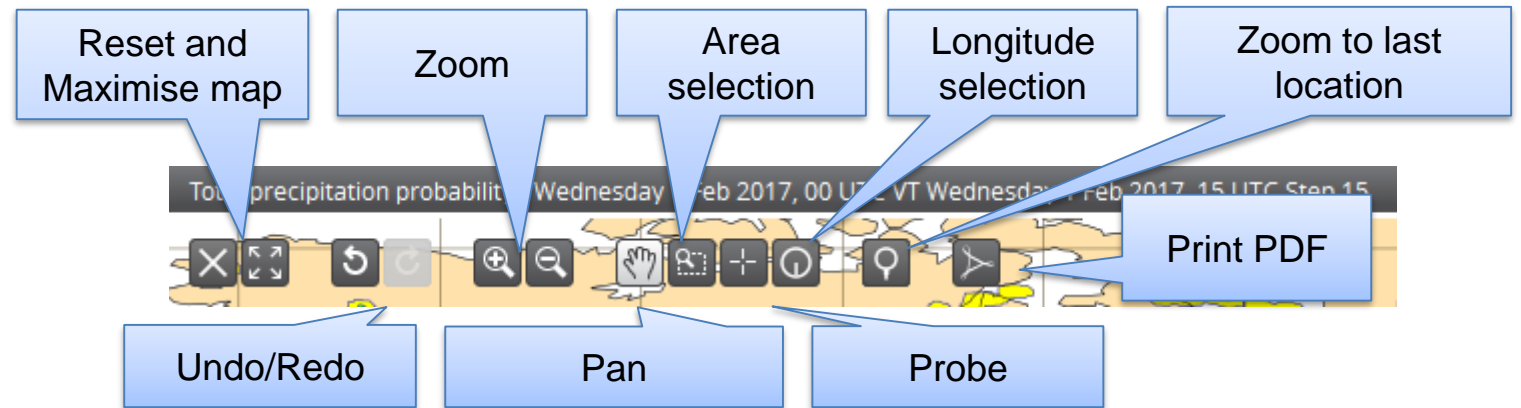
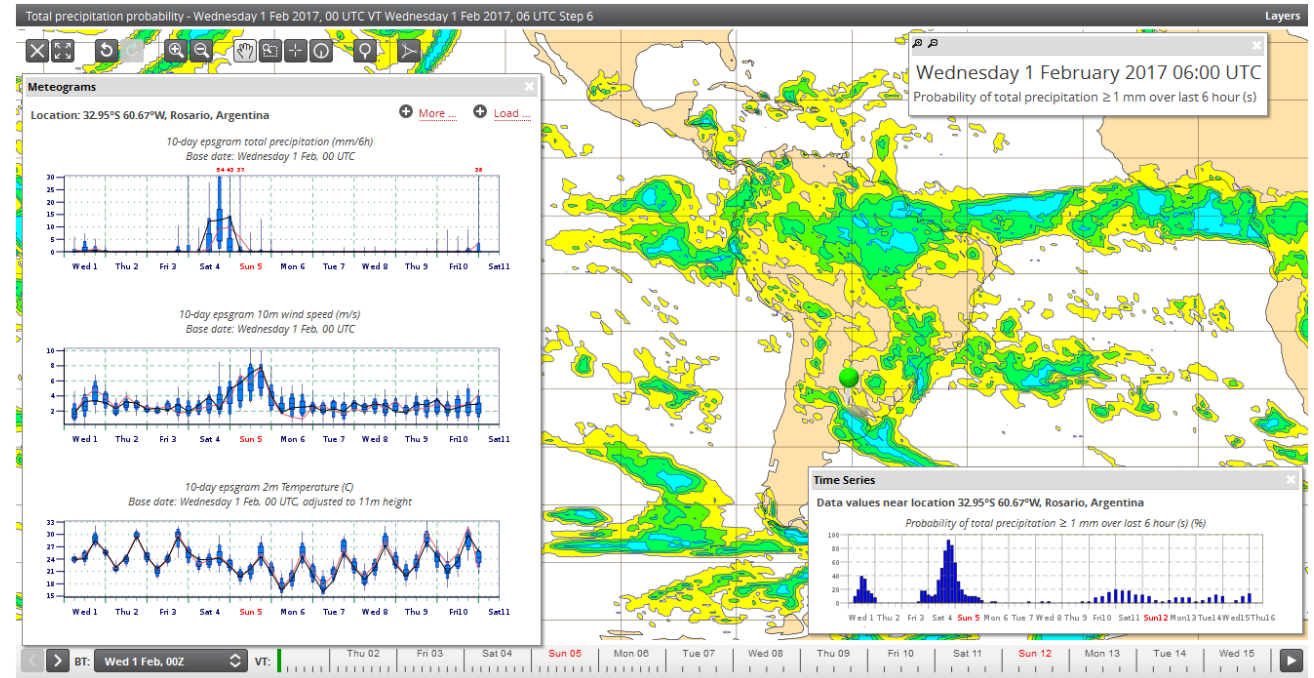
- Tropical cyclone track position error
- EFI skill 10m wind



# ecCharts

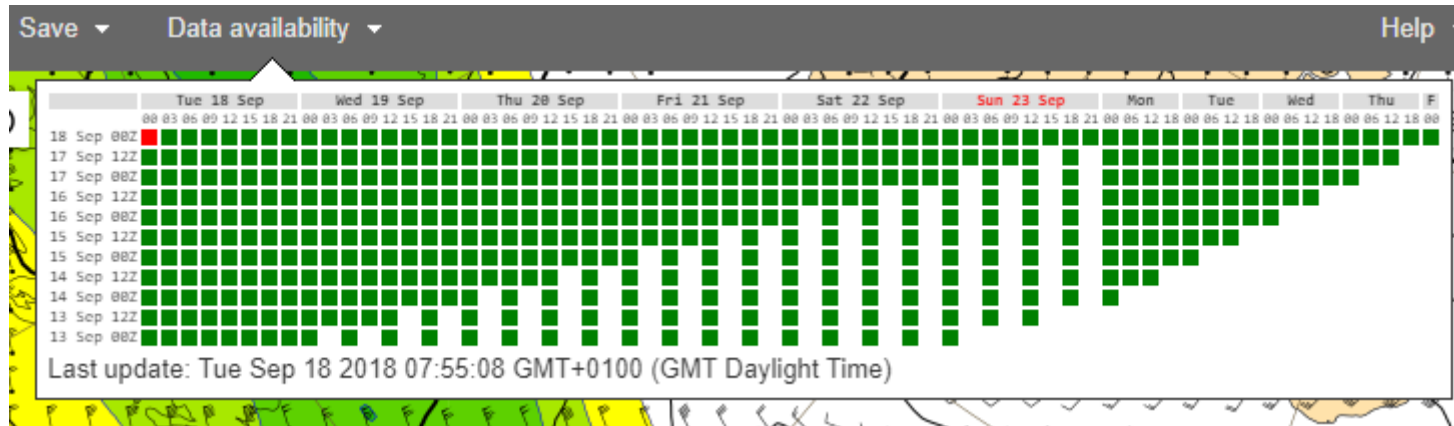
# ecCharts forecaster

- Interactive tool (zoom, pan ...)
- Global fields
- Clickable maps to obtain extra information
  - Meteograms
  - Vertical profiles
- You may overlay more than 230 parameters from HRES and ENS
- Projection and time controls
- You create your own products





# Data Availability on ecCharts



- As soon as it is made available by our operational production
- On-demand plots as the data become available

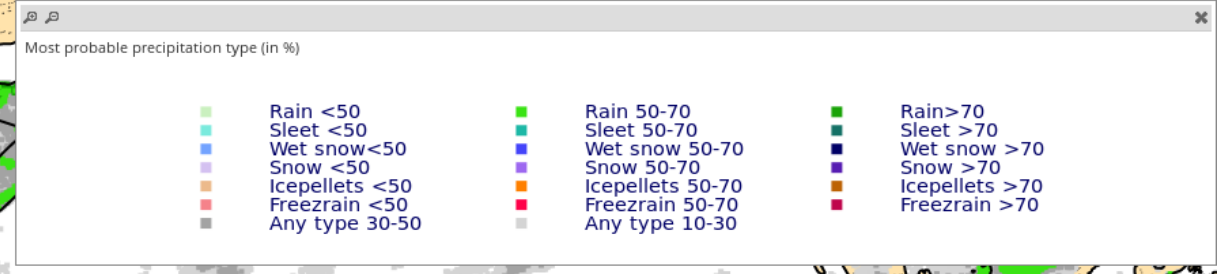
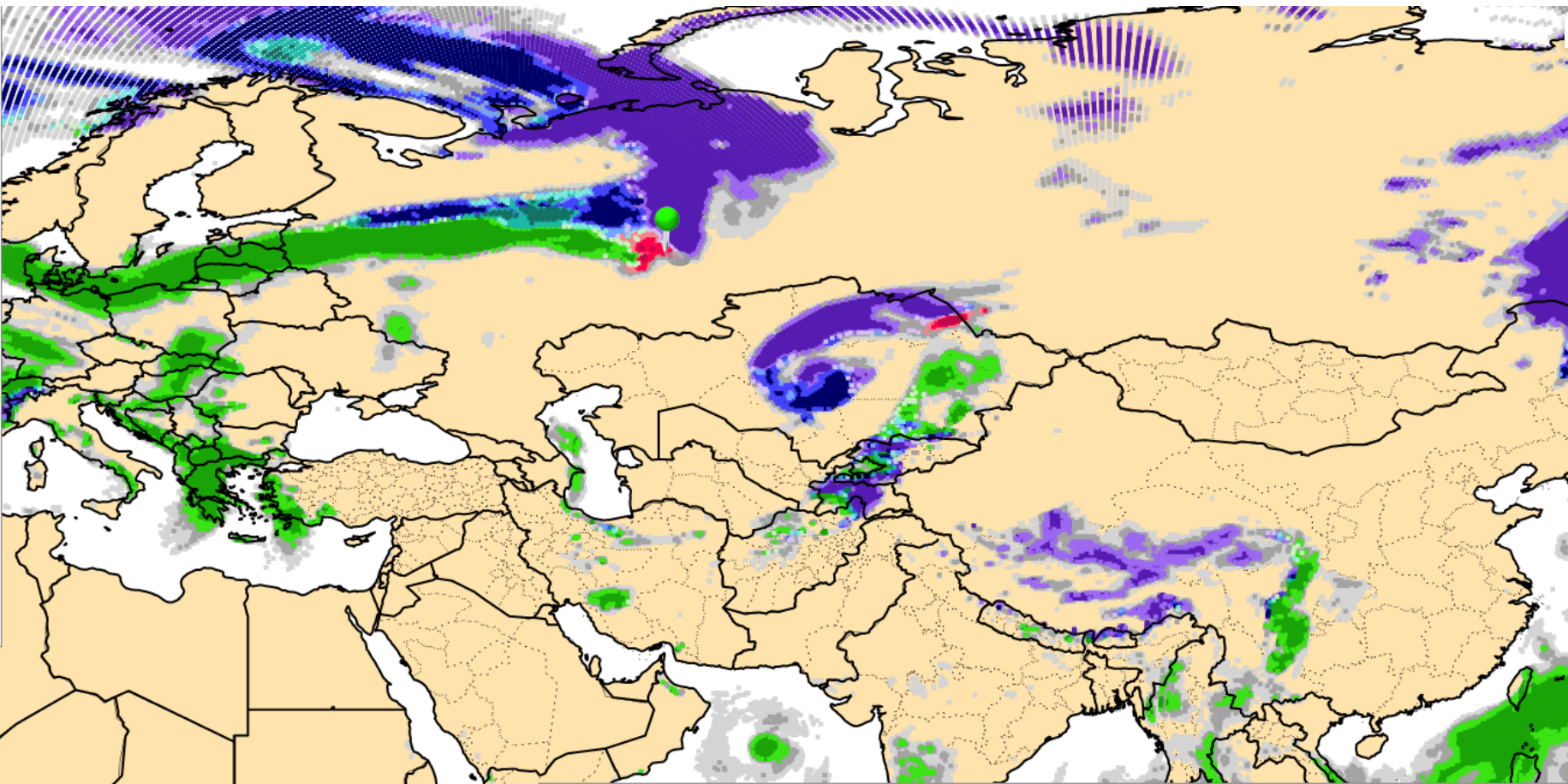
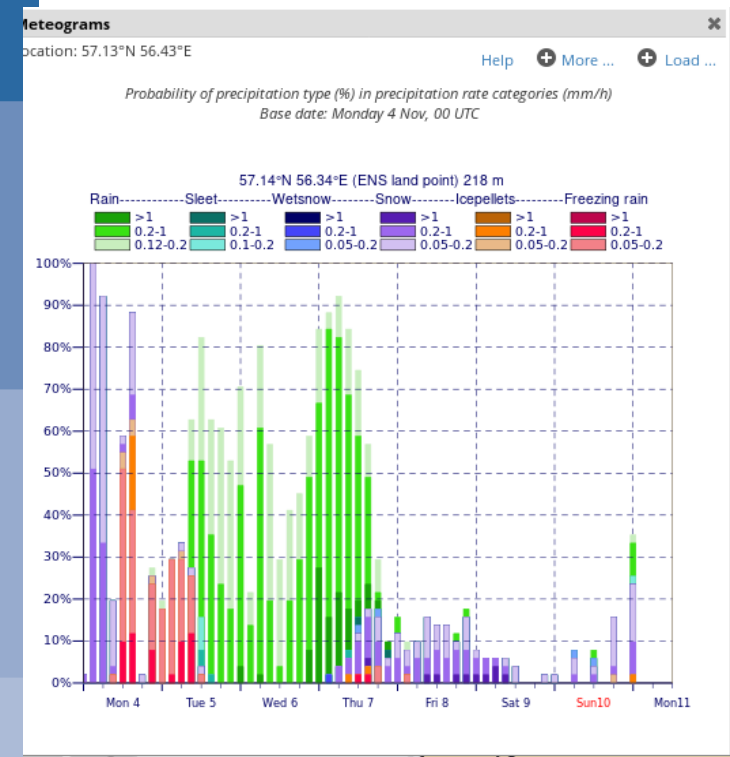


# ecCharts Basic Concepts

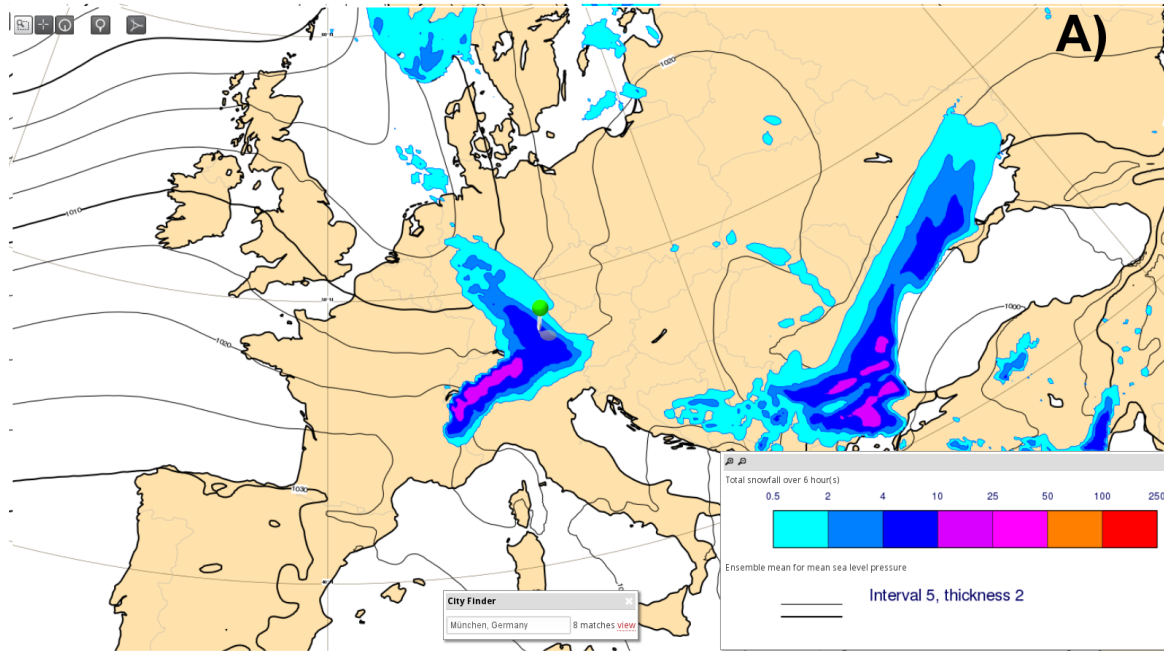
The screenshot displays the ecCharts web interface in a Mozilla Firefox browser. The browser address bar shows 'apps.ecmwf.int/forecaster/'. The interface includes a navigation menu with 'Products', 'Projections', 'Views', 'Save', 'Data availability', and 'Help'. A 'Projections' dropdown menu is open, showing options: 'North atlantic', 'Europe (cyclindrical)', 'Around brazil', 'Global', 'South hemisphere', and 'North hemisphere'. The main map area shows a weather forecast for '2 metre temperature - Saturday 3 Oct 20...' with a color-coded temperature field and contour lines. A 'Layers' panel on the right lists several layers: '500 hPa geopotential', 'Foreground', '2m temperature', 'Grid', and 'Background'. The '500 hPa geopotential' layer is selected, and its style is shown as 'Contour (interval 5, thickness 2)'. The '2m temperature' layer is also visible with a 'Contour shade (Range: -48 / 56)' style. Annotations with blue arrows point to these elements: 'Projection' points to the map area, 'Product (Combination of different layers)' points to the main map, 'Layer (500 hPa Z)' points to the selected layer in the panel, and 'Style for the selected layer' points to the contour style settings.

Many more products  
in ecCharts!

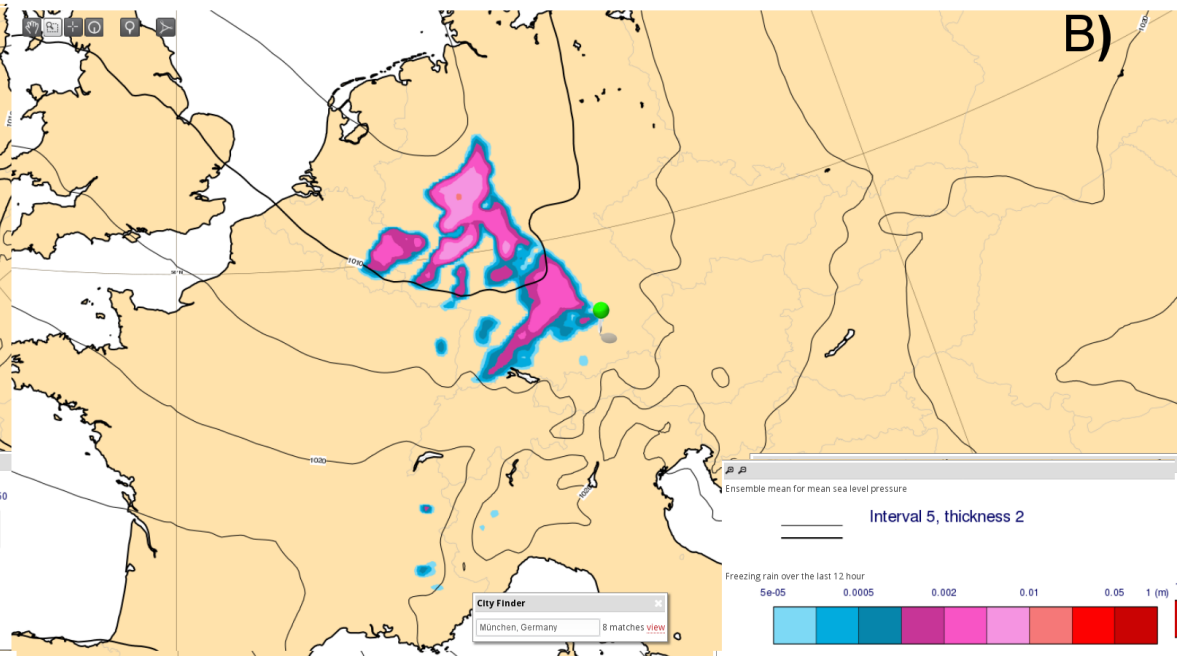
# Precipitation type probabilistic products



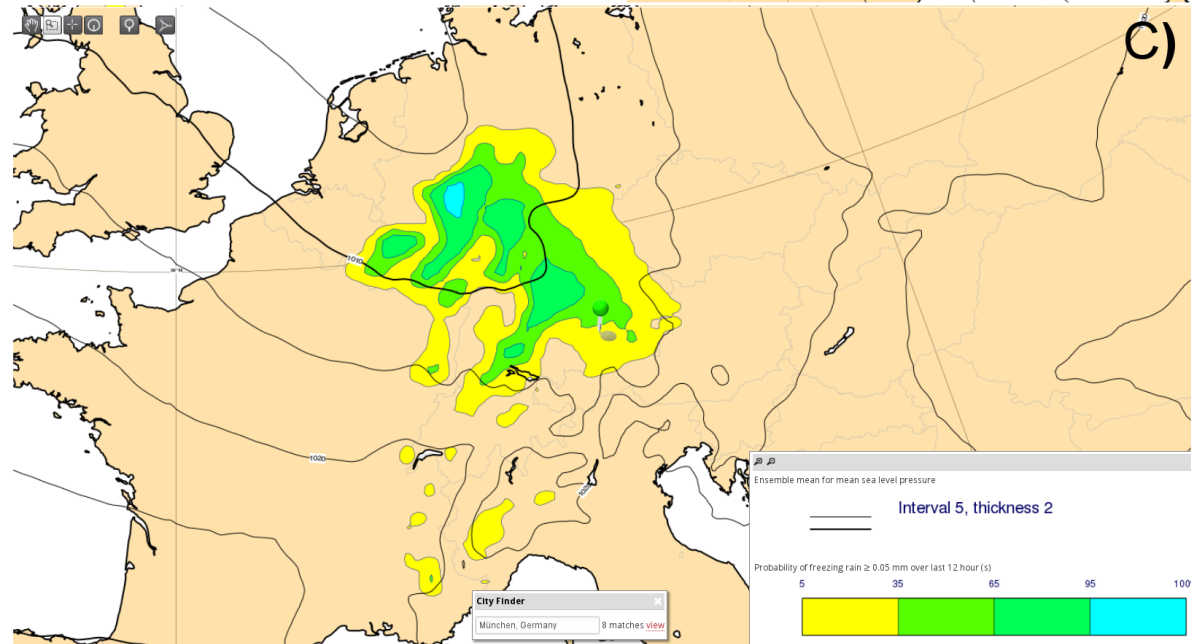
itled - Monday 4 Nov 2019, 00 UTC VT Monday 4 Nov 2019, 12 UTC Step 12



HRES total snowfall over 6 h



HRES freezing rain over 12 h



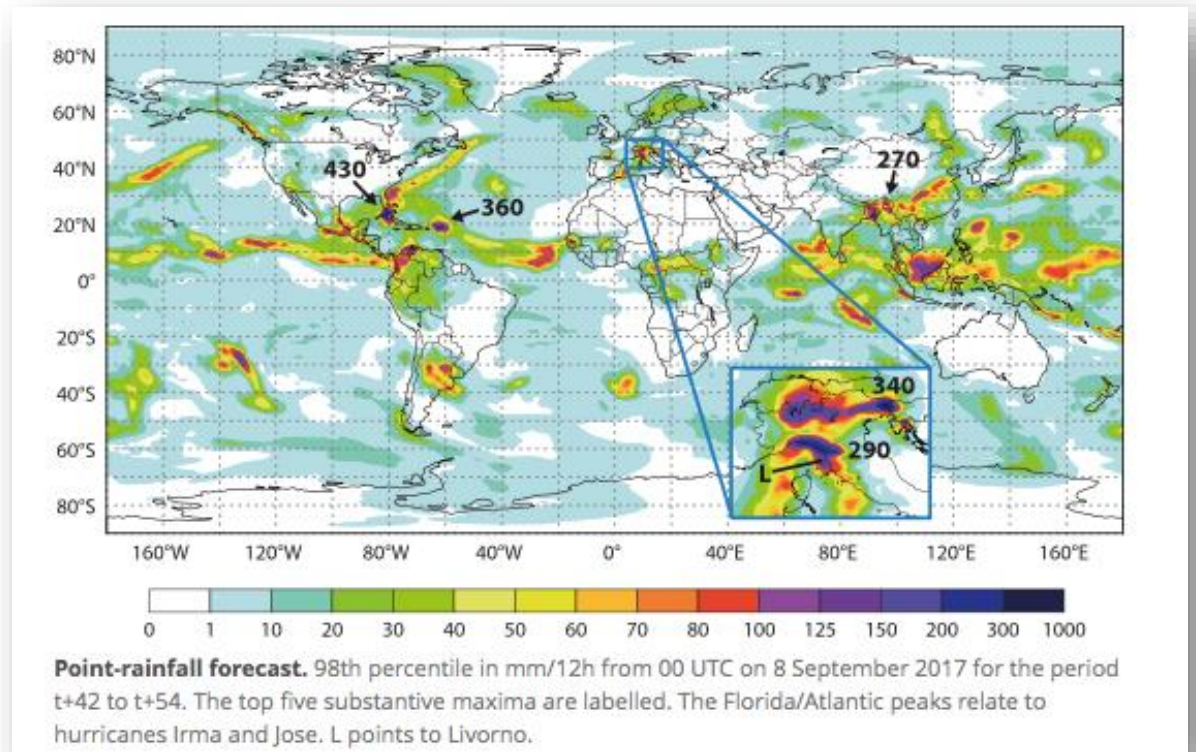
Probability of freezing rain > 0.05 mm over 12 h

**Complementary products**

## New post-processing 12-h Point-Rainfall product (ecpoint)

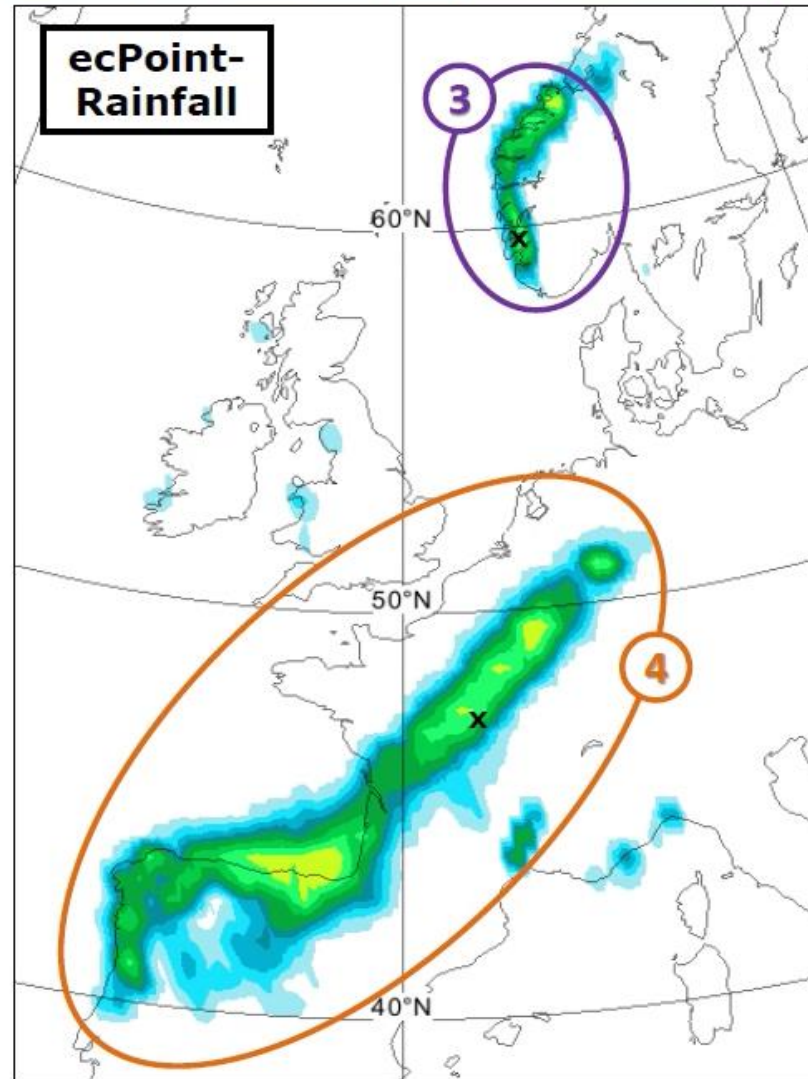
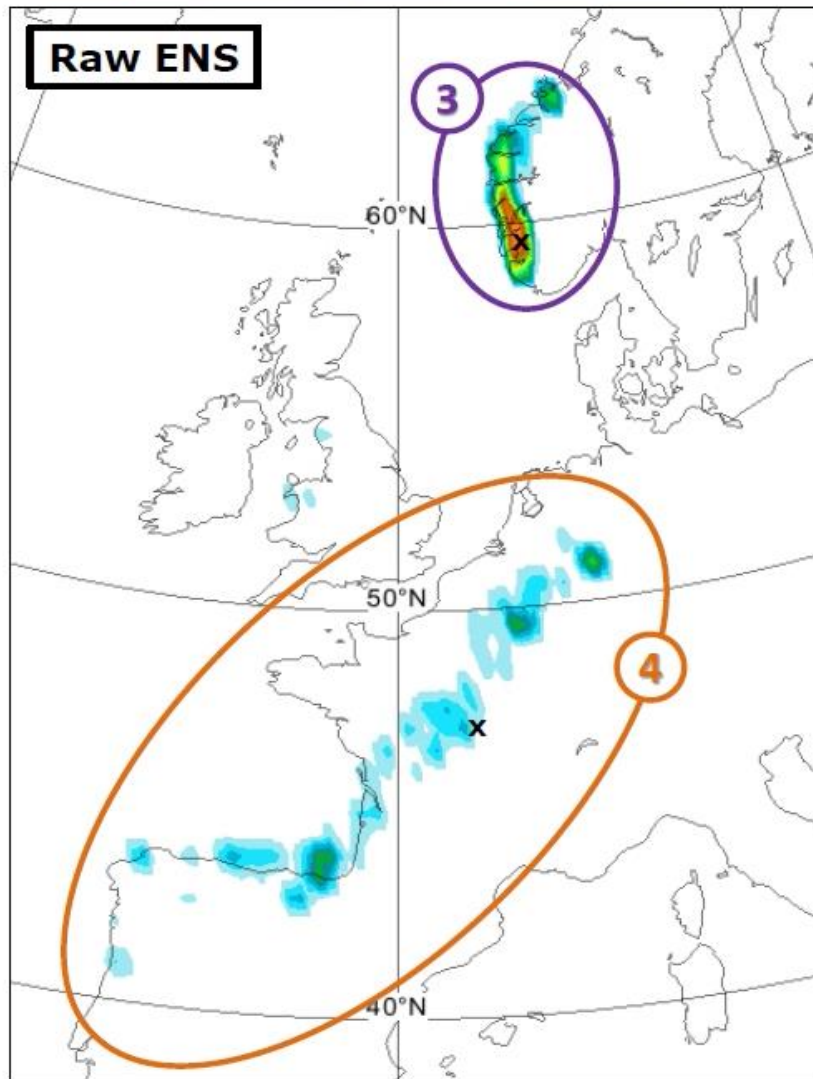
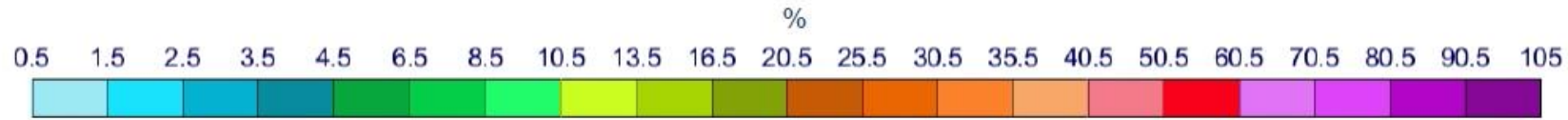
The product aims to bridge the gap between the relatively coarse resolution and higher-resolution limited-area models needed to describe localized heavy rainfall.

Post-processing method blends together information from different locations with similar rainfall generation mechanisms (assumptions: physical mechanisms are universal and dependent on key atmospheric and geographic properties)



<https://www.ecmwf.int/en/newsletter/153/news/new-point-rainfall-forecasts-flash-flood-prediction>

24<sup>th</sup> January 2018, 00UTC (t+30,t+42) – Prob $\geq$ 20 mm/12h



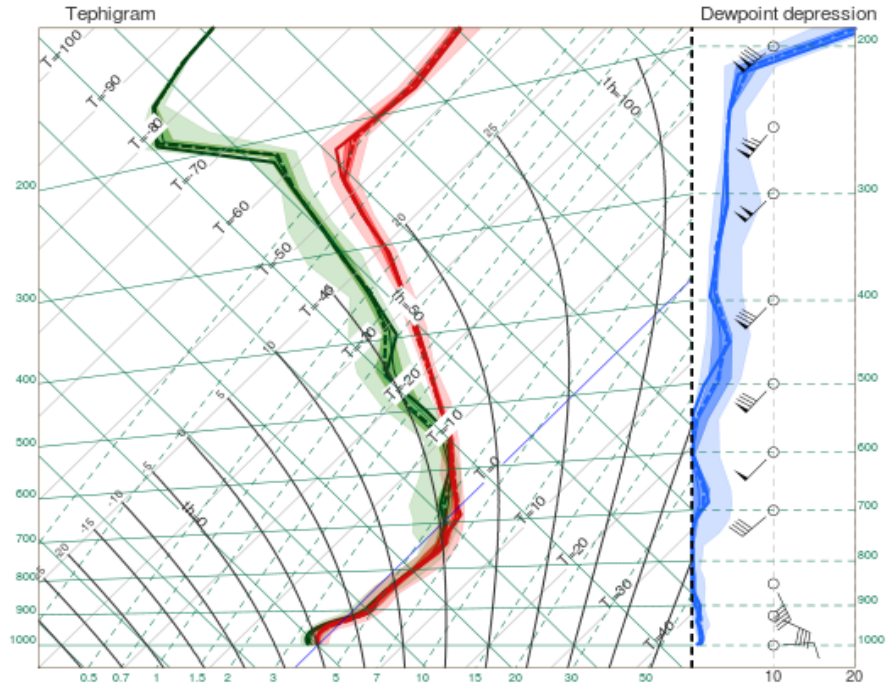
Probability of exceeding 20mm / 12h

### Vertical profiles

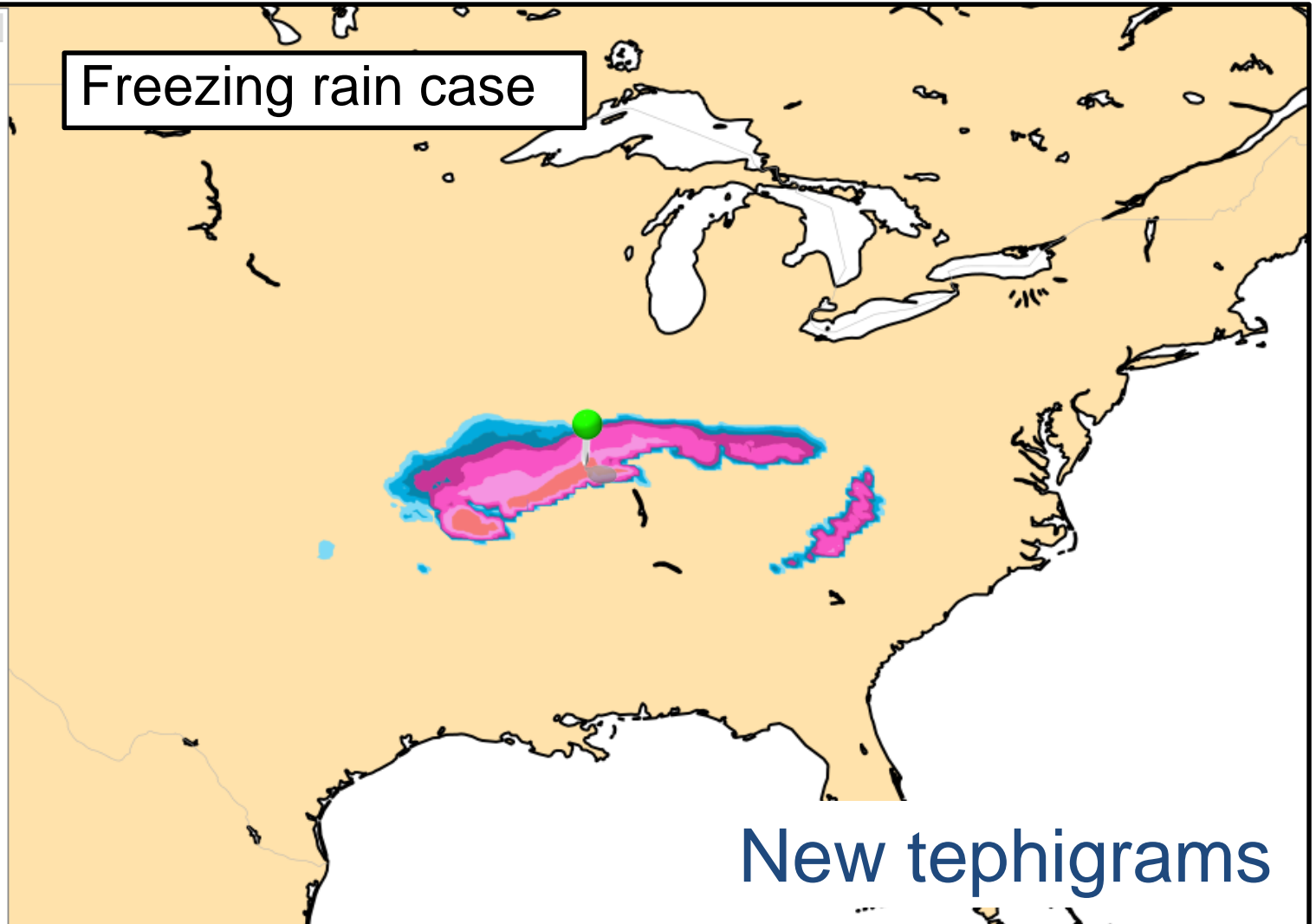
Location: 37.67°N 89.68°W

Vertical profile

Base date: Wednesday 20 Feb, 00 UTC Valid for: Wednesday 20 Feb, 06 UTC

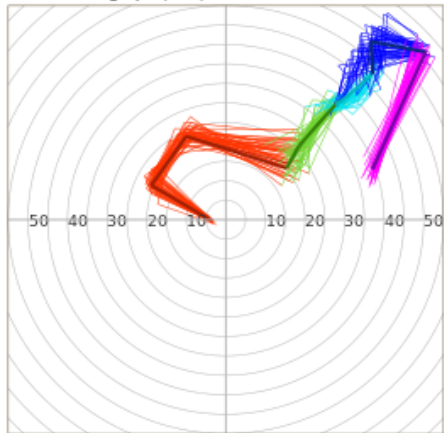


# Freezing rain case

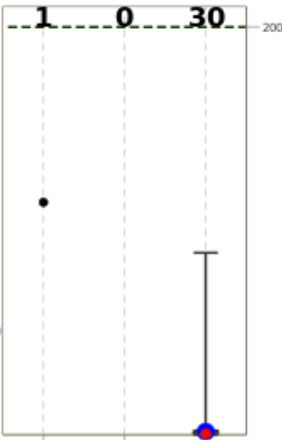


## New tephigrams

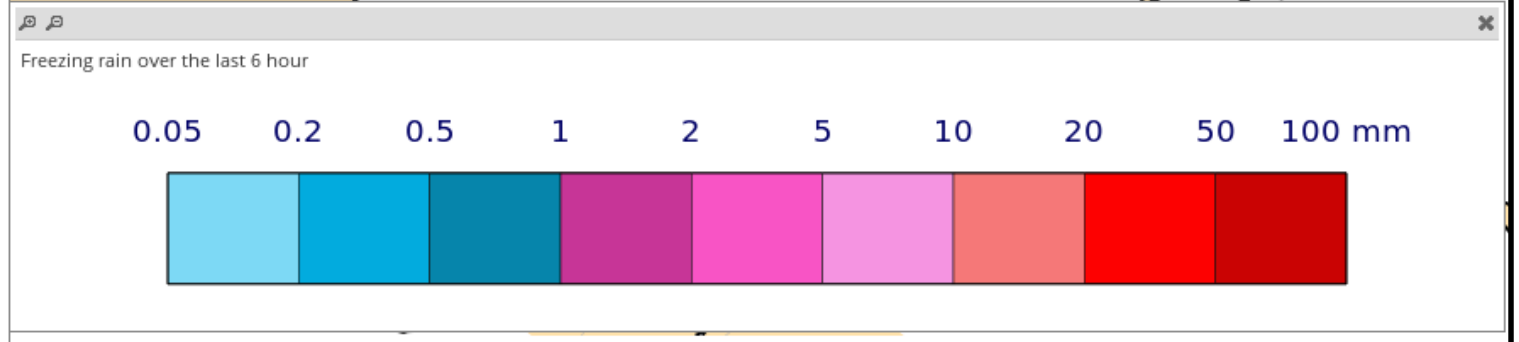
### Wind hodograph (m/s)



CAPE  
● HRES ● Control (CAPE=0: 19)

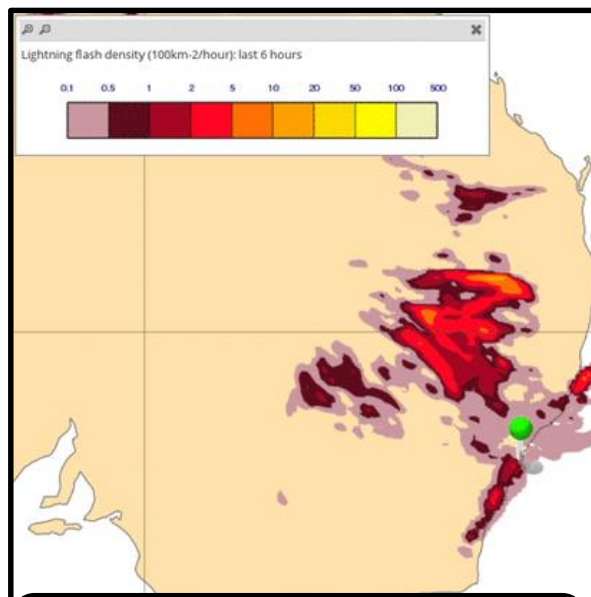


CIN < 50 (50 < CIN < 200) CIN > 200  
J/kg

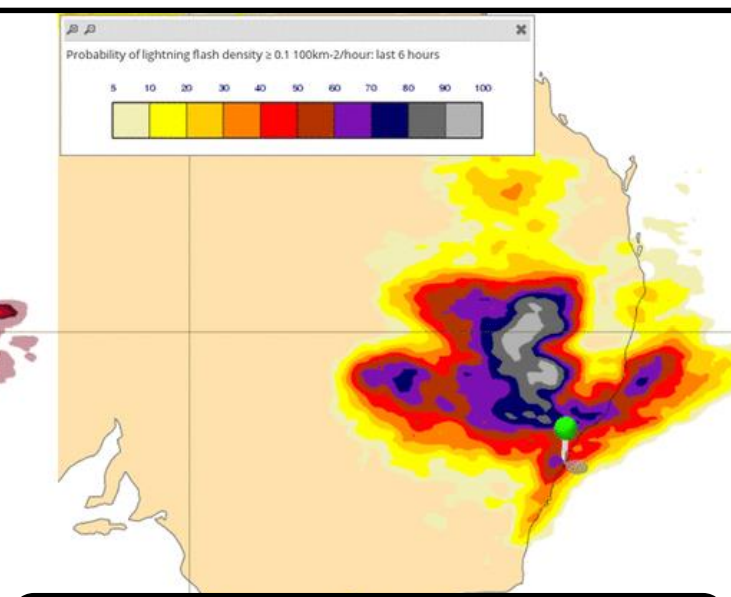




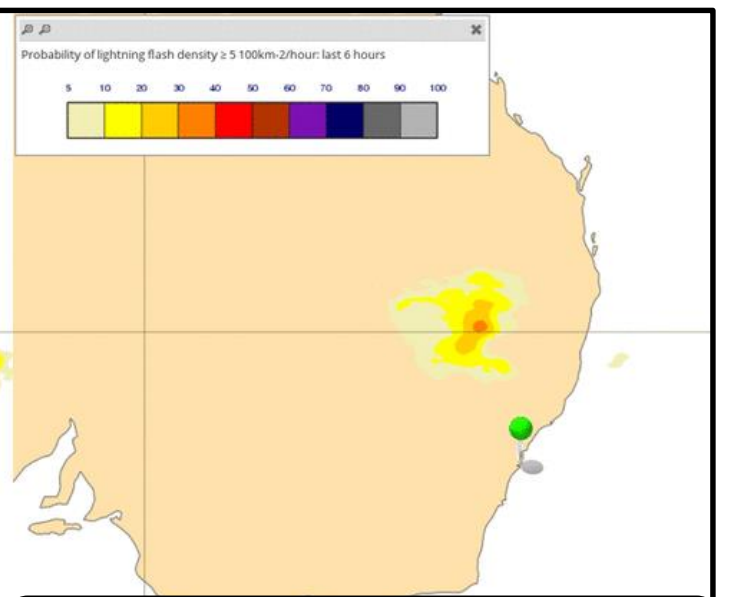
Lead time  
+ 18 h



Lightning flash density  
(100km<sup>2</sup>/h) last 6 h

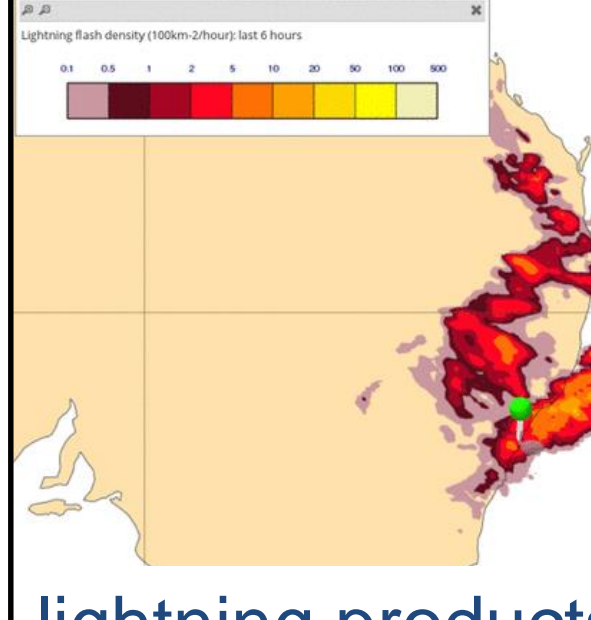


Probability of lightning flash  
density  $>0.1$  100km<sup>2</sup>/h last 6 h

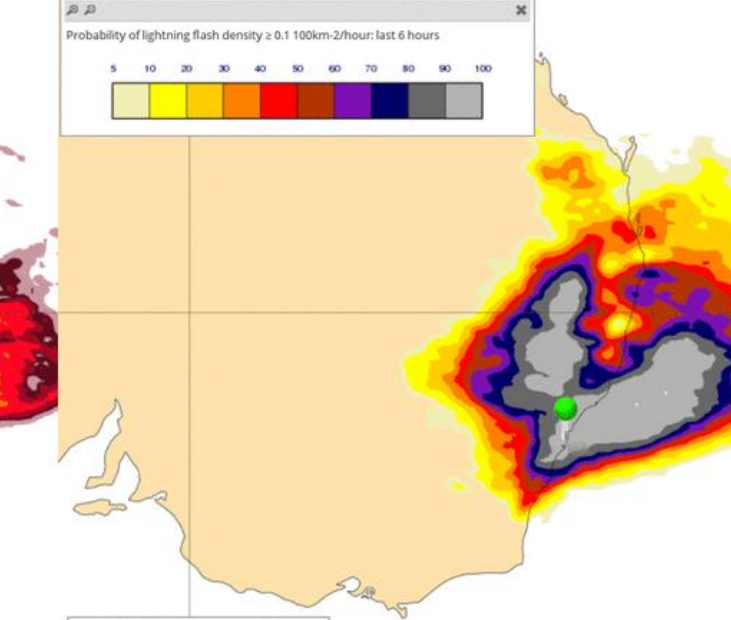


Probability of lightning flash  
density  $>5$  100km<sup>2</sup>/h last 6 h

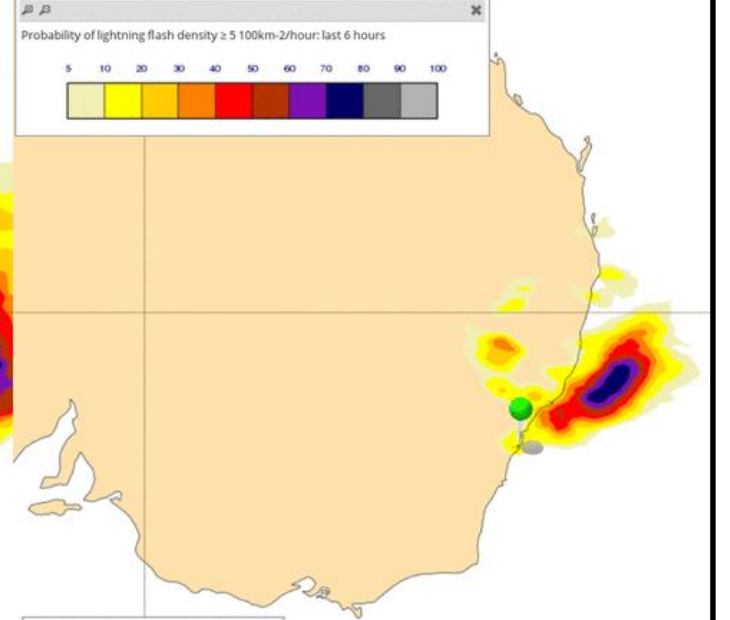
Lead time  
+ 24 h



lightning products

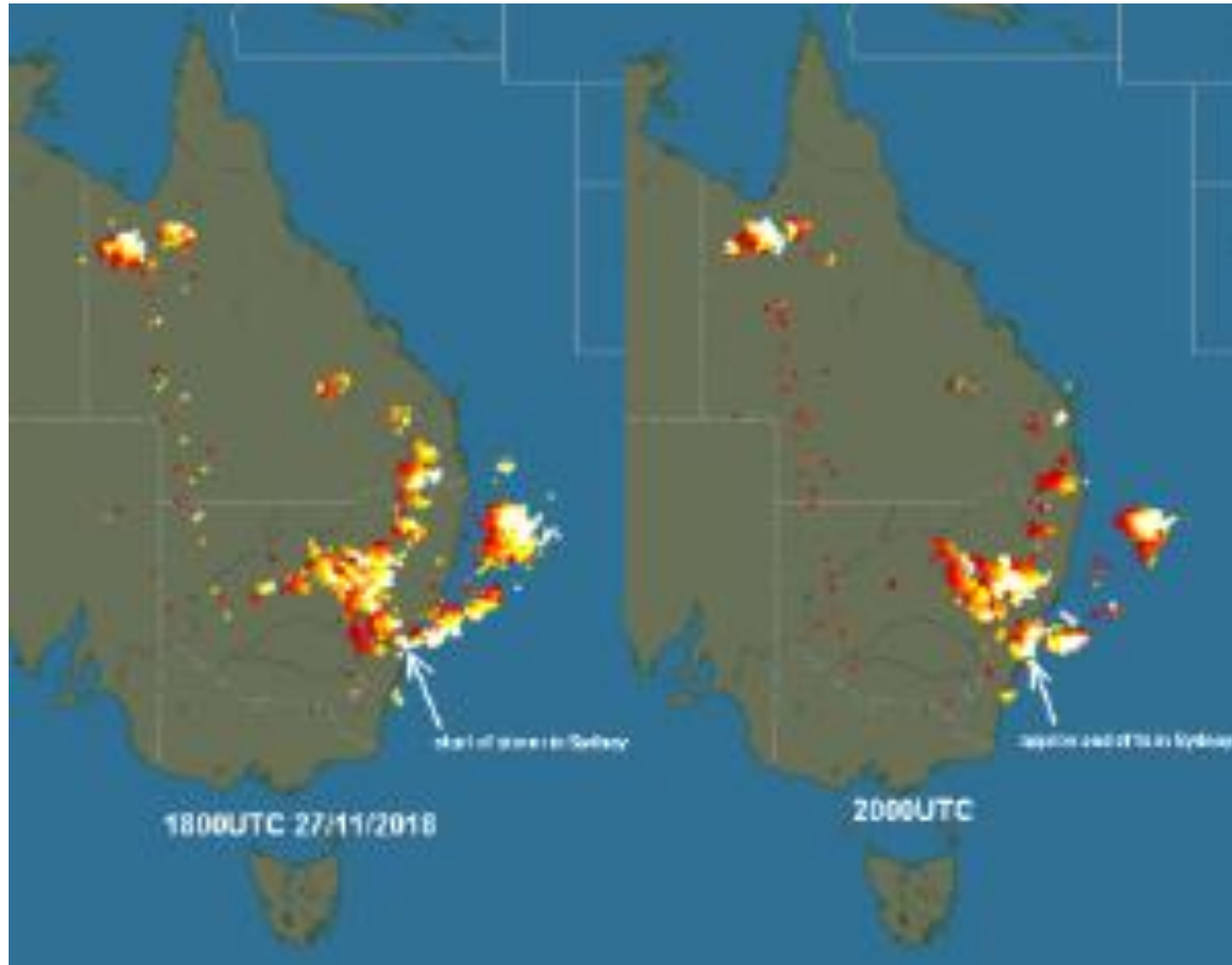


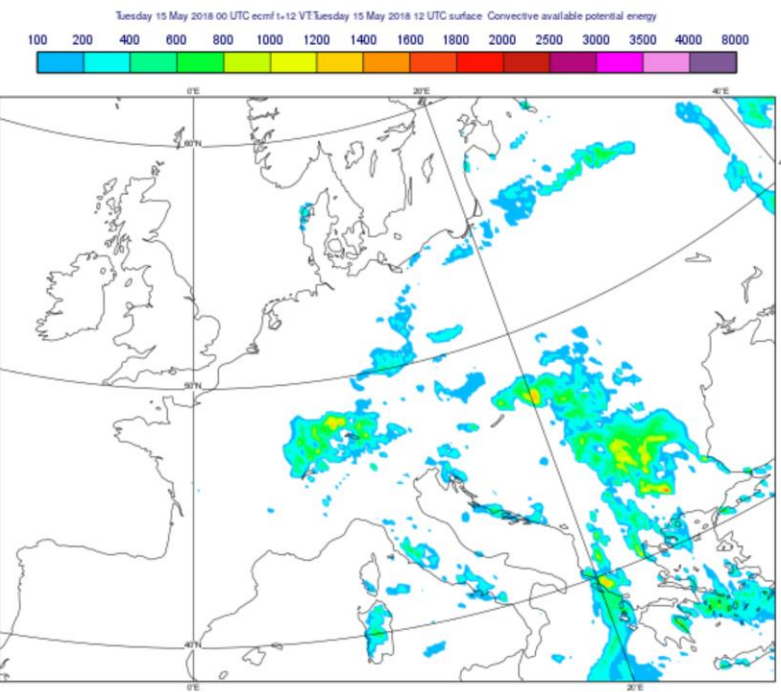
City Finder  
Sydney, Australia 10 matches view



City Finder  
Sydney, Australia 10 matches view

# Lightning observations

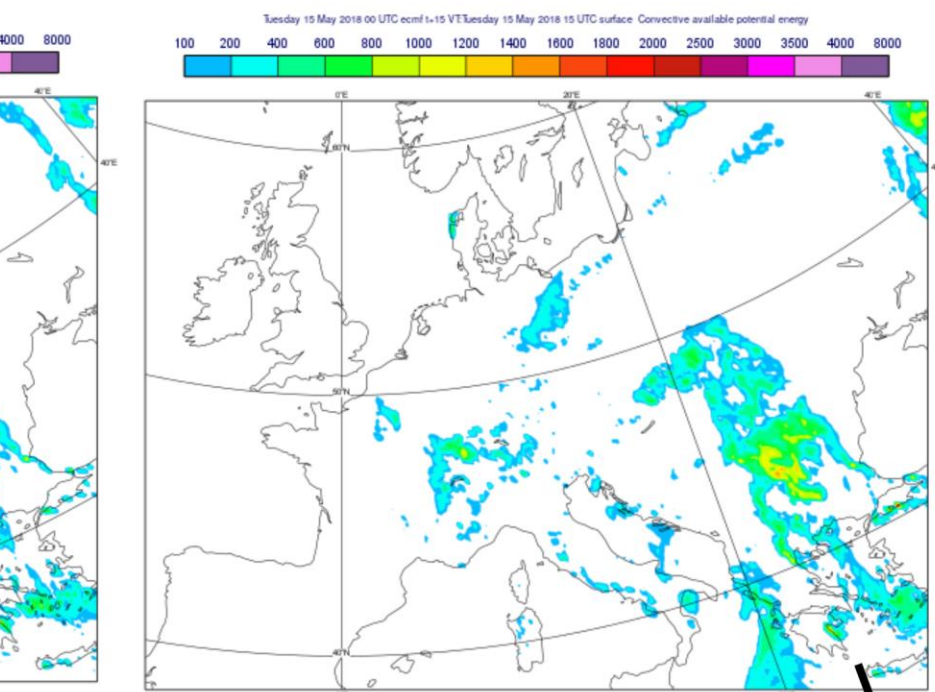




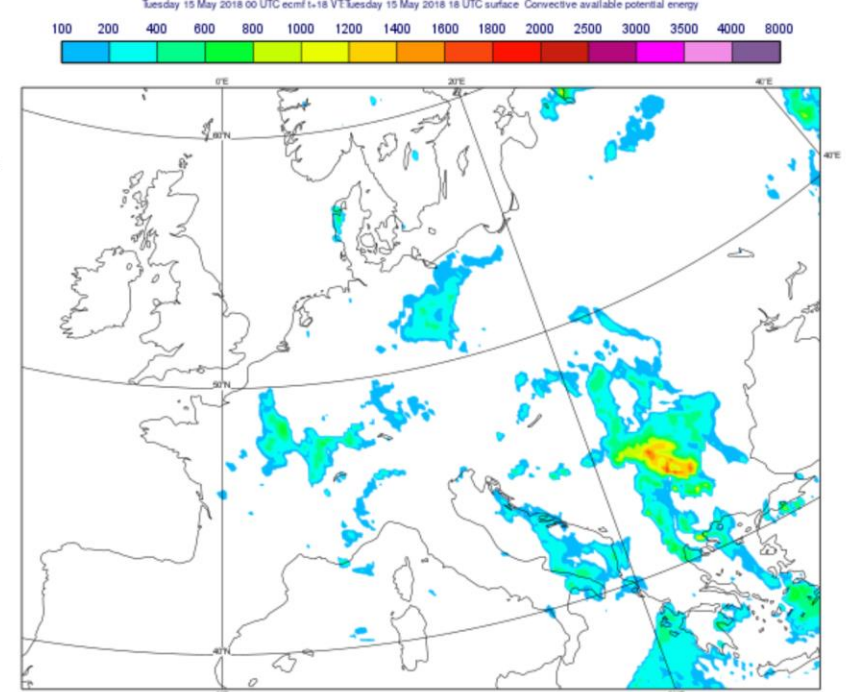
**Instantaneous CAPE**  
Valid on 16/05/2018 **12 UTC**

**Maximum CAPE**

**NEW!**



**Instantaneous CAPE**  
Valid on 16/05/2018 **15 UTC**



**Instantaneous CAPE**  
Valid on 16/05/2018 **18 UTC**

**Maximum CAPE in the last 6h**  
Valid on 16/05/2018 **18 UTC**



# Resources

- Slides and recording will be published on our website shortly:
  - <https://www.ecmwf.int/en/about/media-centre/news/2019/more-ecmwf-products-made-freely-available-wmo-members>
- Charts and Datasets for WMO (free of charge)
  - <https://www.ecmwf.int/en/forecasts/charts>
  - <https://www.ecmwf.int/en/forecasts/datasets/wmo-and-acmad-datasets>
- License information
  - <http://www.ecmwf.int/en/forecasts/accessing-forecasts/licences-available>
  - [data.services@ecmwf.int](mailto:data.services@ecmwf.int)
- Forecast Products User Guide:
  - <https://www.ecmwf.int/en/about/media-centre/focus/user-guide-ecmwf-forecast-products>
- For any other query:
  - [servicedesk@ecmwf.int](mailto:servicedesk@ecmwf.int)