

UEF feedback session

Tim Hewson

Principal Scientist, Forecast Performance Monitoring and Products

tim.hewson@ecmwf.int

Structure of the Feedback Session

- 15:20 Summary of Responses to the Online Feedback Survey
- 15:50 Disperse into Breakout Groups (set of 5)
- 17:00 Finish
- We plan to post **Breakout Group Summary** bullet points online in due course, in the Forecast_User portal:
 - To primarily cover new requests and any unanswered questions
 - check/"watch" the forecast user blog for notification -
<https://confluence.ecmwf.int/pages/viewrecentblogposts.action?key=FCST>

Hybrid Breakout Groups – 15:50-17:00



A **big opportunity** to quiz ECMWF experts directly, deliver requests & feedback, discuss topics...

Lecture Theatre:

1. Technical / Data Issues

Cihan Sahin, Sylvie Lamy-Thepaut, Emma Pidduck, Tiago Quintino

Large Committee Room:

2. Extended Range and Seasonal

Tim Stockdale, Frederic Vitart, Fernando Prates

Council Chamber:

3. Precipitation and Convection

Ivan Tsonevsky, Richard Forbes, Ervin Zsoter

Weather Room:

4. Machine Learning

Linus Magnusson, Mariana Clare, Baudouin Raoult (?)

Classroom:

5. Other Topics (e.g. new cycles, modelling)

Thomas Haiden, Mark Rodwell, Umberto Modigliani (?)

Please “drop by” any of the above that interest you – by all means go to more than one!

Survey Results

- Will include some illustrative plots provided (mainly) by respondents
 - Interpreted as best I can (!)

Q1: Which of the following categories best describes your employer?

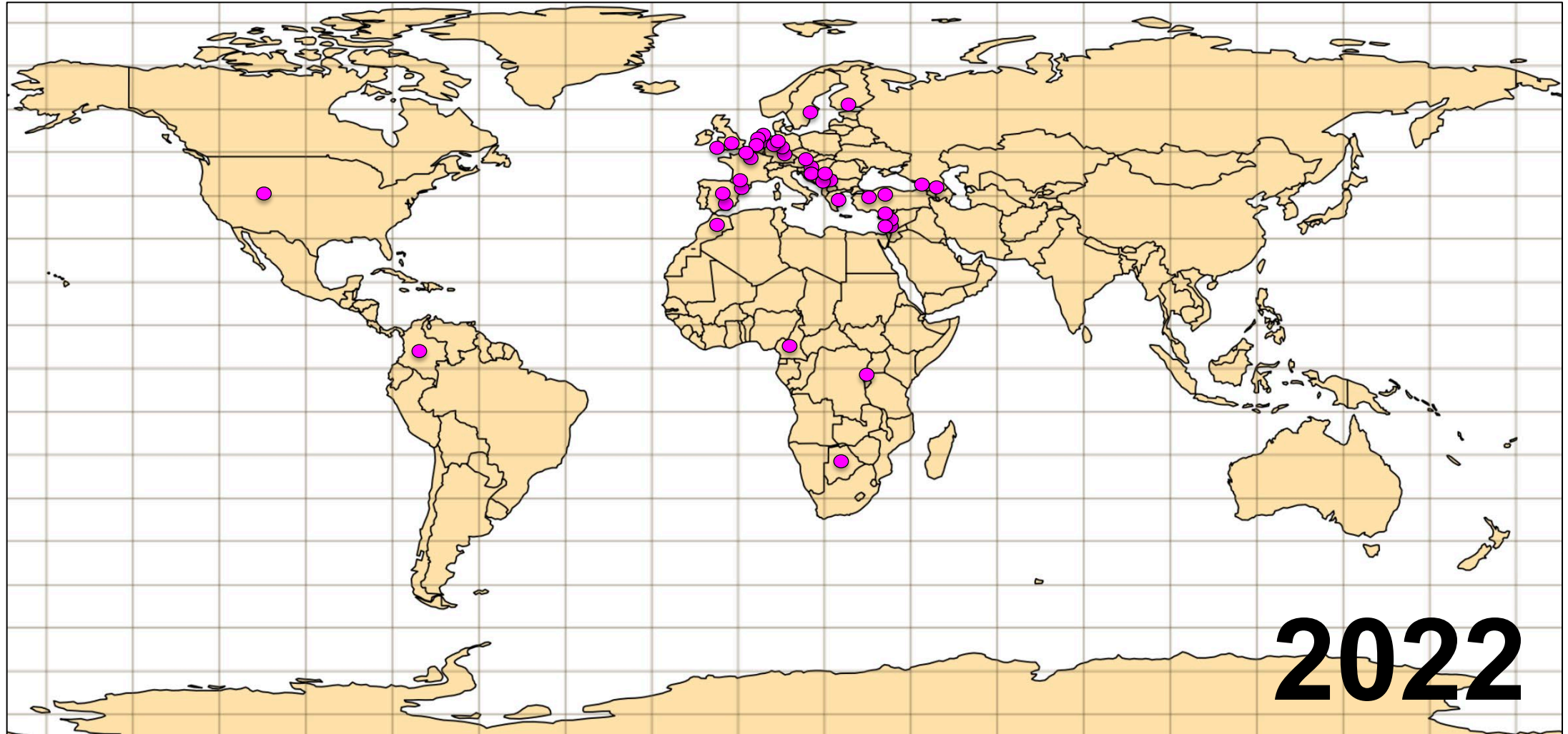
	%			
	<u>2020</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>
• Private Company:	25	32	24	32
• Public Sector (NMHS):	42	58	58	59
• University:	11	3	9	9
• Other:	11	6	9	0
<hr/>				
<i>No. of replies:</i>	56	32	45	22

New approach next year?

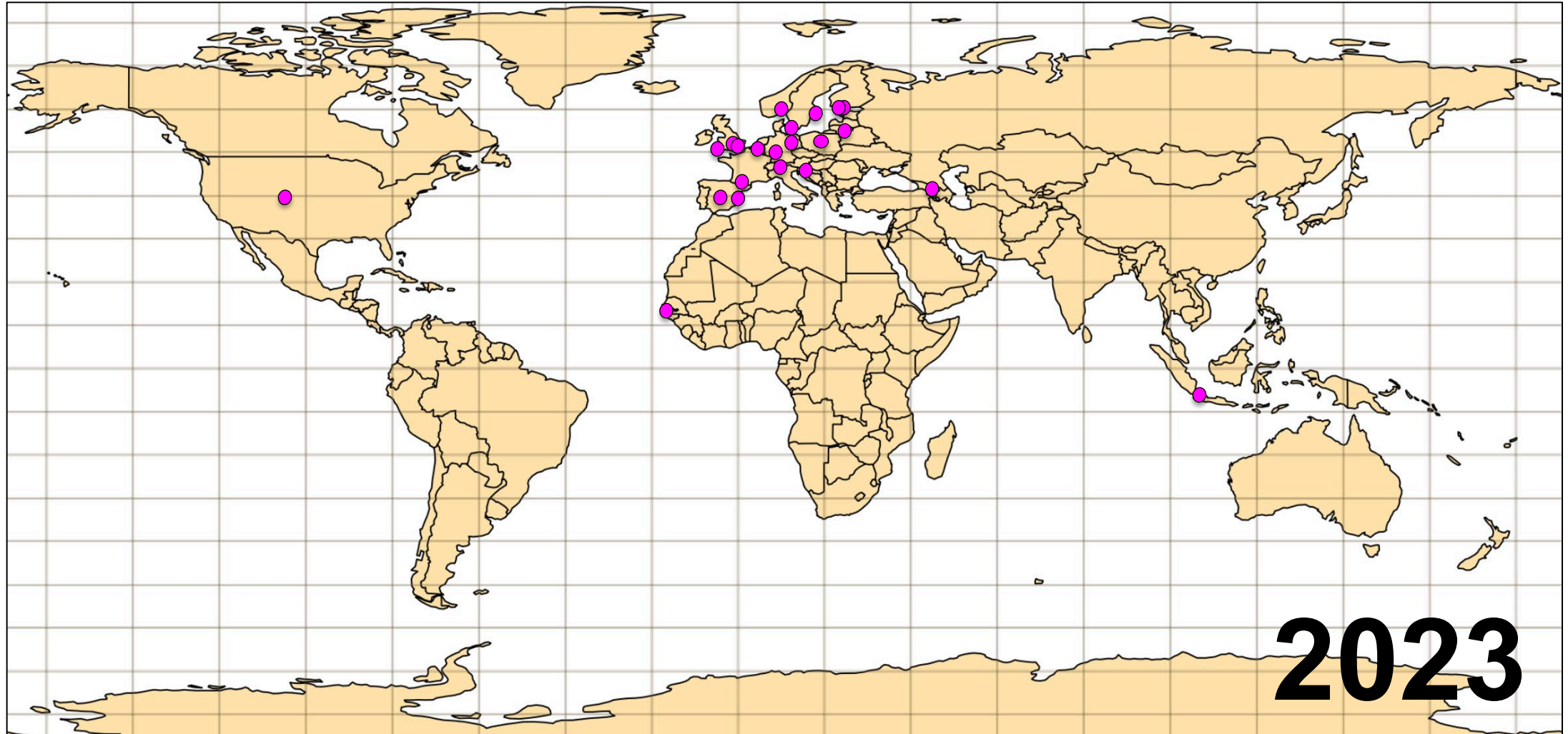
Why did you not respond to the Survey Call ?!

1. Don't recall seeing it
2. Nothing to report
3. ECMWF does not respond to feedback
4. Want to discuss in person instead
5. Too busy
6. Wanted different questions
7. Technical issues with filling out the survey
8. Someone else in my organization is replying instead
9. Survey fatigue

Q2: ...Name and Affiliation... : Where are survey responders based?



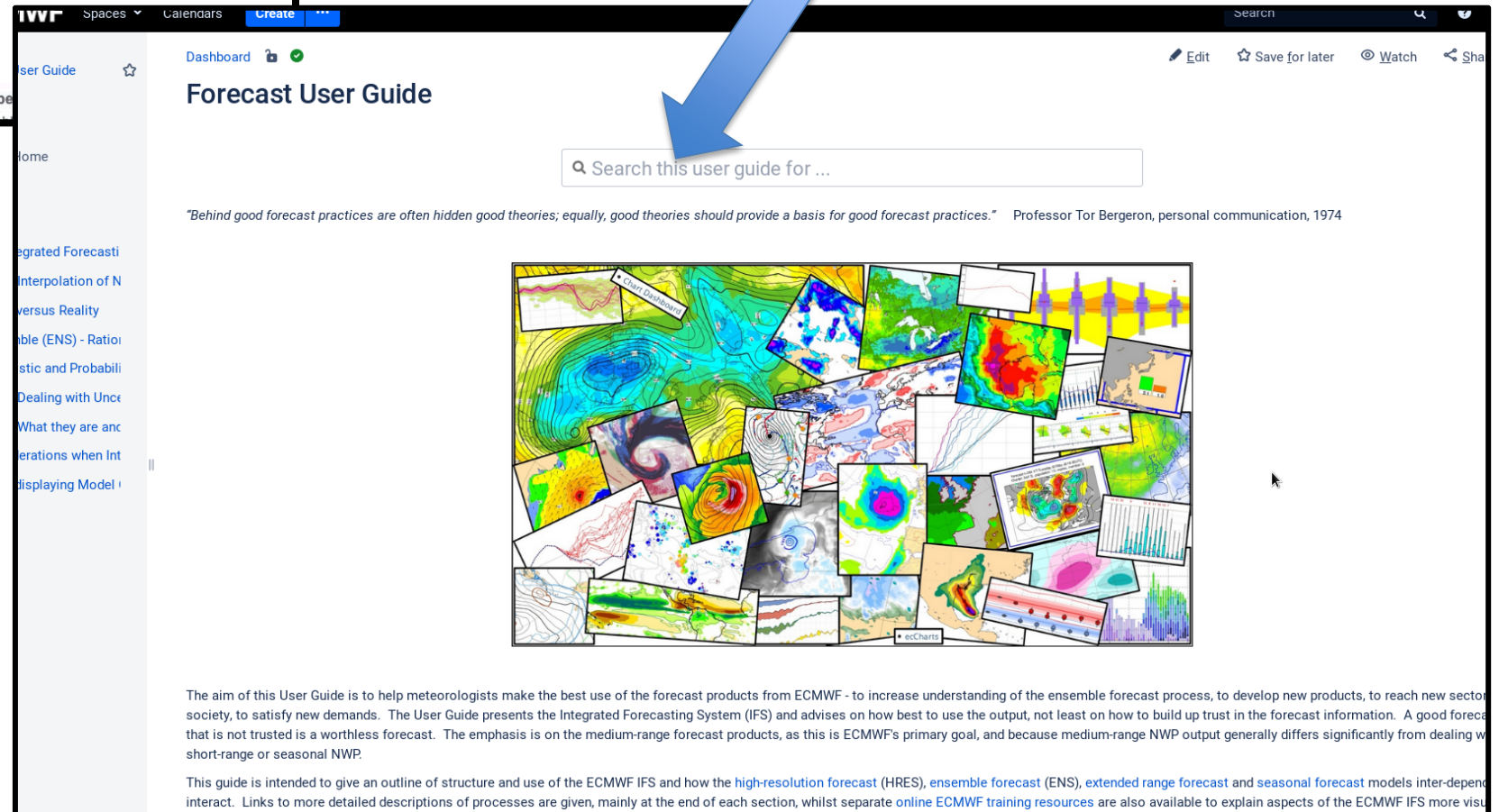
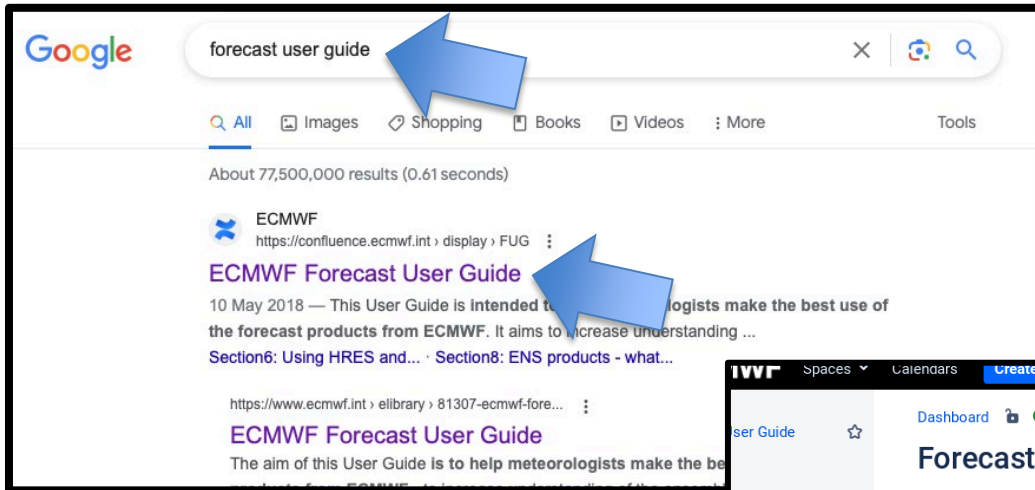
Q2: ...Name and Affiliation... : Where are survey responders based?



General remarks on your online survey responses:

1. Some users have **requested products, or raised issues**, that **ECMWF has already partly or fully addressed**
2. Some users highlight **issues that are known about** and that have been documented / discussed on the **known forecast issues page** and/or in the online **Forecast User Guide**.
3. Many **topics** will be covered in **breakout groups**
4. Other **related topics** will be covered, on Thu, in the **Speakers Corner**
5. Feel free to contact me, or other ECMWF staff, for **anything else** that needs addressing!

ECMWF's online Forecast User Guide



Currently being comprehensively updated for cycle 48r1 😊

Q3: What forecasting aspects that relate to ECMWF model outputs are of particular concern to you and your organisation? (1 of 4)



- Medium Range (ENS) **6**
- Short Range **3**
- Extended (=Monthly) **3**
- Seasonal **3**
- HRES **2**
- **Nowcasting 1**
- **EFAS 1**
- **C3S 1**

- Rainfall/Precipitation **7**
- Low level Winds (10m, 100m, gusts, ...) **5**
- Temperature **4**
- Solar Radiation **3**
- Humidity **3**
- MSLP **1**
- Visibility **1**
- Precipitation Type **1**
- Cloud **1**
- **Waves 1**

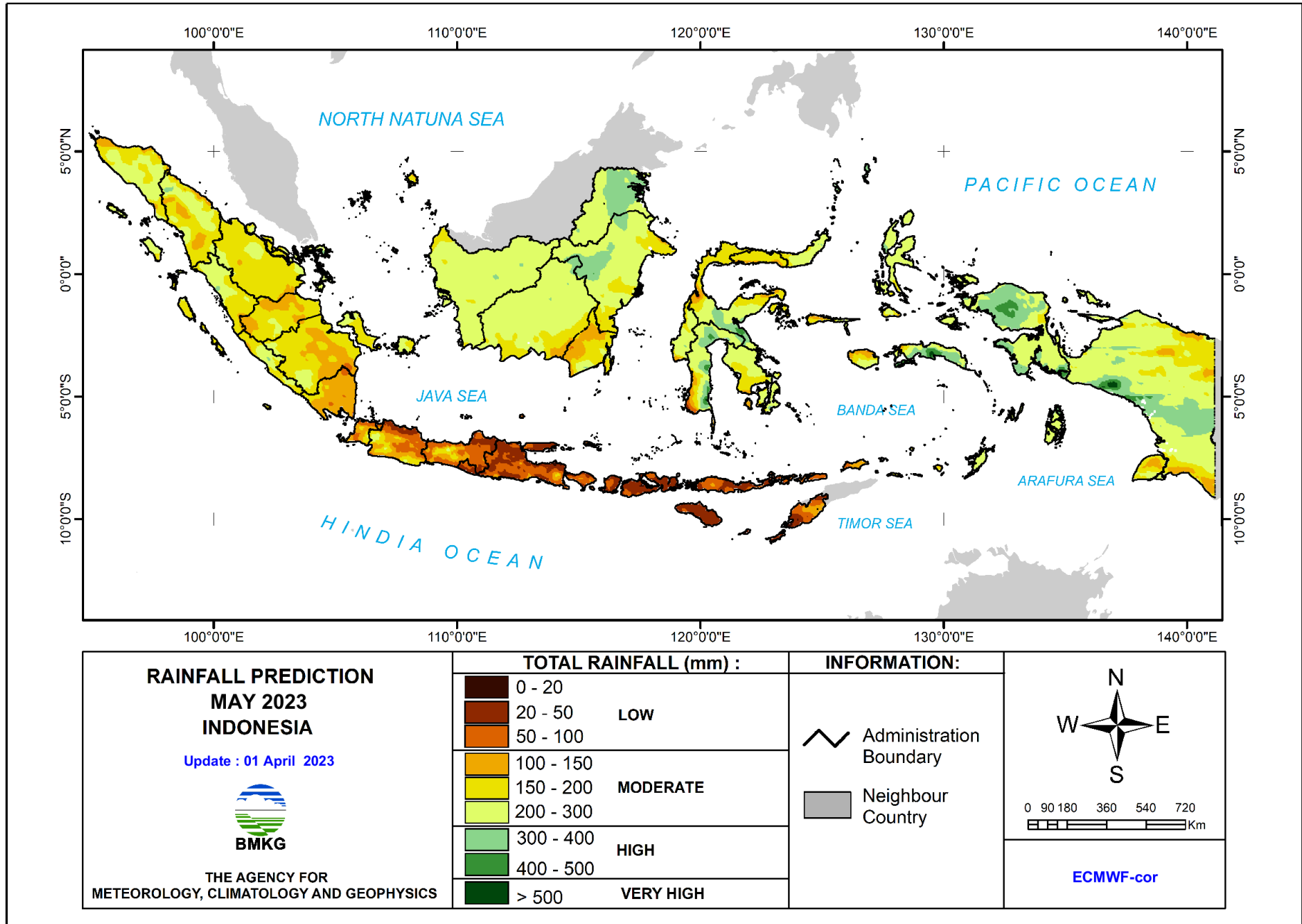
Range / Model

Parameter



Q3: What forecasting aspects that relate to ECMWF model outputs are of particular concern to you and your organisation? (2 of 4)

- Extremes / High Impact Weather **2**
 - Aviation forecasting / Aviation hazards (e.g. turbulence / icing) **2**
 - Tropical Cyclones / Tropical Weather **2**
 - **Regimes 1**
 - **Road weather 1**
- Hazards*
- **ecCharts / chart dashboard 2**
 - **EFI 2**
 - **Meteograms 1**
- Products*
- **Timeliness 1**
 - **Data volumes (given higher resolution) 1**
- Access*
- **Everything 2**
 - **Ensemble size 2**
 - **Model Resolution 1 / Post-Processing 1 / Boundary condition usage 1**
 - **Model updates 1**
 - **Reliability and consistency 1**
- Other*



Q4: Have you experienced any **particular problems** with ECMWF forecasts in the last 18 months (e.g. systematic errors/biases, one off bad forecasts)? (1 of 2)

- No/no entry: **64%** (64% in 2022)

Precipitation

- **Stripey pattern in SEAS5 rainfall output & SEAS5 not good for mountainous areas (both Indonesia)**

2m Temperature

- **2m temperatures in complex topography (reduction to station height not effective)**
- **Days too cold, nights too warm in Nordic anticyclones in spring**
- **Freezing level can exhibit large errors of different types in mountainous terrain**

10m wind

- **Underestimated in mountainous areas**

Turbulence (for aviation)

- **EDR (eddy dissipation rate) fields have the wrong thresholds (?)**

Cloud

- **100% cloud cover too common**

Regimes

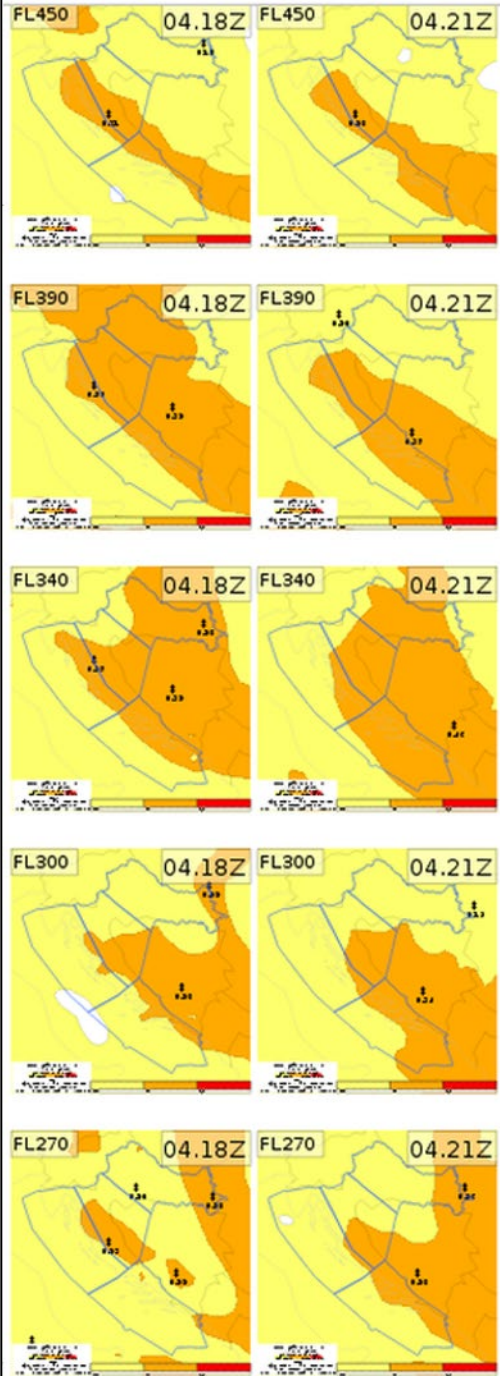
- **Short lead time on regime changes autumn 2022 and winter 2022-23**
- **Lack of propagation of signals from stratosphere to lower troposphere (promised but not delivering!)**

Spread and Bias

- **At shorter lead times a lack of spread plus slight biases**

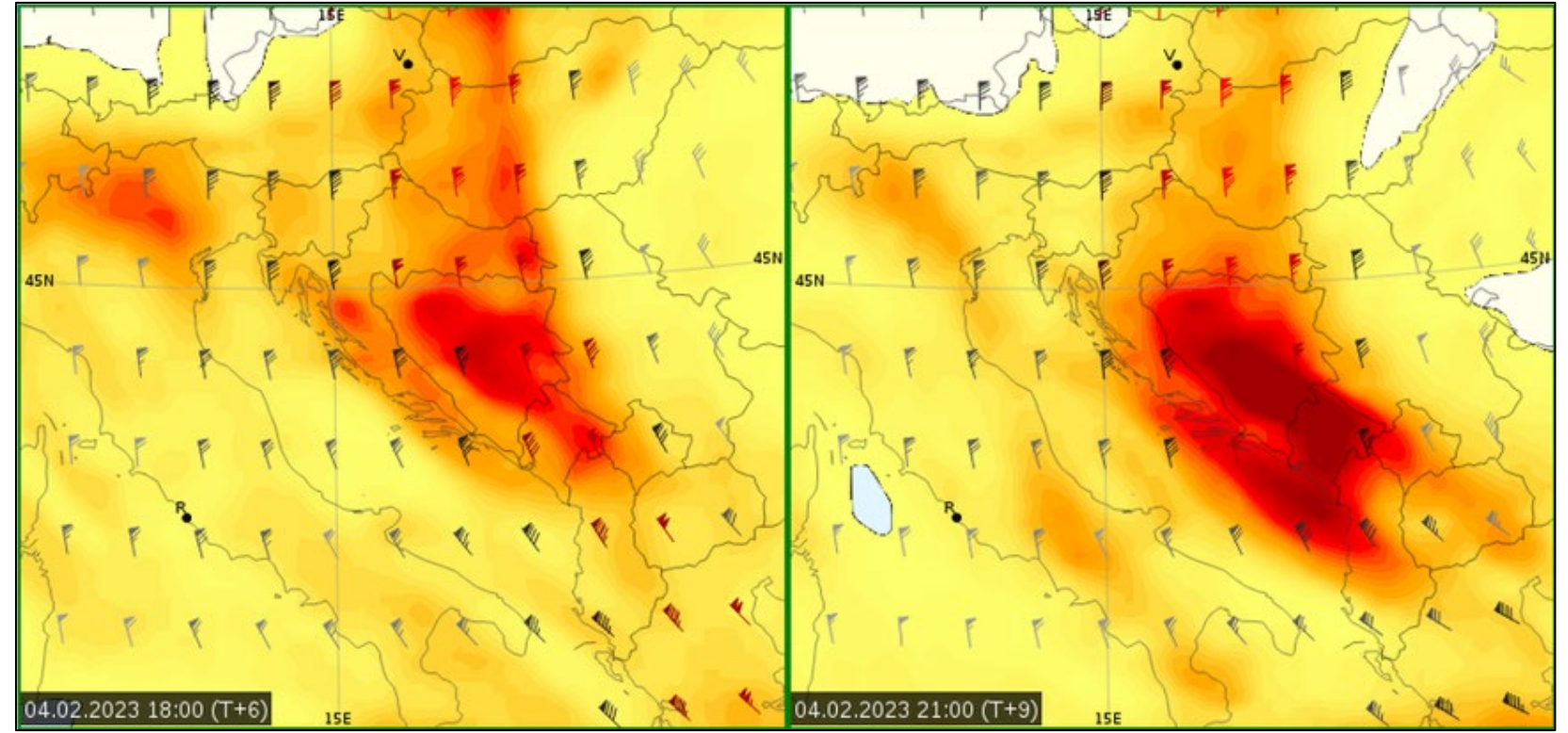
Technical

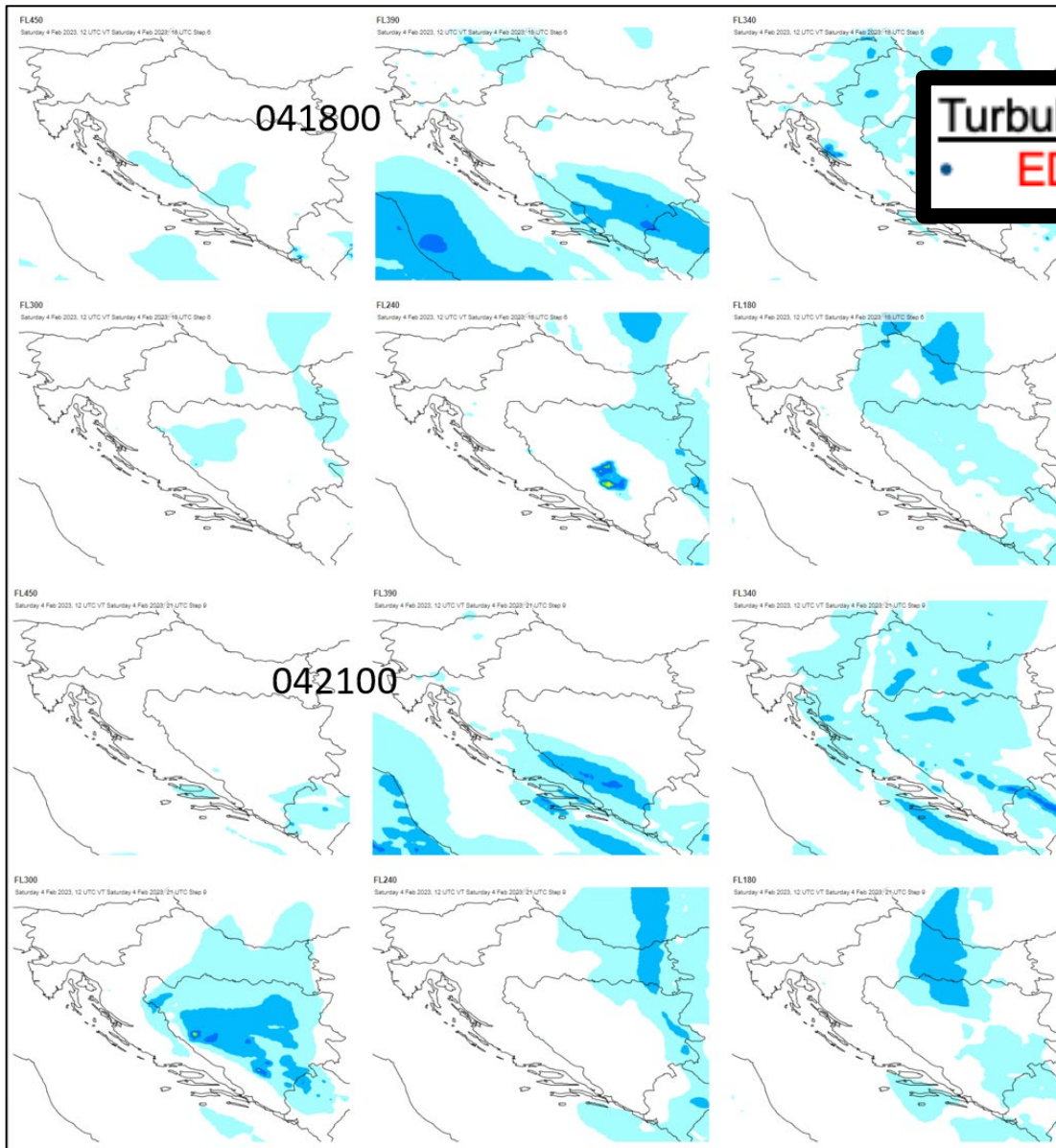
- **Incomplete grib messages – 2-3x per week**
- **ecCharts reliability very poor over year (a bit better of late)**



Turbulence (for aviation)

- EDR (eddy dissipation rate) fields have the wrong thresholds (?)





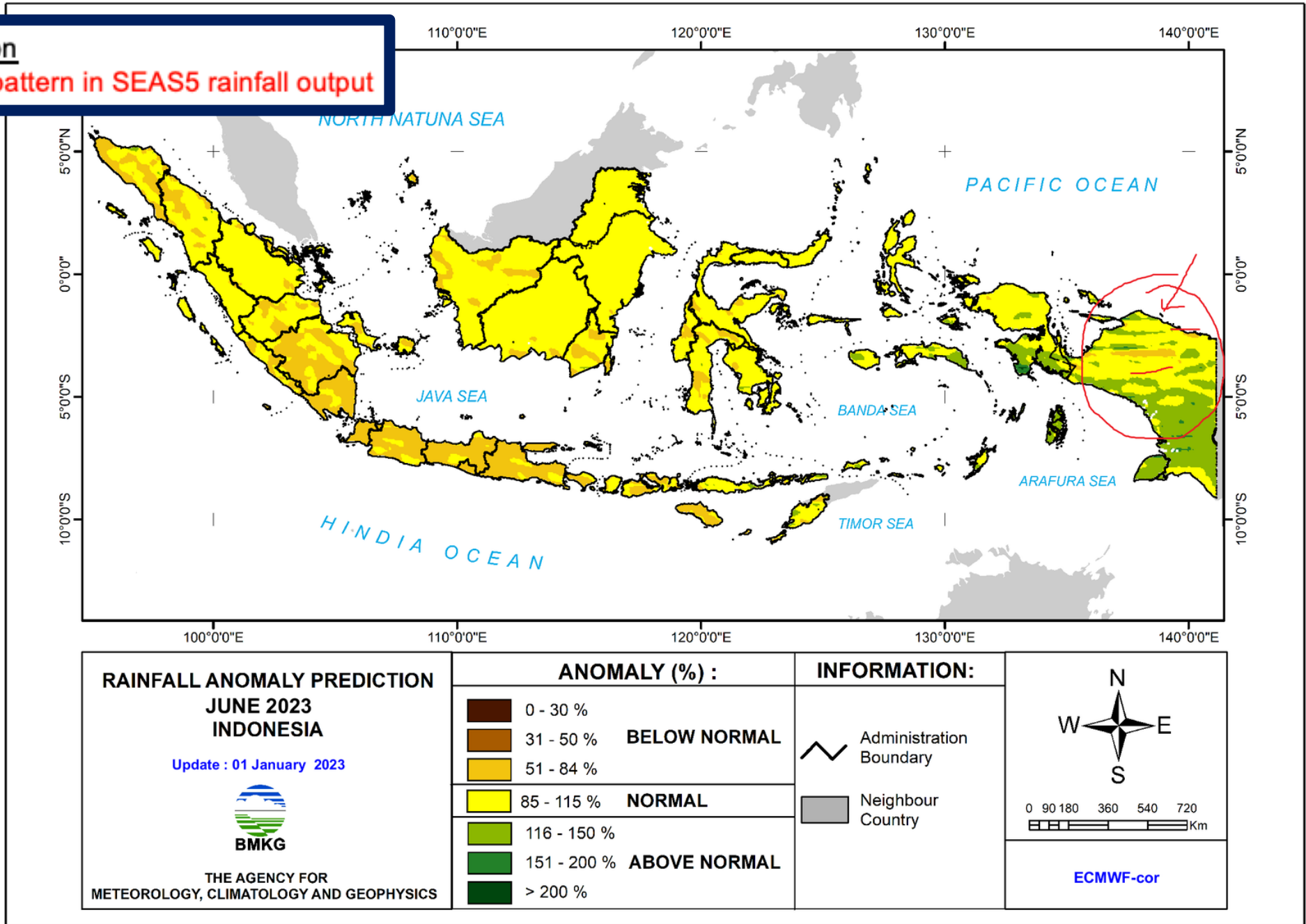
Turbulence (for aviation)

- EDR (eddy dissipation rate) fields have the wrong thresholds (?)

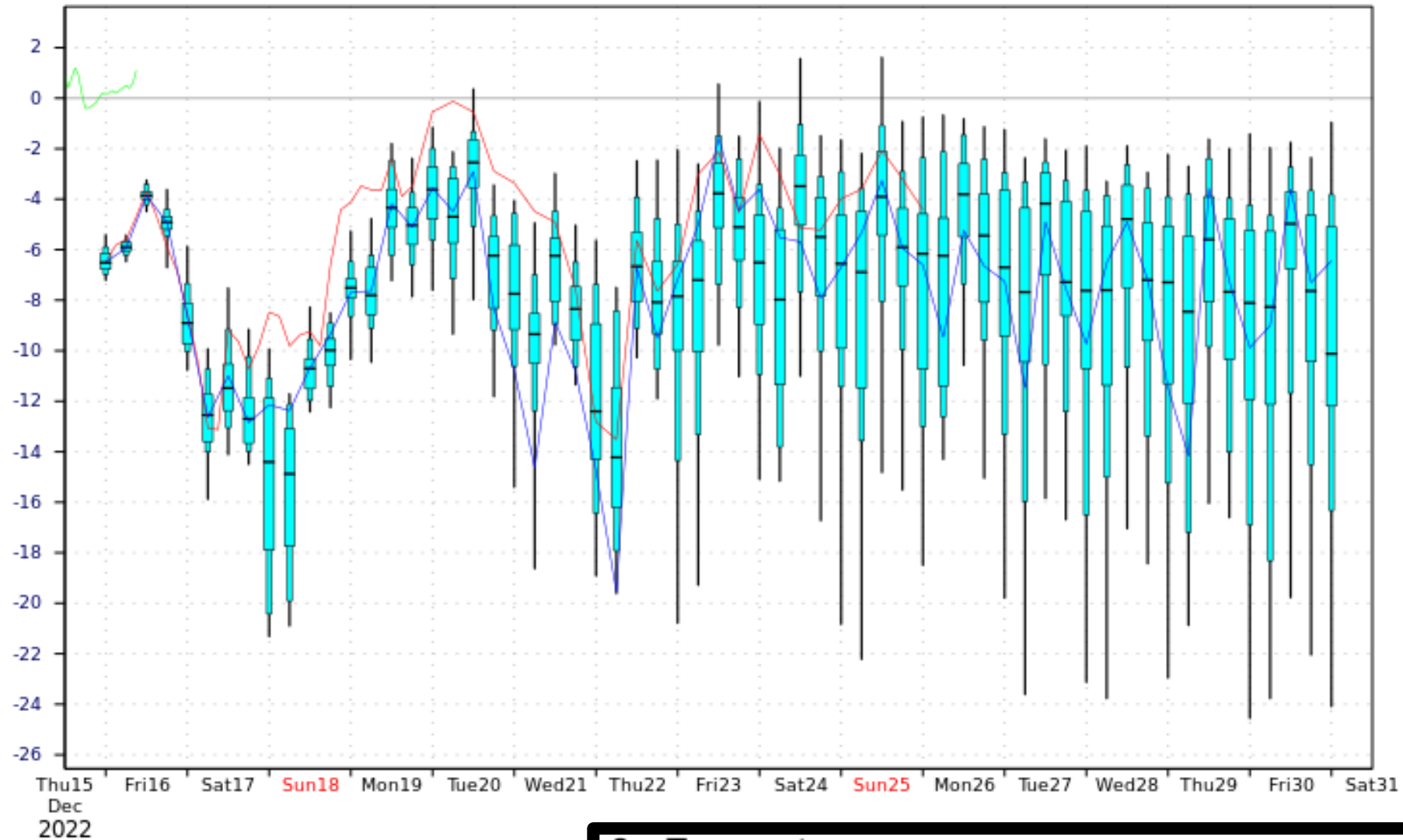
for reliable turbulence estimates (Sharman et al., 2014). The eddy dissipation rate (EDR), which is the cube root of the dissipation rate of turbulent kinetic energy, and hence has units of $m^{2/3} s^{-1}$, has become the International Civil Aviation Organization (ICAO) standard for aircraft reporting and therefore the standard measure for clear-air turbulence (CAT).

Precipitation

- Stripey pattern in SEAS5 rainfall output



raw 2 metre temperature Bormio Run: 20221216 0000 UTC



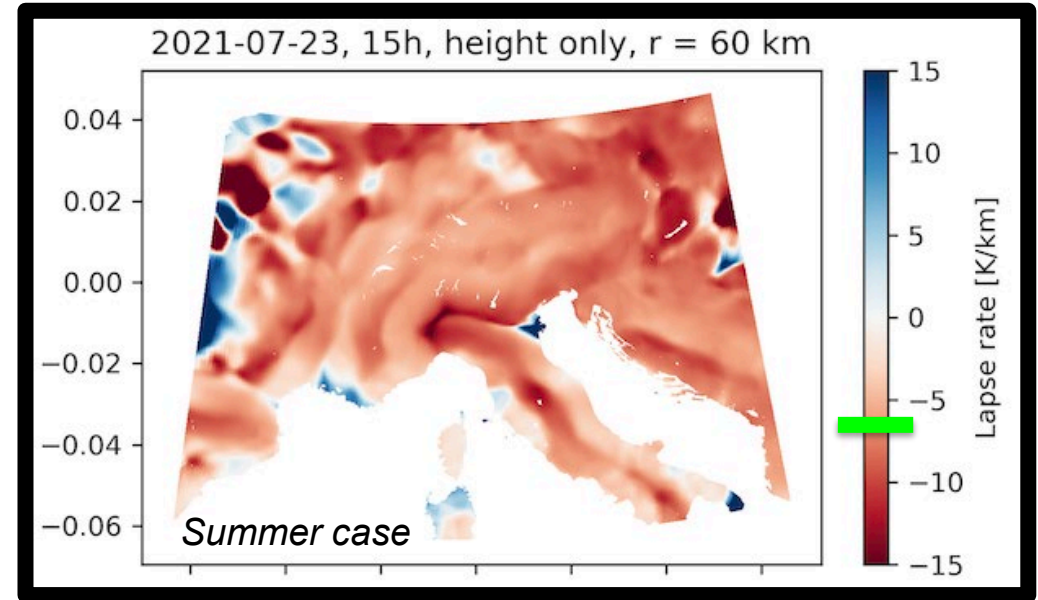
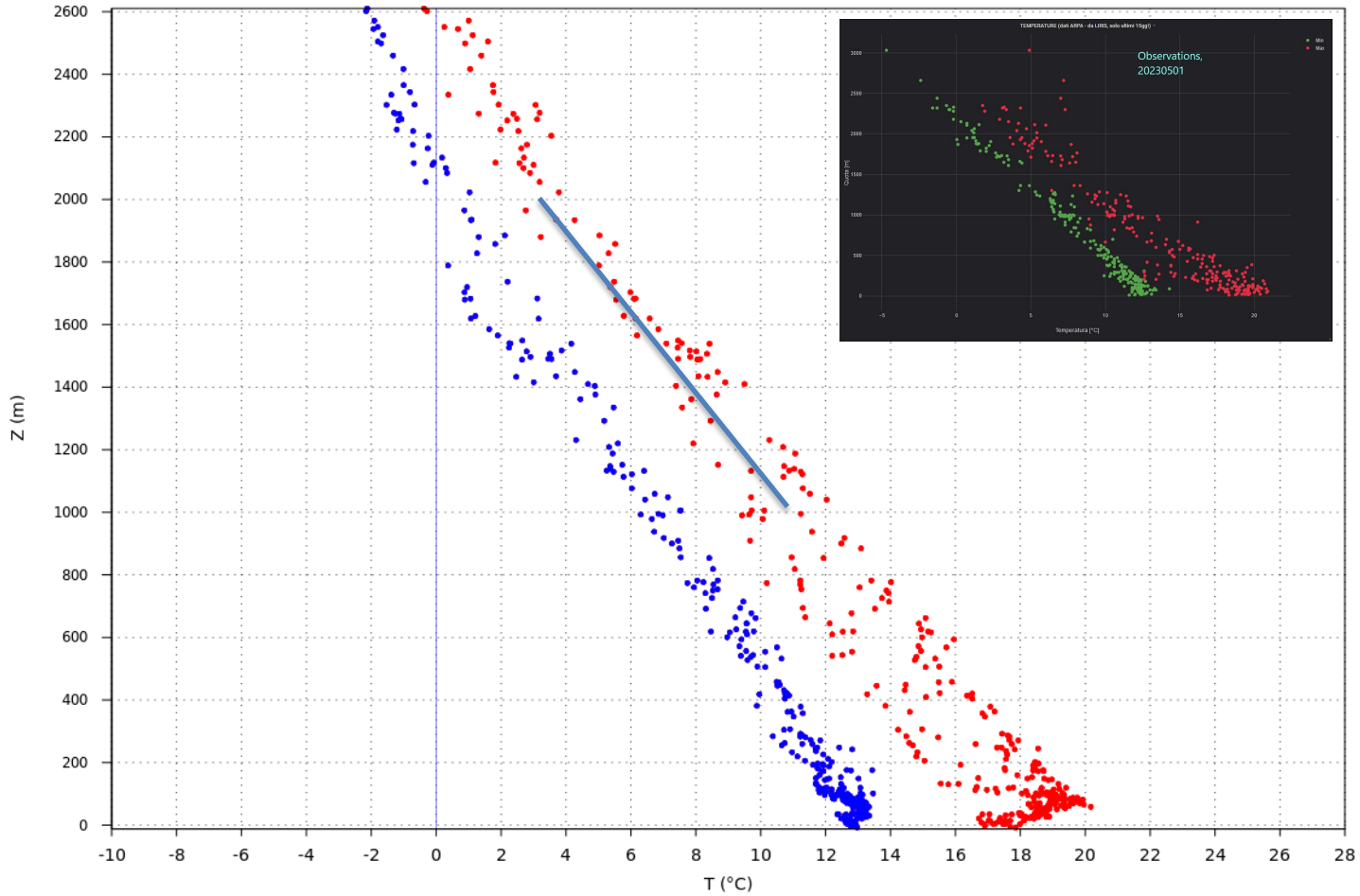
2m Temperature

- **2m temperatures in complex topography (reduction to station height not effective)**

1 May 2023

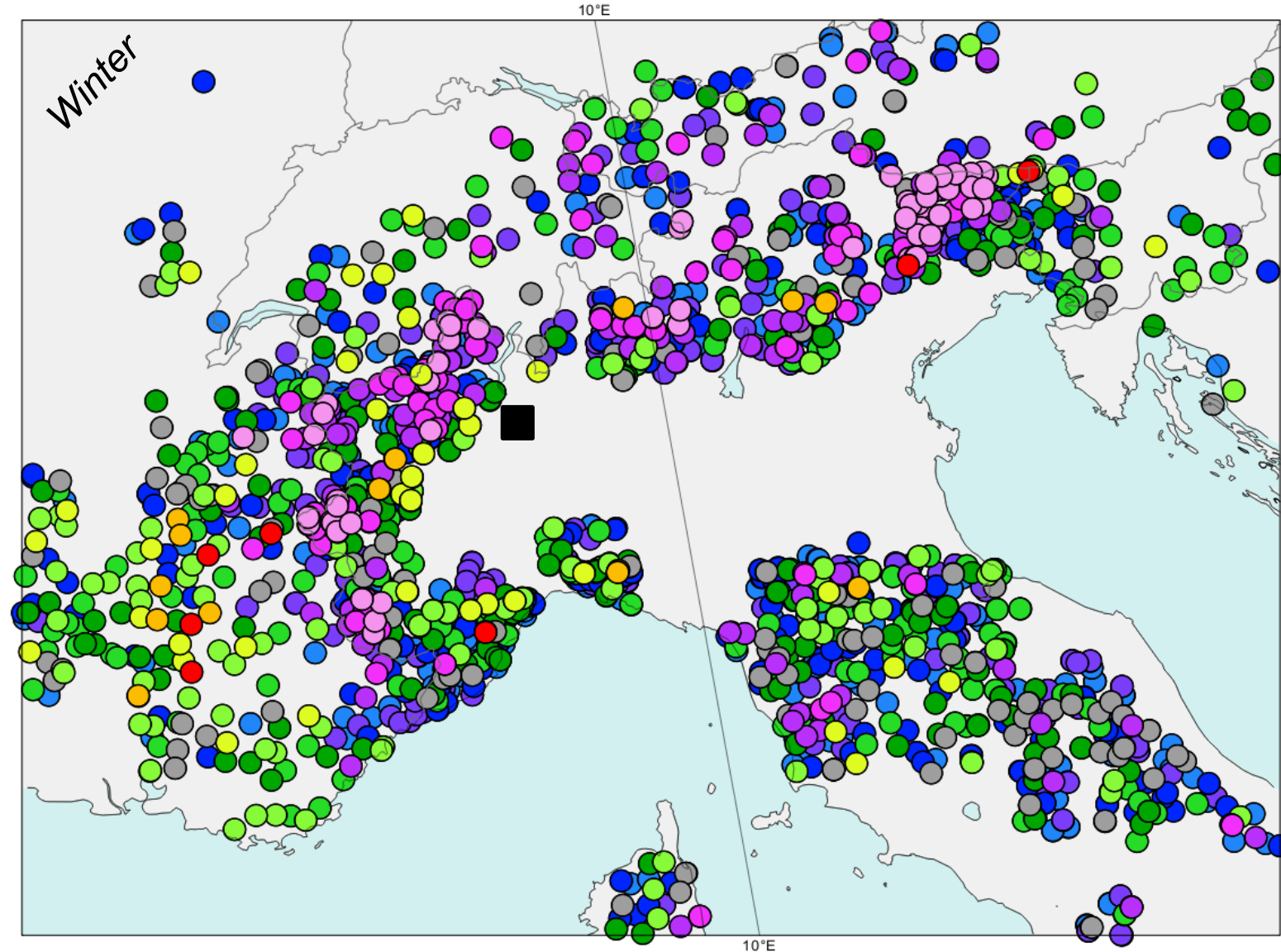
ECMWF - VT: Monday 01 May 2023 [fcst step : +0 - +24h]

T2m daily min-MAX vertical profile on model orography (Lombardy gridpoints) [Run: 0000 - 20230501]

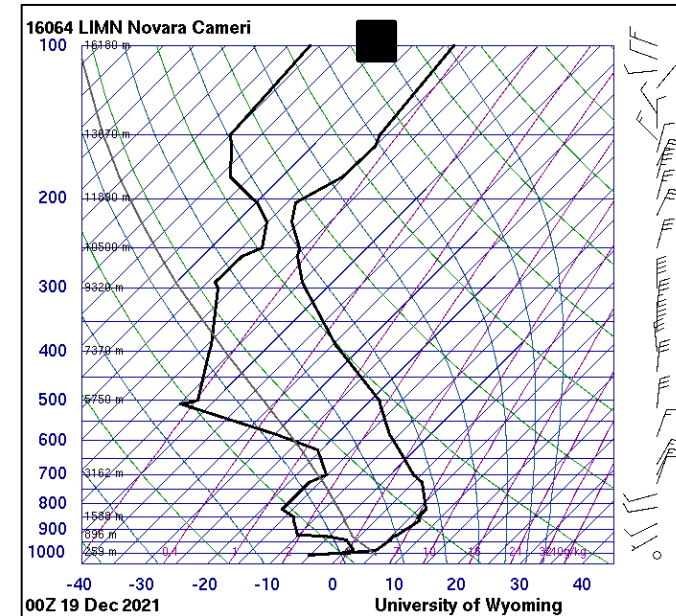
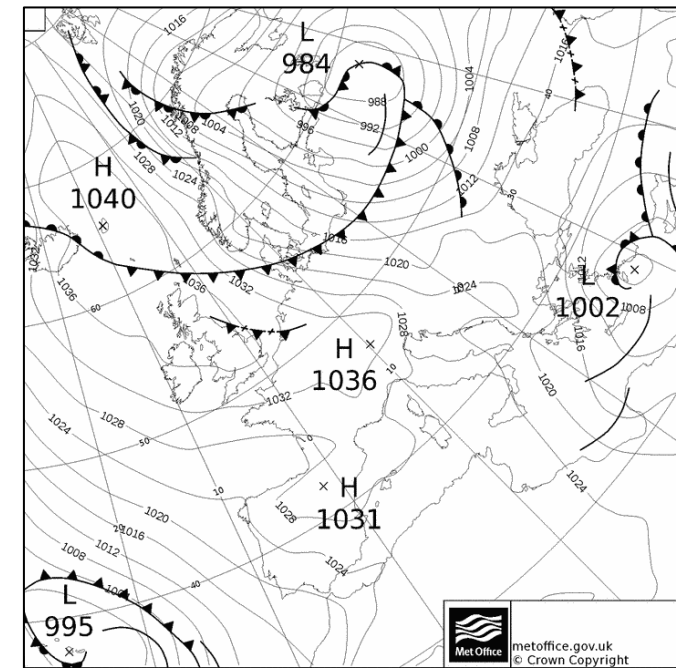


Extreme Errors Example, @T+30 = 06Z 19 Dec 2021

2m Temp errors (deg C): HRES 30 = VT 06Z 19 Dec 2021

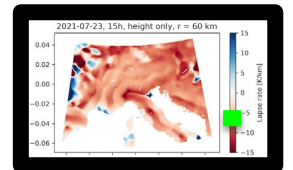


Only sites where the IFS-based (10m wind <2m/s) and (cloud<25%) criteria were met are shown



2m temperature adjustments for station vs model height differences

- 2m temperature ensemble forecasts should improve in 48r1 because of better representation of the topography at 9km versus 18km resolution
- However, the simplicity of the standard lapse rate adjustment for meteograms will still mean there are issues with meteogram 2m temperatures:
 - especially when there is a large height difference - site versus model gridpoint
 - especially in inversion situations
- An ongoing study aims to define dynamically-varying lapse rates, based on IFS model behaviour in the vicinity of each gridpoint (no calibration needed, global coverage)
 - This initiative has great potential, but further testing is needed to see if the benefits outweigh the disadvantages, and any operational implementation would be some way off.



Q5: Have you experienced any notably good forecasts in the last 18 months (e.g. well-forecast events, variables/products performing well)? (1 of 2)

- No/no entry: **45%** (32% in 2022)

Precipitation

- Lightning flash density good for highlighting convective clouds
- SEAS5 good for flat areas of Indonesia
- SEAS5 70-90% accuracy overall over Indonesia in a 4-category system
- Compared to Arome did a great job with convection/showers over Sweden at end of April

10m winds

- Good determination
- Wind and sig wave height away from coasts

Precipitation Type

- Good determination

Other

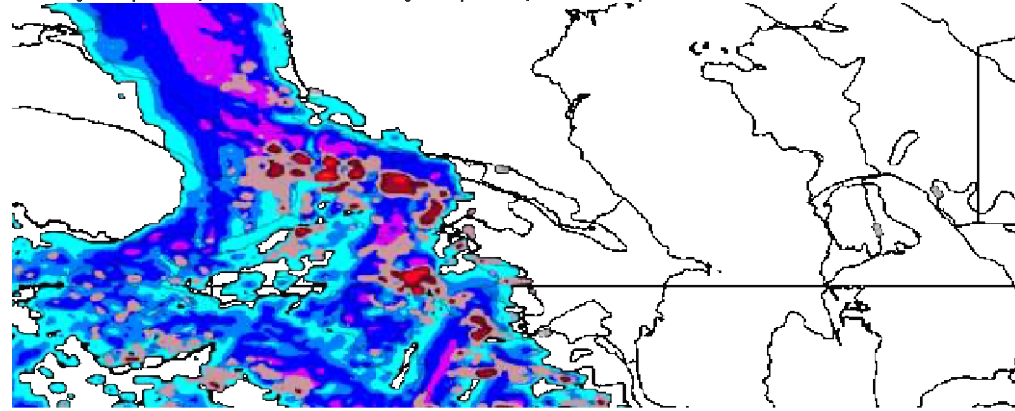
- SSW event in Feb / early March (ref 10mb winds)
- C3S forecasts generally
- Synoptic patterns well forecast
- Front with thunderstorms over France in March

Q5: Have you experienced any **notably good forecasts** in the last 18 months (e.g. well forecast events, variables/products performing well)? (2 of 2)

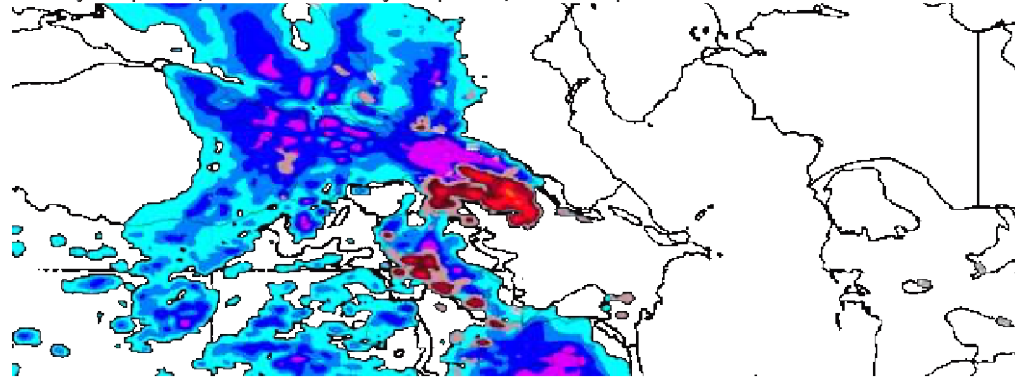
Quotes

- “results are above average and I trust ECMWF forecast” – **IMGW, Poland**
- “Mostly good forecasts” – **Meteo-France + Agricultural institute (ACTA)**
- “Generally happy with quality – most importantly with precipitation forecasts” – **Foreca, Finland**
- “My objective verification generally shows that ECMWF is the best performing model out of the several used” – **Met Office, UK**

Tuesday 11 Apr 2023, 00 UTC VT Wednesday 12 Apr 2023, 18 UTC Step 42



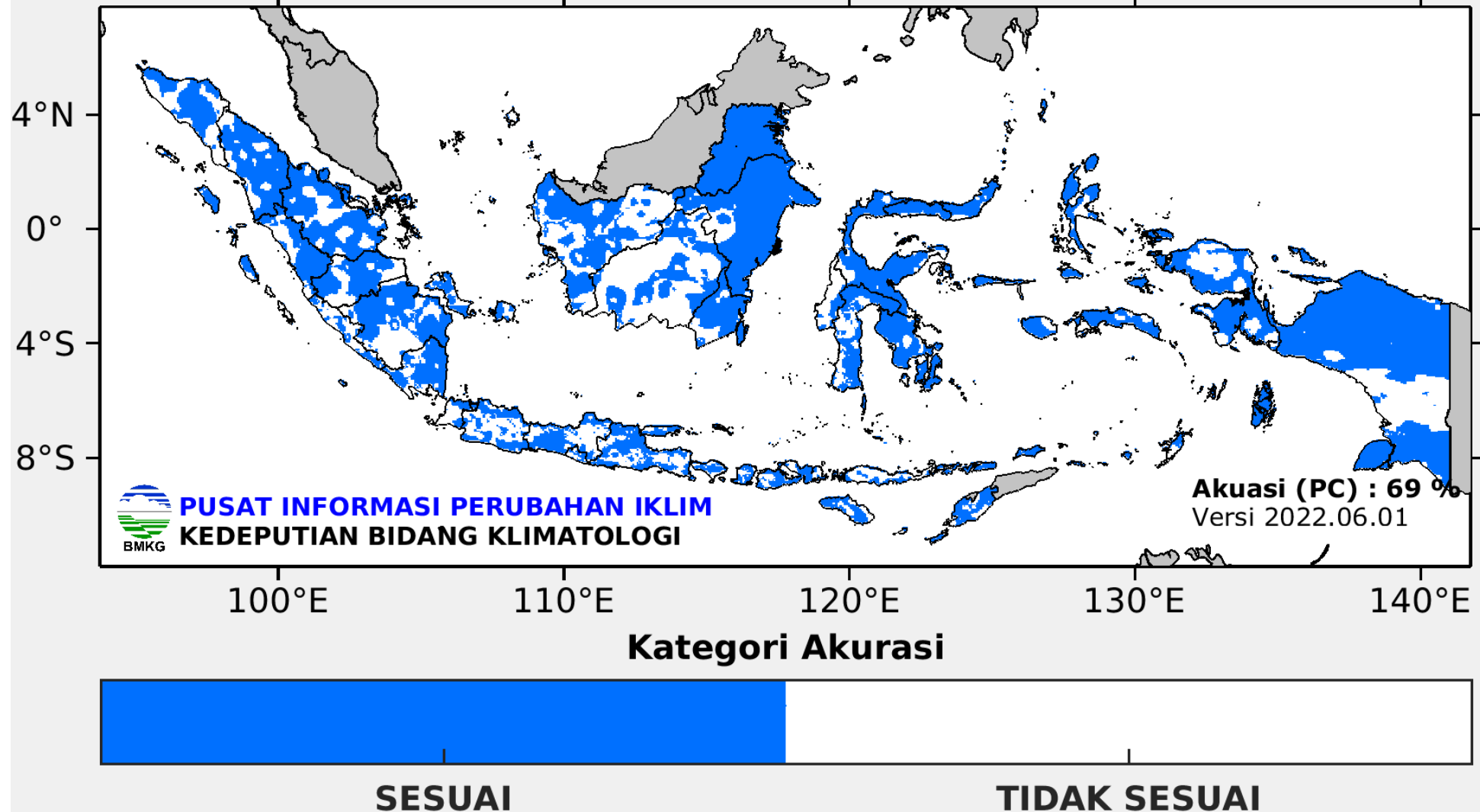
Tuesday 11 Apr 2023, 00 UTC VT Thursday 13 Apr 2023, 00 UTC Step 48



Note: the map shows that at night of April 13, 2023 is expected heavy rain in several regions of Georgia, also there is chance to develop convective clouds (as it is showed on the map of Lightning flash density).

Observation showed, that there was rain in the most region of Georgia, heavy in the some places. There was also hail: in Telavi (start 11:02-11:04; diameter 1 mm) in Tbilisi, Rustavi, Gurjaan, Kvareli (weak hail).

Akurasi Prakiraan CH Bulan : OKTOBER 2022



Q6a) How do you currently use ensemble forecasts? Do you reference both global and limited area ensembles?

Global ensembles: **17**

LAM ensembles: **6**

Neither: **1**

- Ensembles still secondary to HRES, but use increasing
- HRES = first guess, then ENS to assess reliability of that and possible modifications
- For predictability in future – confidence ranges and probabilities
- Mostly medium range for ENS use, but also short range if uncertain

- ENS mean used **3**

- Via yr.no
- Via ecCharts
- Via meteograms

- For the probability of rainfall, day by day (“the most important products for us currently”)

- As a crop irrigation support tool

- Download ENS member data, then compute statistics (lower resolution, small area, because of costs)

- Map-based and point-based usage

- To assess where, when and why there is uncertainty
- To assess winter-time regime evolution

Q6b) How does your use of different types of ensemble compare to your use of deterministic forecasts? e.g. does this depend on lead time?

Background:

Currently:

HRES runs at 9km resolution
ENS runs at 18km resolution

So there are benefits in some geographical/meteorological scenarios, for some parameters, in using HRES, especially at short leads.

In cycle 48r1 (targeting late June implementation):

HRES and ENS will have the same (9km) resolution

So the benefits of HRES versus ENS are markedly reduced. Only benefits are then HRES is unperturbed, and that output arrives slightly earlier.

Q6b) How does your use of different types of ensemble compare to your use of deterministic forecasts? e.g. does this depend on lead time?

- **Deterministic runs used more than Ensembles** **6**
- **Deterministic used more at short leads, Ensembles more at longer leads (dividing line = day 2-6)** **7**
- **Ensemble runs used more than Deterministic** **7**

Some Quotes:

- “Usage depends mainly on habit (so still more use of deterministic)” – **Hydromet Service (Lithuania)**
- “Most of our stake holder in Indonesia more concern to deterministic forecast than the probability.” – **BMKG (Indonesia)**
- “The deterministic forecast is used as a first-overview of the weather, then when assessing specific details ensemble products are utilized” – **SMHI (Sweden)**
- “We use ensemble from lead time zero onwards” – **Vaisala (Finland)**
- “I have never used deterministic forecasts in the products I generate” - **Met Office (UK)**
- “Customers are well aware of probability as a concept” – **FORECA (Finland)**
- “Ensemble members very important - they are realisable weather patterns (ensemble mean often is not).” – **Lake Street Consulting (UK)**
- “Loss of ensembles would be far more of a hit (than loss of deterministic)” - **Lake Street Consulting (UK)**

Q6c) The ECMWF strategy is to go more ensemble-based, please provide any comments you have on this.

Very Positive	5
Positive	10
Neutral	2
Negative	0

Main Message: This strategy is good, but needs to be backed up by ECMWF undertaking supporting activities in several different areas

“Very good strategy”,

“Happy”, “Very supportive”

“The challenge is the
“Should be supported
“Only slowly incorporated
“Work still needed on
“Forecaster communication

... (comparing forecasts) more important”
“Strategy needs to incorporate an ‘easy to understand’ component for users”
“We also need post-processing to link model values to real world values”
“Need new technologies to deal with the data volume”

Q7) With cycle 48r1 being implemented in summer 2023, ECMWF will have two separate ensemble systems running in parallel, each supported by its own re-forecast set. For the 00UTC data time we will run at 9km resolution (days 1-15, with 51 members), and at 36km resolution (days 1-46, with 101 members). From 12UTC we will just run the 9km ensemble, whilst the shorter 06 and 18UTC ensemble run sets, for days 1-6, which are part of the BC Optional Programme, will also run at 9km resolution. Would you like ECMWF to explore ways of creating products by **combining some or all of these various ensemble run** sets, on a given day or even across days, with or without post-processing? If so please give details – feel free to be creative!

Yes: **6**

Neutral / No Answer: **11**

No: **4**

- “Please compute precip exceedance probabilities, max values in ENS-combined”
- “Multi-model super ensemble forecast products wanted for SYNOP stations (with HRES/Control)”
- “Use large neural networks for data compression, via interpolation (e.g. hourly from 6-hourly)”
- “Strongly support getting access to the BC data”

- “ECMWF should focus on NWP development only”
- “Happy to have the raw data only”

Q8) One technical challenge with the structural ensemble changes in 48r1 is **increased data volumes** (because of parallel systems, more members, higher resolution, more frequent runs). To help address ECMWF is switching to using a new and **more efficient compression algorithm** for GRIB2 fields (“CCSDS”). Please comment on how you are dealing with the increased data volumes. For example, will the new compression affect your use of ECMWF GRIB2 fields? If so how?

Great! : **2** Not a problem: **3** Not sure / Neutral / No Answer: **15** Problematic: **2**

- “Data volumes big concern – any tools to address very welcome”
- “Compression likely to help expand our usage”
- “Don’t have data volume issues (small downloads only).”
- “Will compression reduce precision?”
- “Will there be delays as a result of compression?”
- “This compression is obscure. It’s perhaps coming in a cycle too soon.”
- “Would like a video tutorial to help us through this.”
- “Interleaving with GRIB1 is sub-optimal for some decoders.”
- “We have limited internet capacity and already face regular data transfer issues: we are concerned.”

<https://youtu.be/C1e0AkkNMMs>

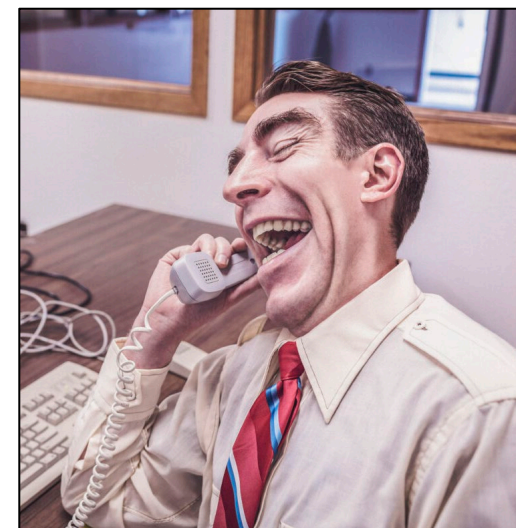
Q9) Please use the box below if you have additional comments on topics that have not been covered in any of the questions above (e.g. regarding the new field of Machine Learning (“data driven”) models and ensembles)..

Very few replies to this question, but 4 users were keen or very keen to hear about ECMWF plans related to Machine Learning 😊

Summary of Main Messages

User Voice Corner

- Satisfaction with ECMWF forecasts and products continues to be very high overall
- Survey response rate low this year – why ?
- Precipitation, Winds, Medium range, Hazardous weather continue to be high on the agenda for many
- ECMWF needs to investigate / work on some ‘details’ related to products / output
- Technical Issues of various types continue to crop up (but less than previously)
- ENS usage grows beyond short range lead times (but post-48r1?)
- User are “pro-ensemble” overall, but need various types of support to navigate more in this direction
- Maybe ECMWF can do a bit better than fixed lapse rate adjustments for 2m temps
- Users are (currently) a bit lukewarm regarding multi-run ensemble blending
- Some concerns about data volume increases with 48r1
- Some interest in Machine Learning topics



Hybrid Breakout Groups – 15:50-17:00



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Tim Stockdale, Frederic Vitart, Fernando Prates

Leave lecture theatre, immediately turn left through door, go upstairs...

Council Chamber:

3. Precipitation and Convection

Ivan Tsonevsky, Richard Forbes, Ervin Zsoter

Leave lecture theatre onto concourse, turn left then enter double doors on far side of 'bar area'

Weather Room:

4. Machine Learning

Linus Magnusson, Mariana Clare, Baudouin Raoult (?)

Classroom:

5. Other Topics (e.g. new cycles, modelling)

Thomas Haiden, Mark Rodwell, Umberto Modigliani (?)

To the right of the Weather Room

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Following on...

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