Research to Operations (R2O)

45 minute session at #UEF2020

Jenny Rourke and Mike Sleigh

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ECMWF

Introduction

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Head of Production Services Section, ECWMF

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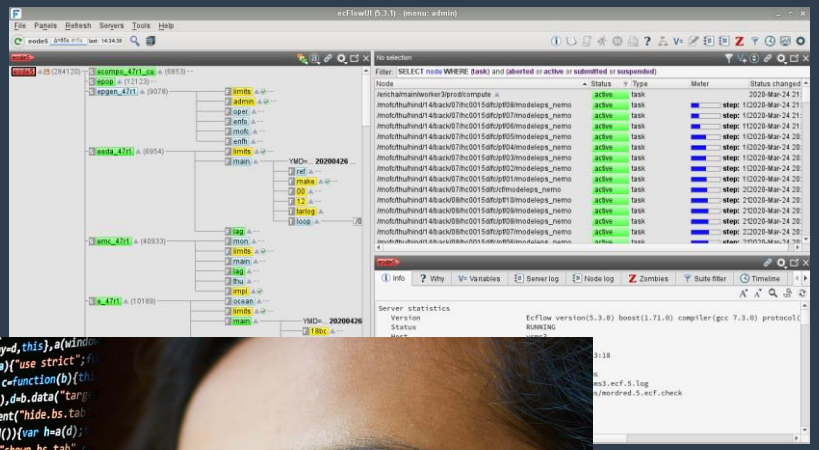
Head of Integrated Forecast Systems (IFS) Section, ECWMF

Introduction

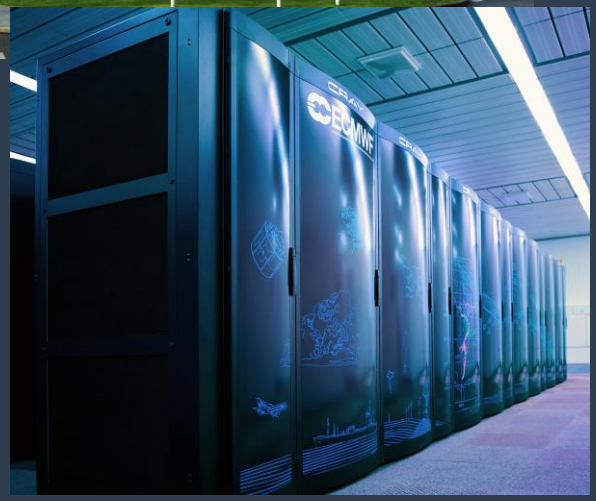
	Timings:
1. What is the R2O process?	3 minutes
2. How do you fit into this as a user of ECMWF data?	5 minutes
Time for you to get involved ☺	5 minutes
3. Overview of the R2O process at ECMWF	15 minutes
4. Improvements planned for the future of R2O at ECMWF	5 minutes
Another chance for you to get involved ☺	5 minutes
5. What can we learn from your organisation?	2 minutes

1. What is the R2O process?

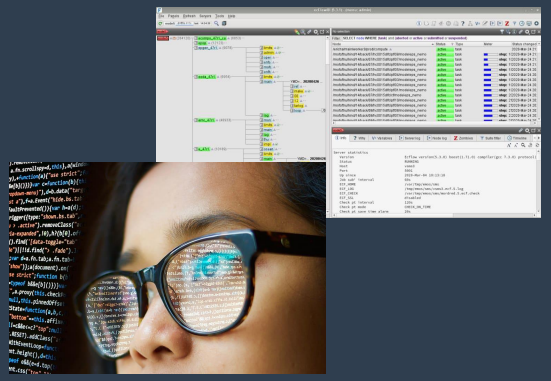


Research

Operations



1. What is the R2O process?



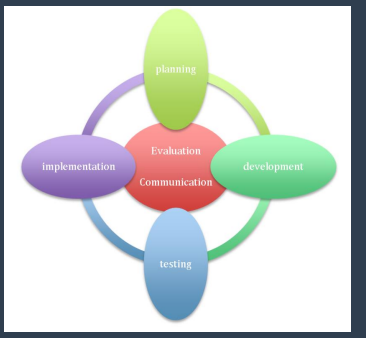
Planning: 10 year strategy → **Planning: 5 year plans** → **Individual developments (stand alone testing)**

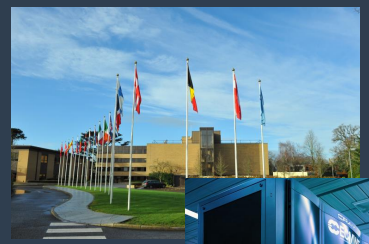
↓

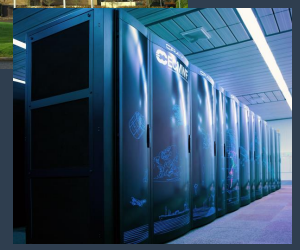
Developments are combined and tested → **Accepted developments are merged in the new IFS cycle** → **Testing and evaluation**

↓

Operational testing and assessment → **Test data to users and communication** → **Cycle upgrade**



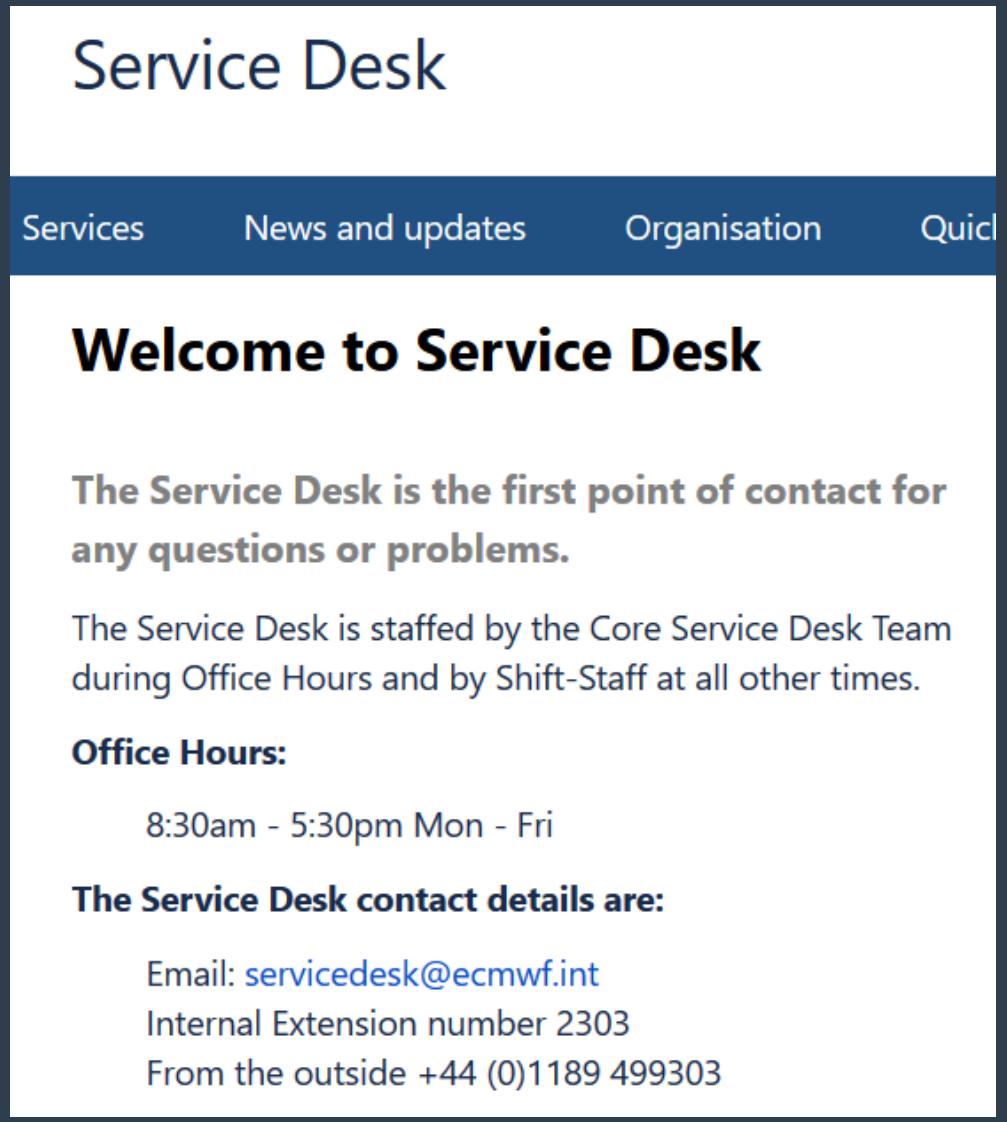




2. How do you fit into this as a user of ECMWF data?

One of the main ways we collect feedback from Users is at the UEF – so thank you for your feedback!

2. How do you fit into this as a user of ECMWF data?



You can reach out to us any time with feedback.
The best way is via the “Service Desk”
Servicedesk@ecmwf.int
+44 (0)1189 499303

Or

You can tweet @ECMWF

Or

Email or call any of your contacts at ECMWF any time with feedback!

2. How do you fit into this as a user of ECMWF data?

We gather a lot of useful feedback through our Member State visits:

Montenegro and Serbia February 2020

Lithuania and Lativa November 2019

2. How do you fit into this as a user of ECMWF data?

Every other year (next will be 2021) we also collect reports on the application and verification of ECMWF's forecast products from Member & Cooperating states: "The Green Book"

Application and verification of ECMWF products 2019- Denmark

H Gisselø, B Hansen Sass, K Skovgaard Madsen

2019, Green Book 2019, Book Chapter, ECMWF.

19194-application-and-verification-ecmwf-products-2019-denmark.pdf

Application and verification of ECMWF products 2019- Austria

Wittmann C, Atencia A, Dabernig M, Hirtl M, Kann A, Maurer C, Skomorowski P

2019, Green Book 2019, Book Chapter, ECMWF.

19191-application-and-verification-ecmwf-products-2019-austria.pdf

2. How do you fit into this as a user of ECMWF data?

We also have a team of analysts at ECMWF who analyse our output and produce a Daily Report – with a weekly “Weather Discussion”

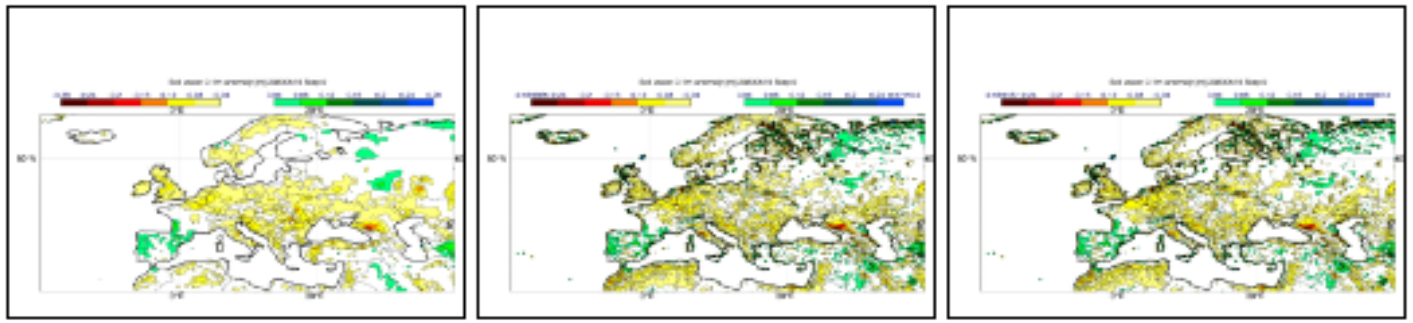
4B. Soil Moisture ☑ *o* ☑ *e*

After the very wet February, the rest of the spring has been very dry in UK and in other parts of North-we
The o-suite and e-suite plots look noiser as the land specifications are different to the climate data. Anyv

The pattern with a dry anomaly in north-western Europe and wet anomaly in the south-west is very diffe
two months and the observation climatology for a box over southern UK (left), north-western Europe (mi
conditions before. The current conditions could play a role for the extended-range anomalies we current

One question one could ask is the connection between the precipitation anomalies and the Euro-Atlanti
flow to the regime with highest projection among the 4 regimes (a bit simplified explanation). The plots

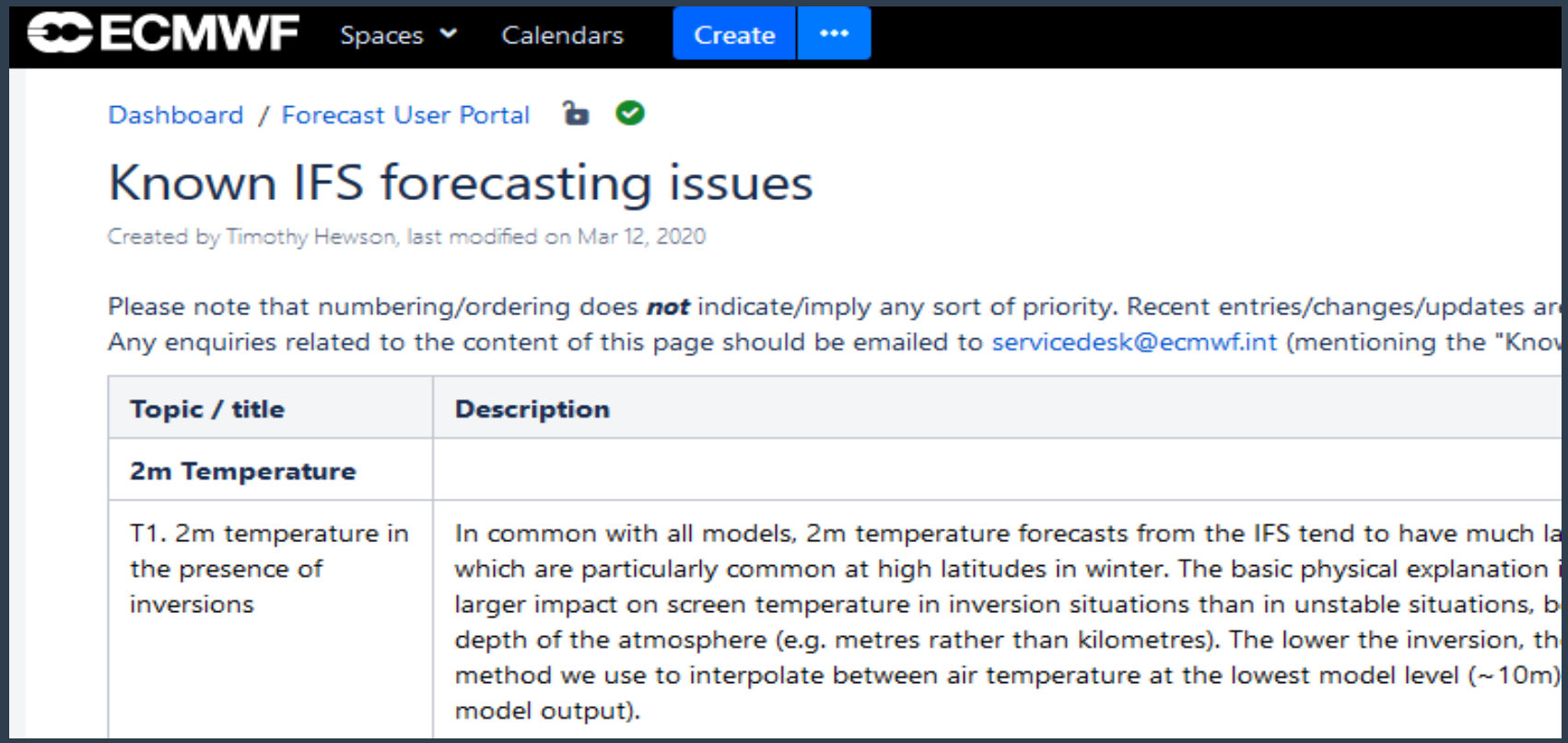
In the final plot I try to diagnose the variance explained by the different regime definitions. By condensir
and is able to explain more of the variance. A difficulty in this comparison is that we normally only use th



2. How do you fit into this as a user of ECMWF data?

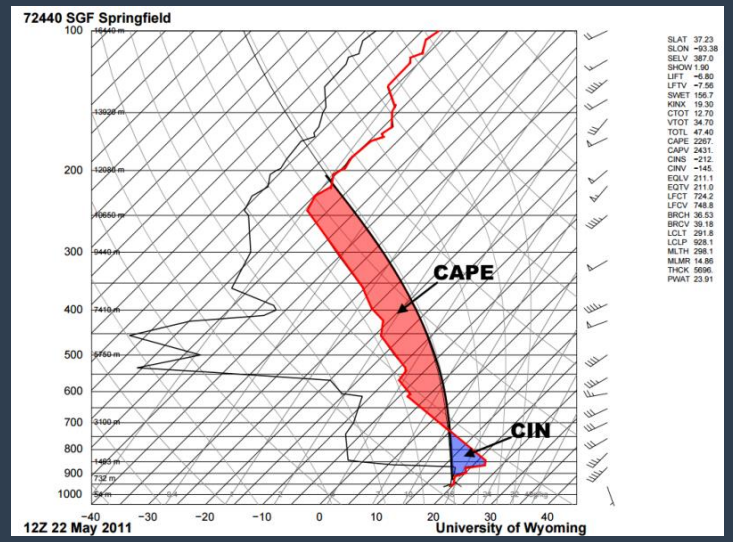
ECMWF have a Quarterly Evaluation and Developments (QED) internal meeting where model issues are also discussed.

All of these feed into the “Known IFS forecasting issues” page (https://confluence.ecmwf.int/display/FCST/Known+IFS+forecasting+issues)



2. How do you fit into this as a user of ECMWF data?

Examples of User feedback making improvements to operations:



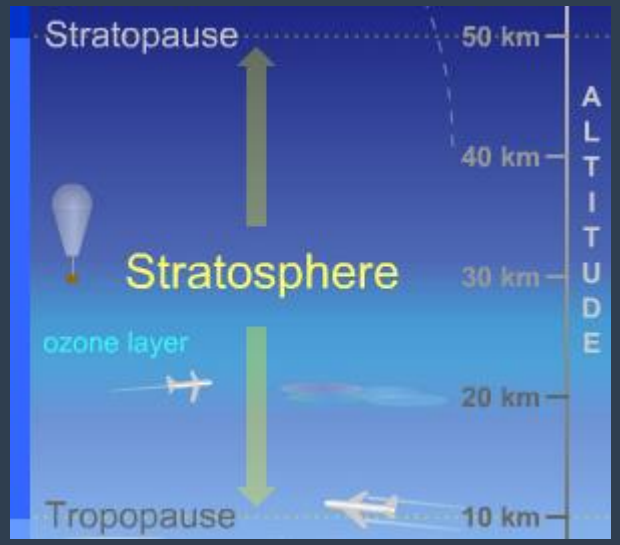
ECMWF + ESSL

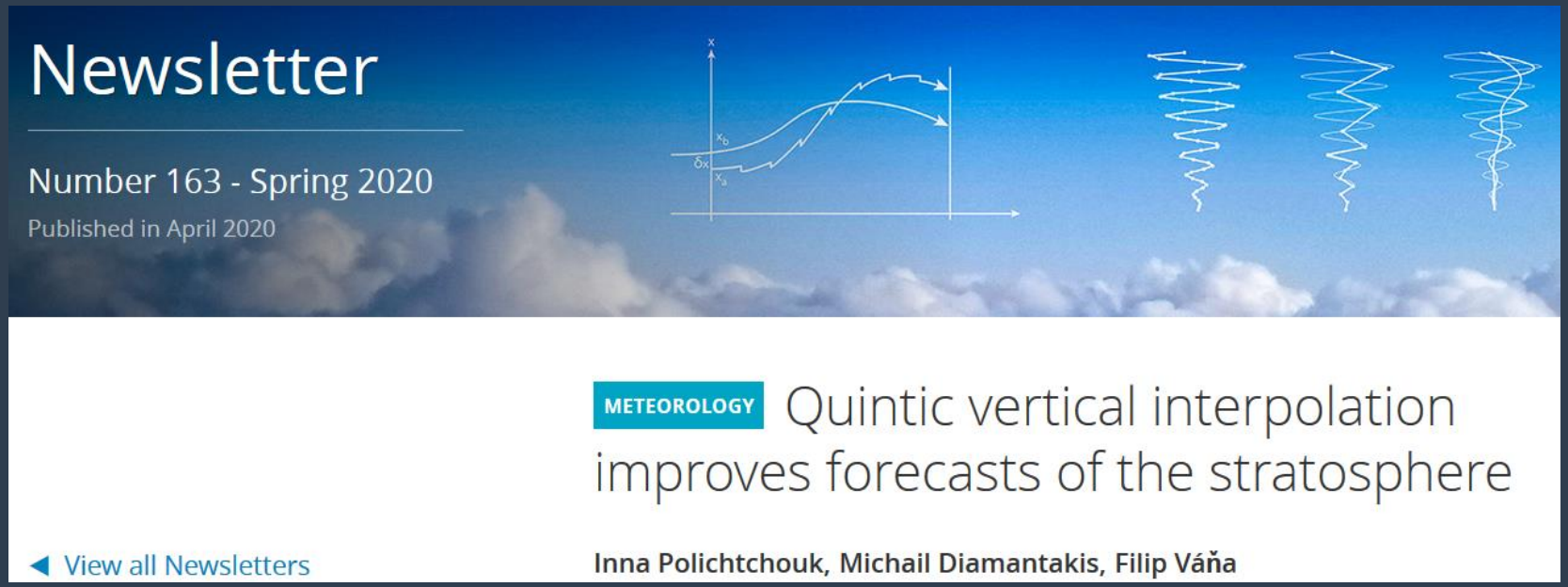
Improvements to CIN and CAPE in cycle 47r1 (30th June 2020)

Please see Ivan Tsonevsky's presentation at the #UEF2020 "Speaker's Corner"
12:40-13:45 UTC
Wednesday 3rd June 2020

2. How do you fit into this as a user of ECMWF data?

Examples of User feedback making improvements to operations:





https://www.ecmwf.int/en/newsletter/163/meteorology/quintic-vertical-interpolation-improves-forecasts-stratosphere

Time for you to get involved

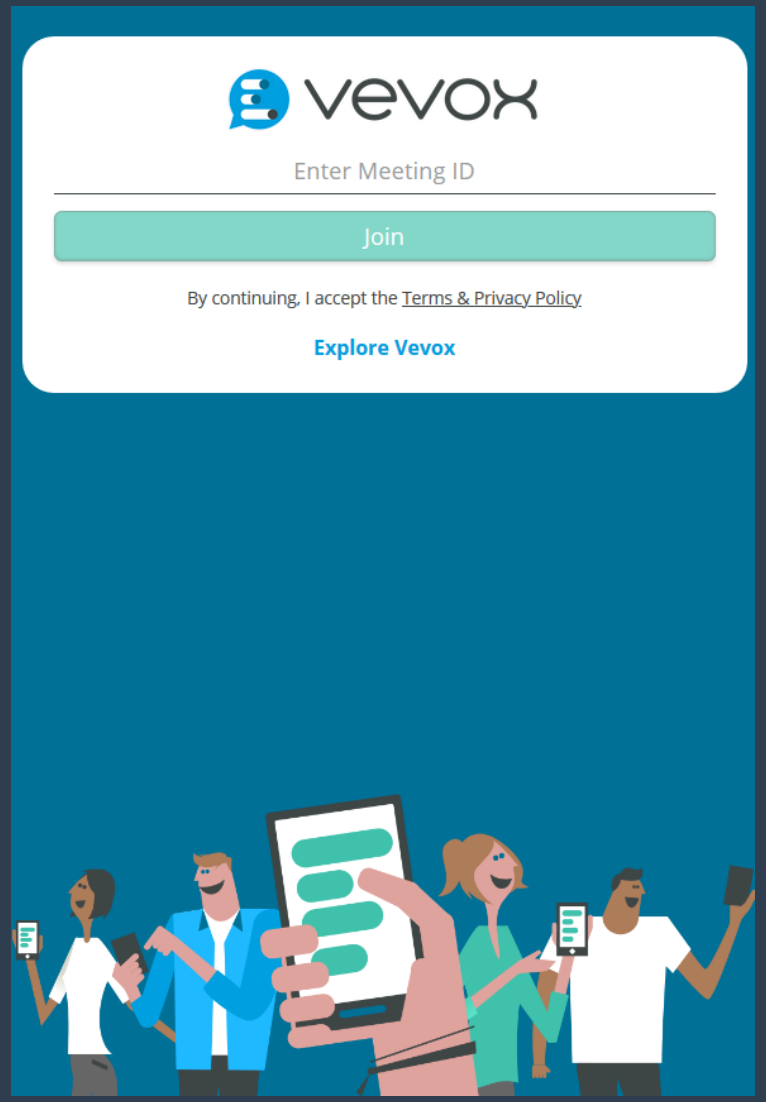
Live poll!

On your smart phone or computer, please go to:

VEVOX.app

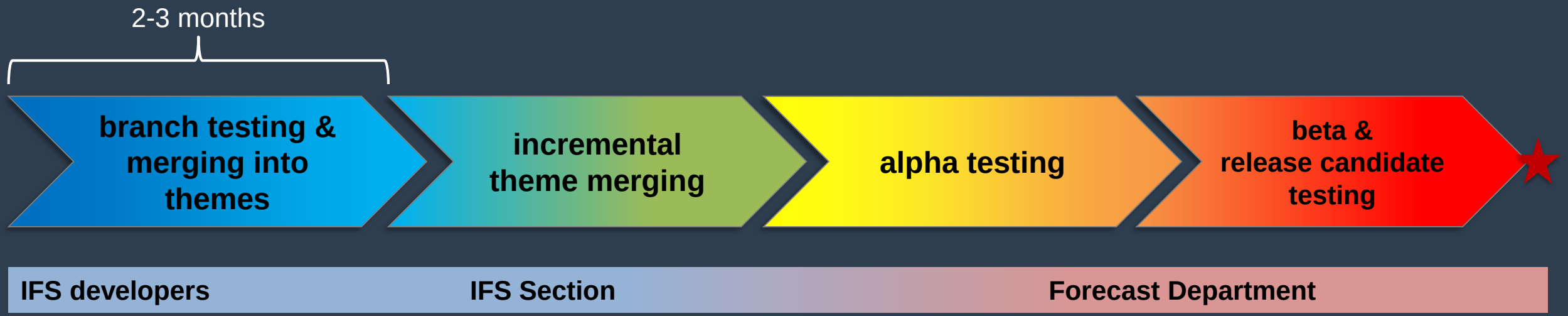
Put in the Meeting ID:

199-103-393



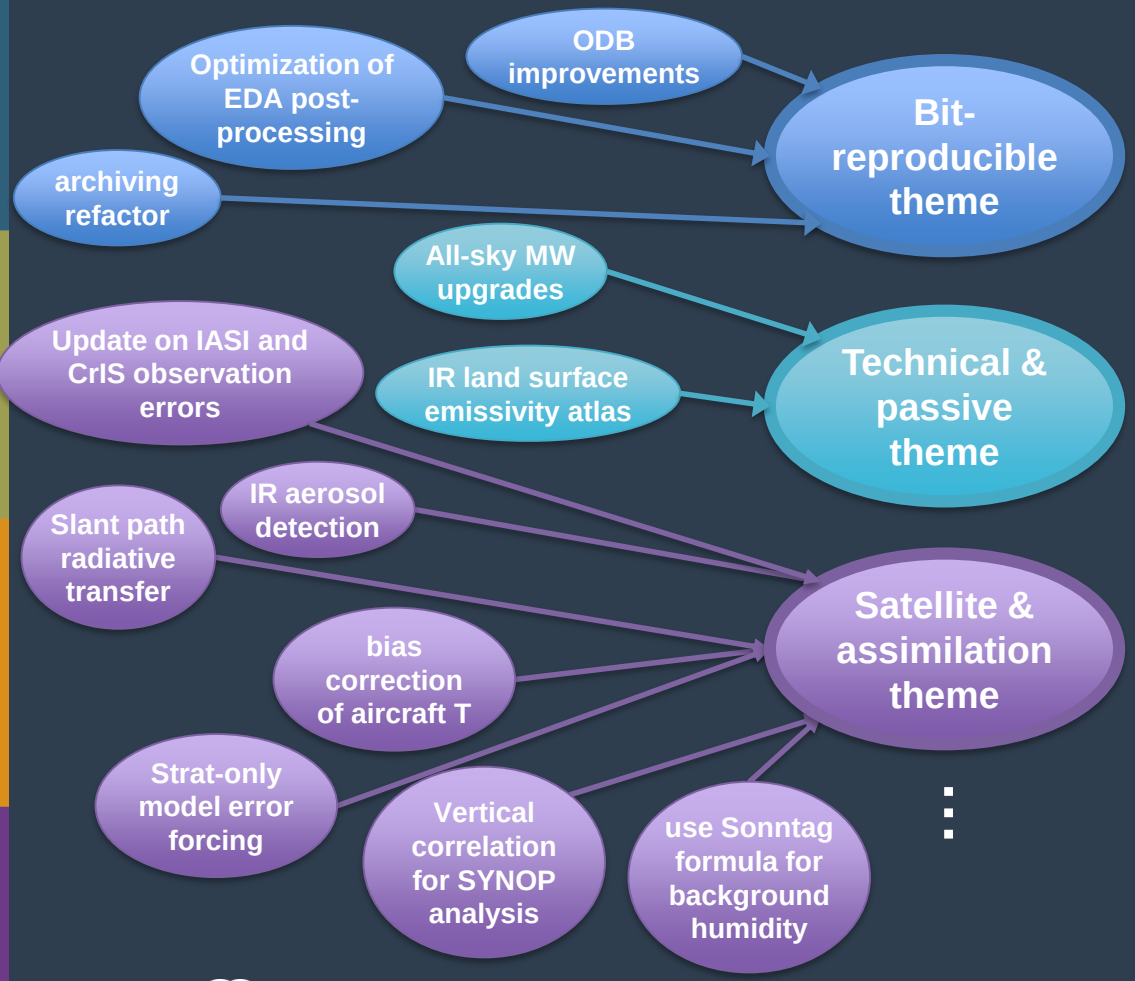
3. Overview of the R2O process at ECMWF

The road to implementation: timeline

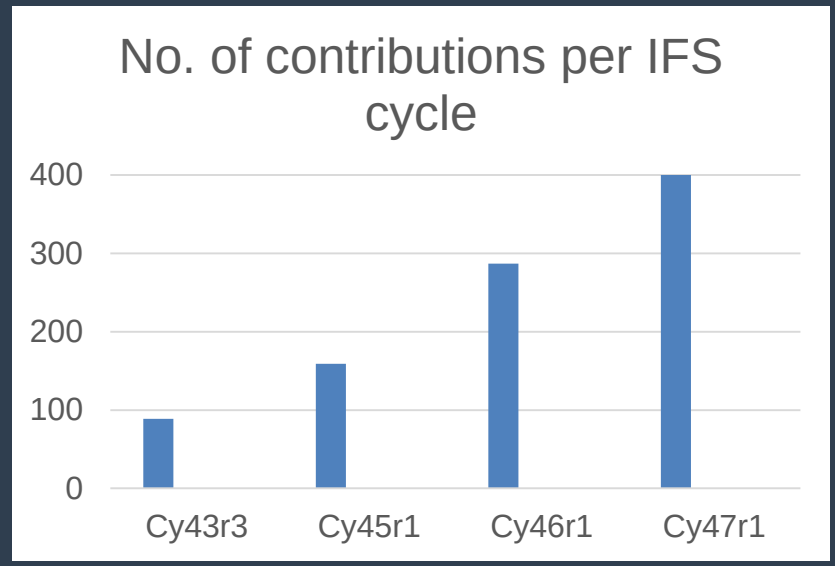


branch testing & merging into themes → incremental theme merging → alpha testing → beta & release candidate testing

IFS developers | IFS Section | Forecast Department



Cycle	No. of contributions
43r3	89
45r1	159
46r1	287
47r1	400 !!!



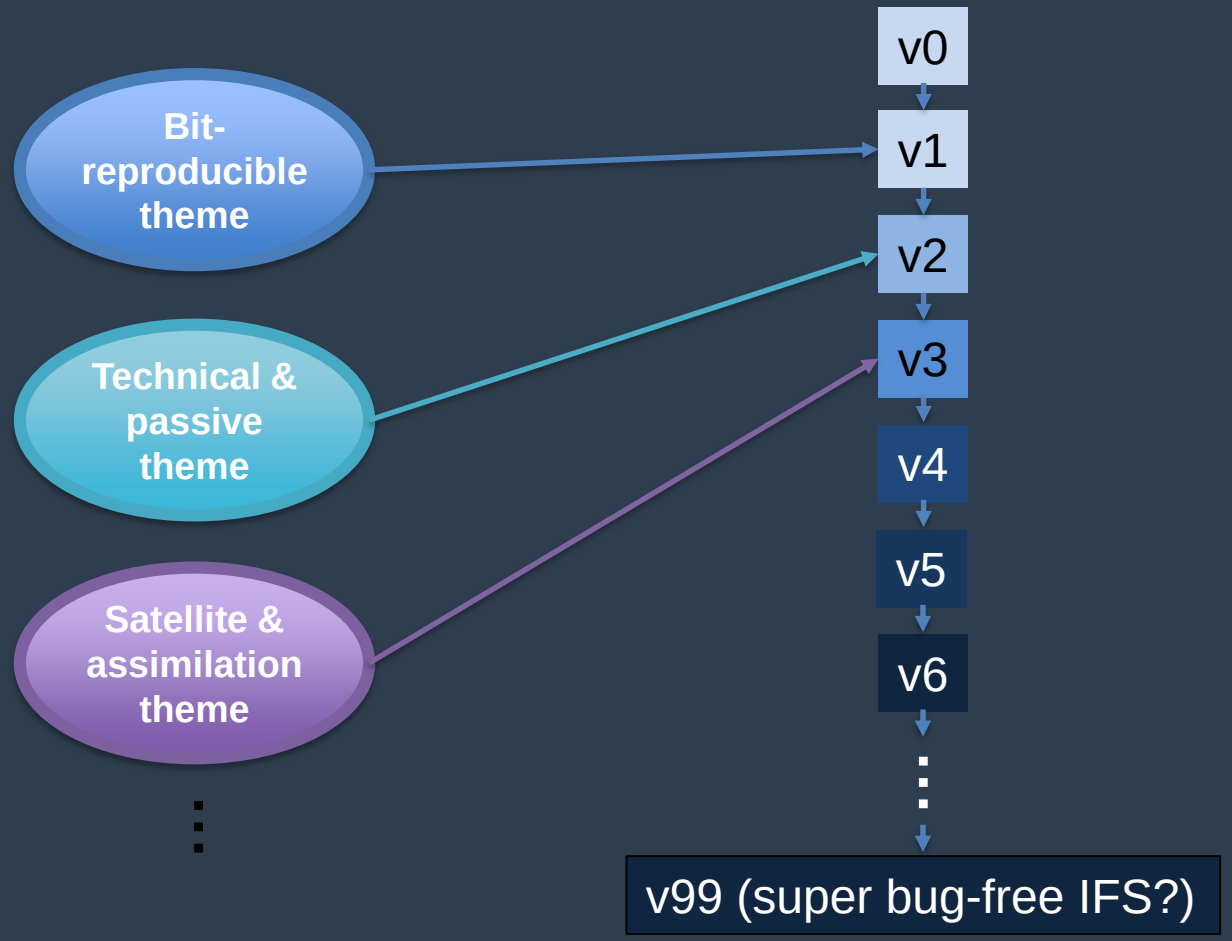
branch testing & merging into themes

incremental theme merging

alpha testing

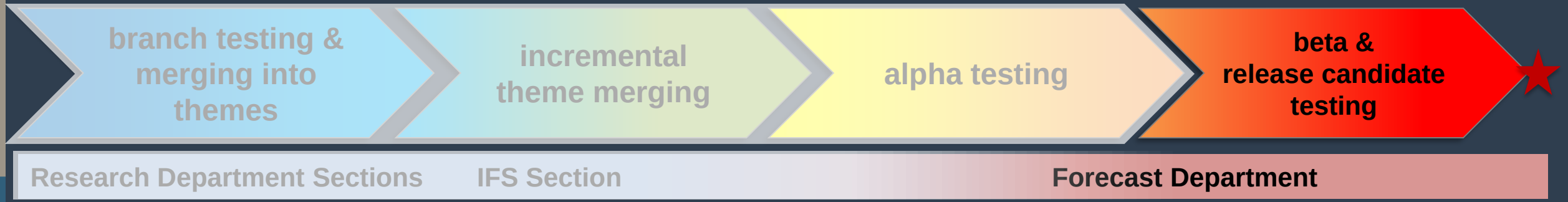
beta & release candidate testing

IFS developers | IFS Section | Forecast Department



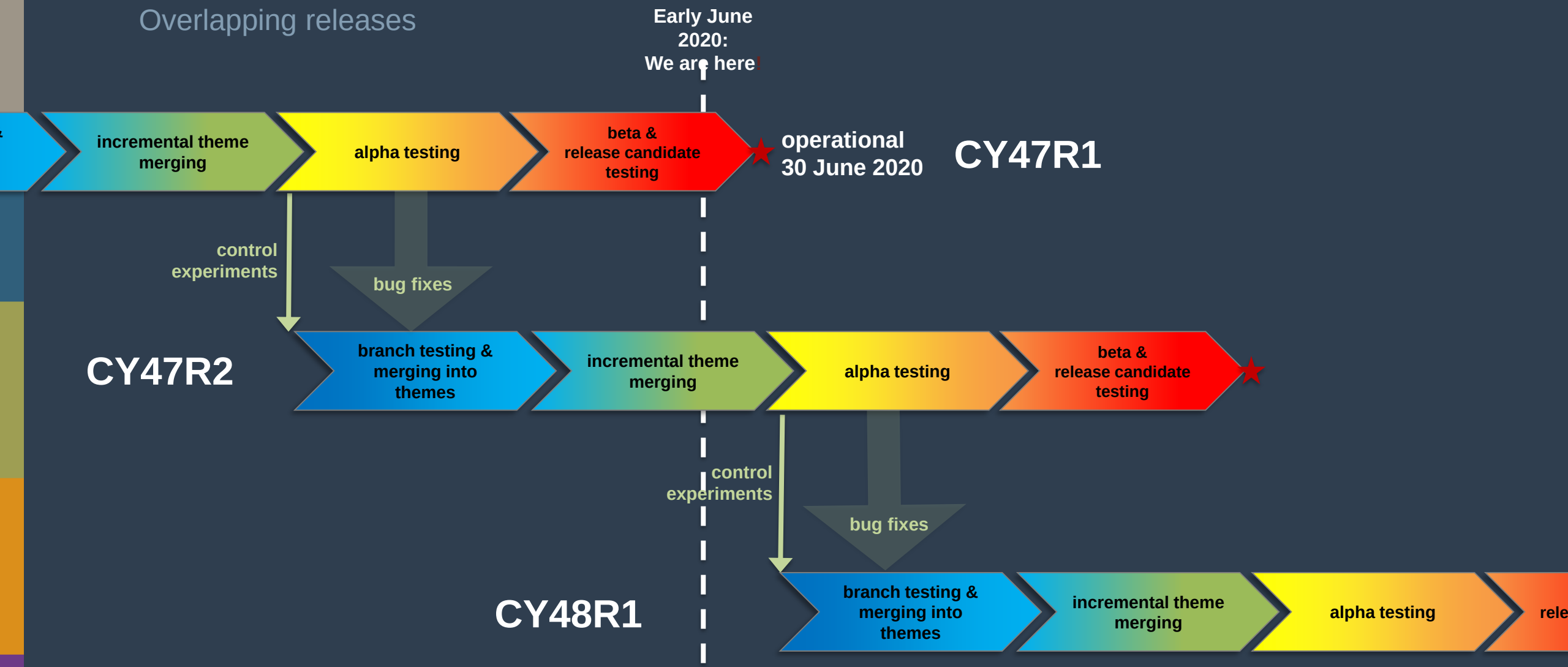
ECMWF

- **Full-resolution testing and EDA**
- Some contributions only tested at this stage
- Bug fixes
- Gradual handover from Research to Forecast department



- E-suite – full-system end-to-end testing in operational mode
- Decision & announcement to external users
- Data available to external users
- Real-time testing
- Frozen parallel run (1 or 3 months)
- Product generation & dissemination

Overlapping releases



Improvements to date

- Modernised development process and tools

- More formalised process
  - defined roles & decisions
  - minimum & standard tests

- Involve Forecast Department much earlier

- Improved communication
  - content, progress & interactions
  - central place for docs & “audit trail”

- Continuous improvement

Improvements to date - continued

- Continuous integration for IFS has been introduced
  - Bit-identical branches merged any time – no need to wait for a cycle release
  - Tested nightly in a wide range of full research experiment configurations (ENS, HRES, extended-range, CAMS, ocean, etc.)

4. Improvements planned for the future of R2O at ECMWF

- Develop a “d-suite” to do full end-to-end testing, nightly – cheap, but complete, e-suite
- This builds on the continuous integration testing for IFS and all the other individual software packages in the end-to-end forecast chain
- We still aspire to do more frequent cycles; make cycles less complex (fewer changes)
- The upside to users is that fixes and improvements get into operations quicker than otherwise
- The downside is that each cycle upgrade implies a lot of work for forecast users too, to adapt to our changes
- A middle way, which deserves investigation, is to do more frequent minor updates (Cy47r1.1, Cy47r1.2, Cy47r1.3, …) between major cycles
  - Minor updates would, by design, imply minimal work for the majority of users
  - We already do this for new observations, for example, critical bug fixes, infrastructure changes (but not versioned)
  - Extend to other types of improvement to allow the delivery of these to be spread out rather than delivered in big bangs

Time for you to get involved again

Live poll!

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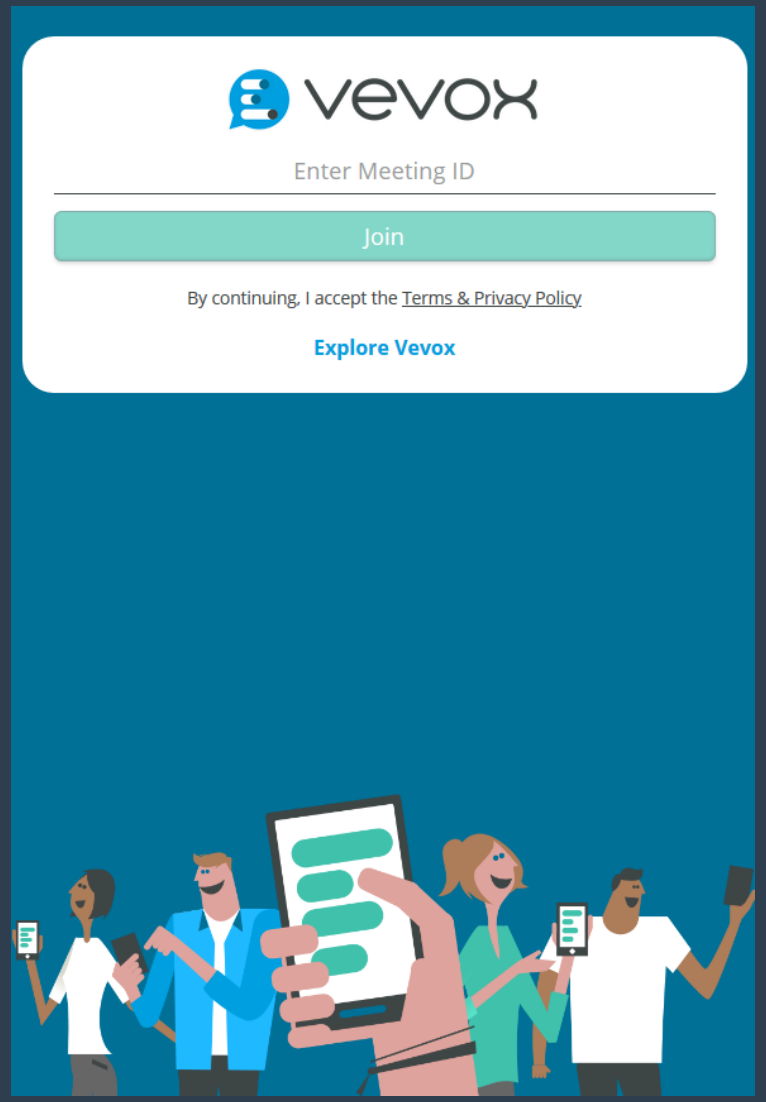


5. What can we learn from your organisation?

We would like to learn from you:

- Can we benefit from aspects of your organisation's R2O process?
- Would you like to connect with us to learn more from each other?

How do you get in touch…….?

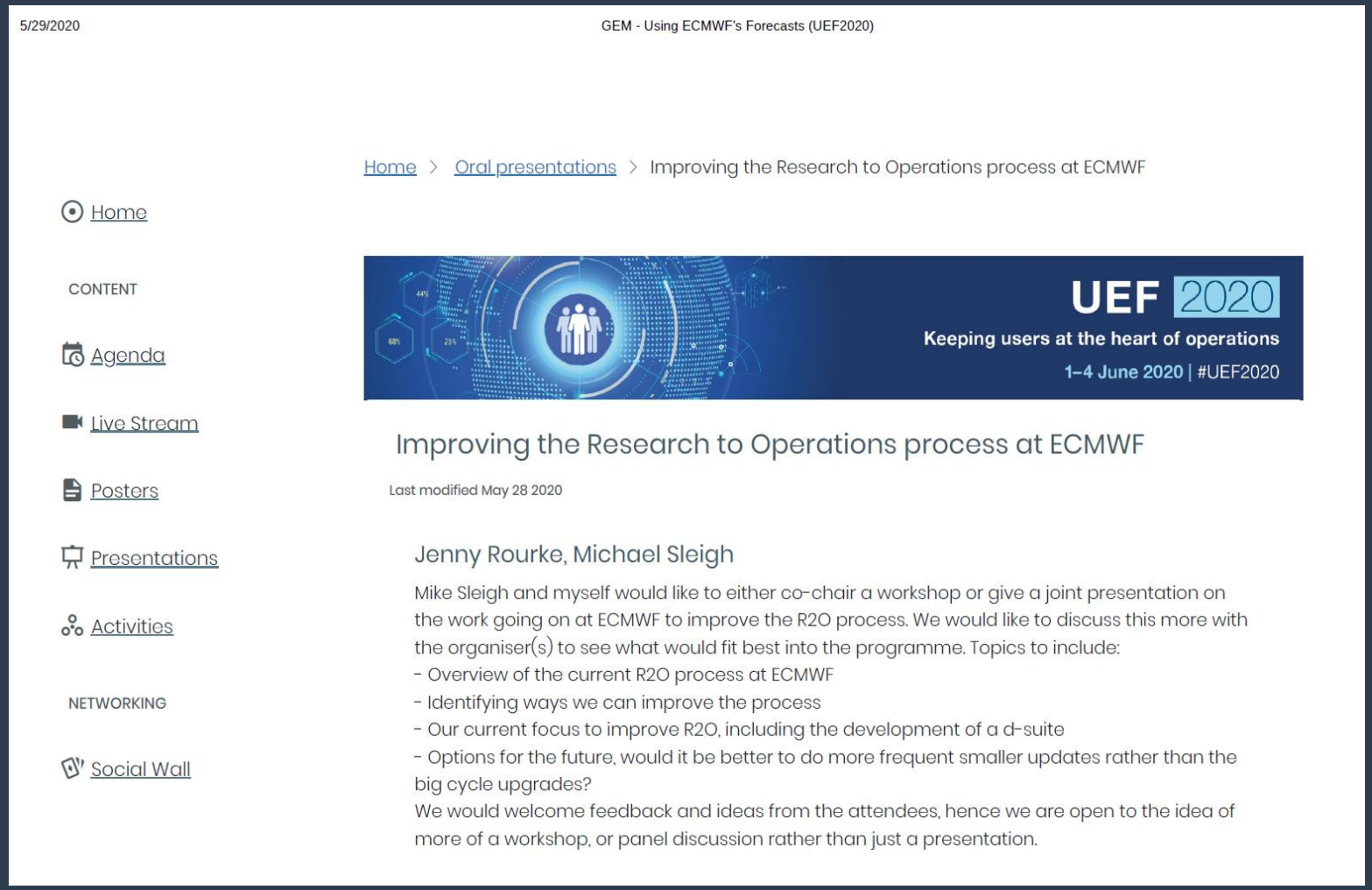
5. What can we learn from your organisation?

We would like to learn from you:

- Please go to our oral presentation page on the UEF website → and leave comments at the bottom so that we can gather your feedback and respond

Or email us directly:

Jenny.rourke@ecmwf.int &
Michael.sleigh@ecmwf.int



Happy to take your questions