Met Office
Consortia Presentation

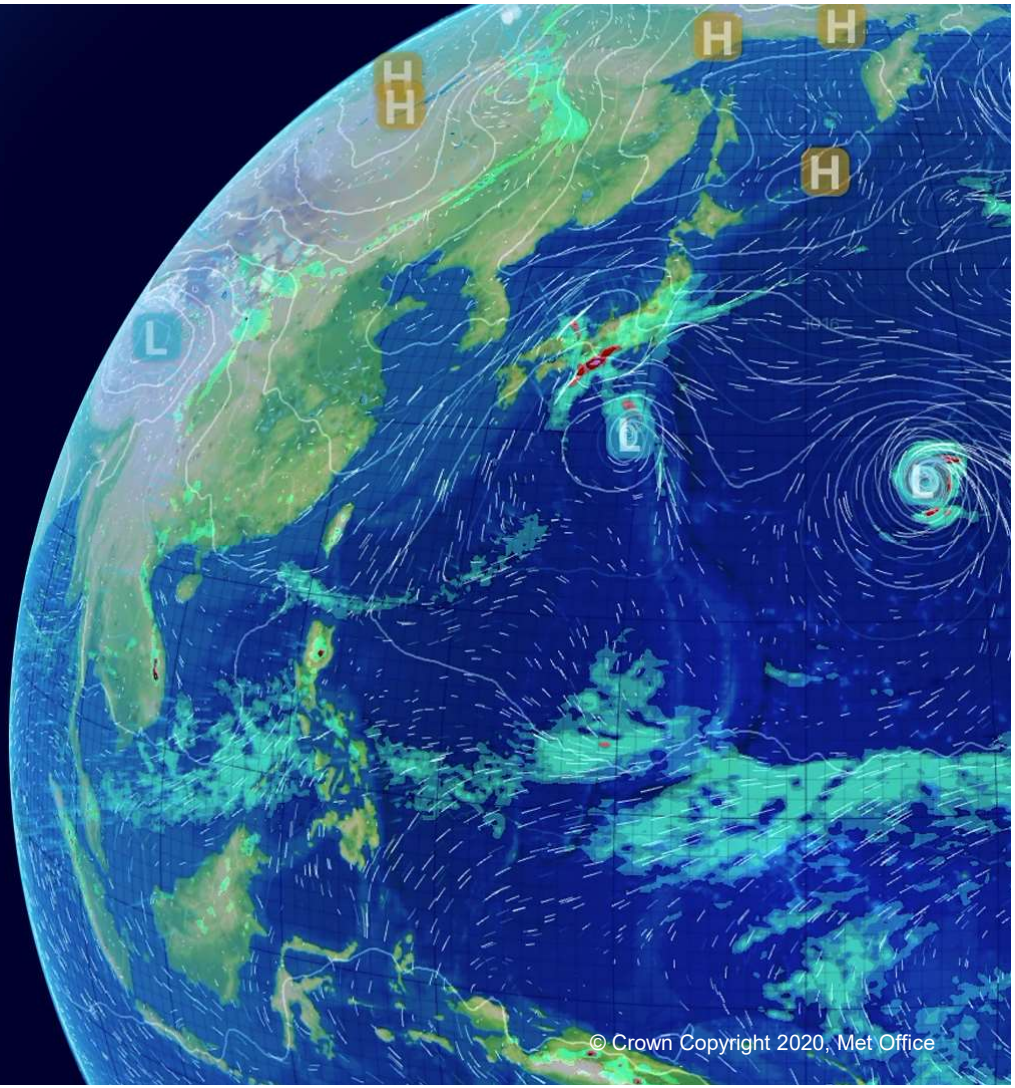
42nd EWGLAM and 27th SRNWP meeting

28th September 2020

Mike Bush

Content by many colleagues and collaborators, but special thanks to:

Bruce Macpherson, Cristina Charlton-Perez, Gareth Dow, Breo Gomez, Christine Johnson, Marion Mittermaier, Aurore Porson, Adrian Semple



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Talk structure

- General consortia (UM Partnership) news
- PS43 (went Operational on 4th December 2019)
- PS44 (due to go Operational ~November 2020)
- Future plans

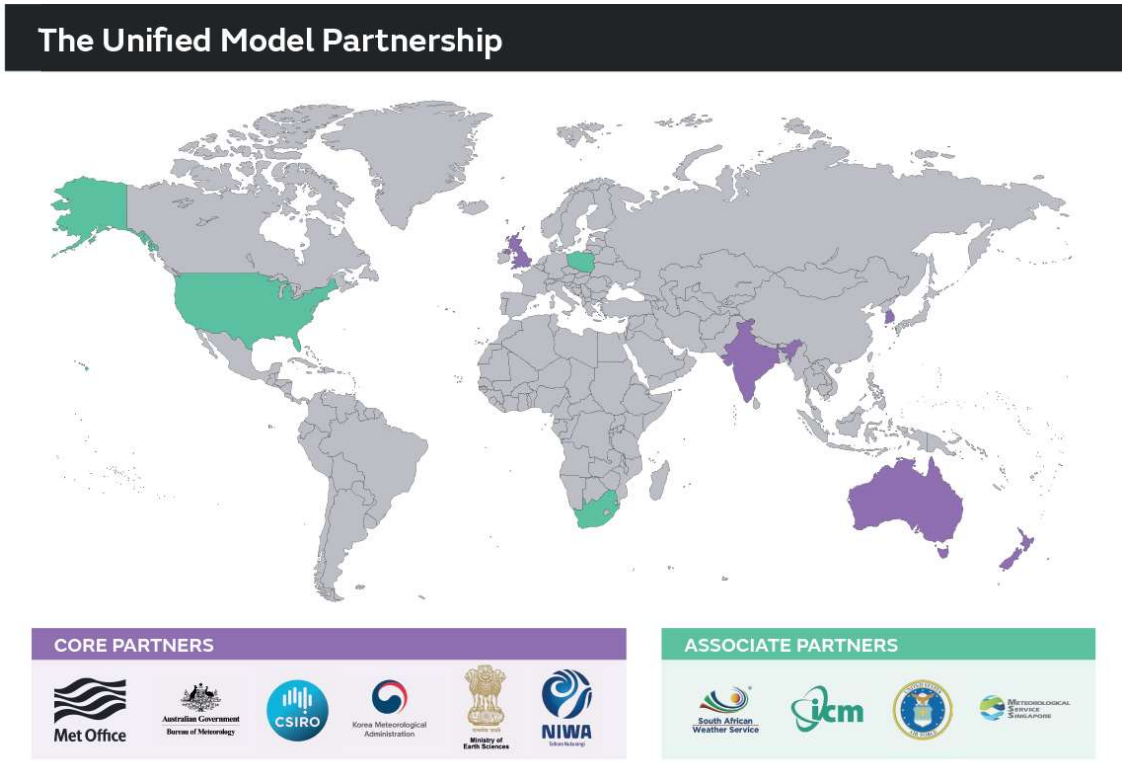
UM partnership 2020

Member news

- SAWS confirmed as associate member to 2025

Senior staff moves

- Gilbert Brunet: BoM Chief Scientist
- Bertrand Timbal: CCRS Singapore to BoM
- Dale Barker: Met Office to CCRS



10 year research strategies

- Met Office and the Bureau of Meteorology have published their 10 year research strategies:
  - https://www.metoffice.gov.uk/research/approach/research-and-innovation-strategy
  - http://www.bom.gov.au/research/
- Relevant Met Office Research & Innovation themes:
  - Path to High Resolution
  - Producing and Exploiting Ensembles
  - Capturing Environmental Complexity
  - Seamless Environmental Prediction
  - Next Generation Modelling Systems
- Relevant Bureau of Meteorology objectives:
  - Customised forecasts and warnings: more localised, timely and better
  - Reliable and trusted forecasts: enhanced assimilation
  - Earth System numerical prediction capability
  - Seamless weather and climate insights

Meetings

Highlights 2020:

- 4th Convective Scale modelling workshop Boulder (Jan)
- EMMDA workshop Delhi (Feb)
- CylcCon development workshop Wellington (Feb)
- NASA LIS JULES tutorial (Mar)
- 2020 UM user workshop (June - virtual)

Presentations: All at SharePoint UM Partnership Workshops UMUW 2020 Mini Series

Teams Q&A sessions: The live Q&A discussions had their own Microsoft Teams "Channel". Conversations and questions with the chat feature on the Channels were chaired 9-10am UTC on the day of the session

Feedback survey: A Microsoft form survey was made available after the workshop: the result is that another virtual workshop is being planned for November 2020!

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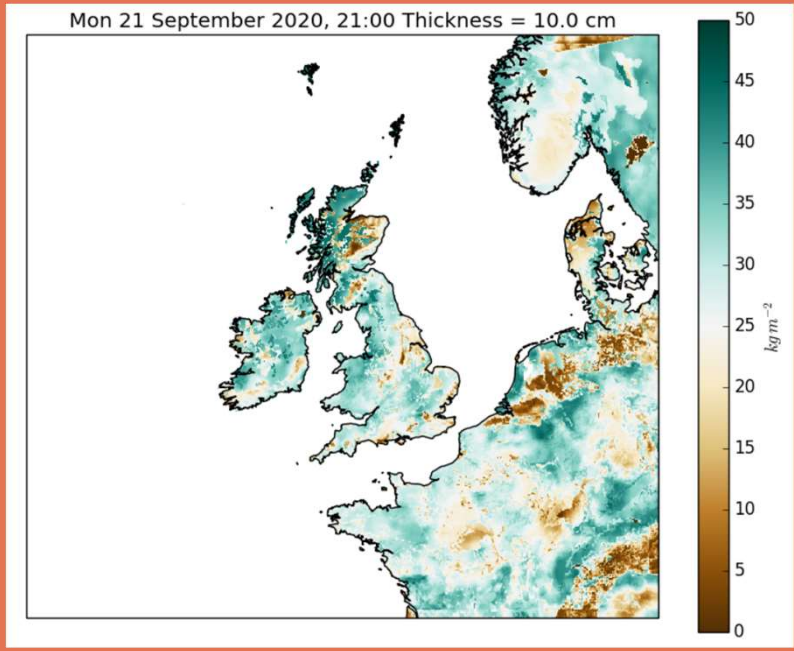
PS43 The introduction of the UKV's own hourly soil moisture assimilation

- The introduction of the UKV's own hourly soil moisture assimilation (via a simplified Extended Kalman Filter (SEKF) technique).
- This replaces the previous daily interpolation of global soil moisture analyses followed by free-running soil moisture evolution.
- The SEKF uses the JULES land surface model to help derive increments to soil moisture from ASCAT satellite observations and screen-level errors in temperature and humidity.



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PS43

New En-4DEnVar scheme introduced to the global ensemble:

The main goal of PS43 is to introduce the new En-4DEnVar scheme to the global ensemble. En-4DEnVar provides an ensemble of initial conditions which are generated through their own data assimilation cycles and provides a more sophisticated and stable method of producing probabilistic forecasts than the previous operational scheme.

Its introduction leads to better ensemble probability forecasts with improved spread and reduced forecast errors. Because the resulting ensemble spread is also used in the assimilation stage of the deterministic Global Model, the improvements introduced here also have a positive impact on the initial analysis of the deterministic Global Model.

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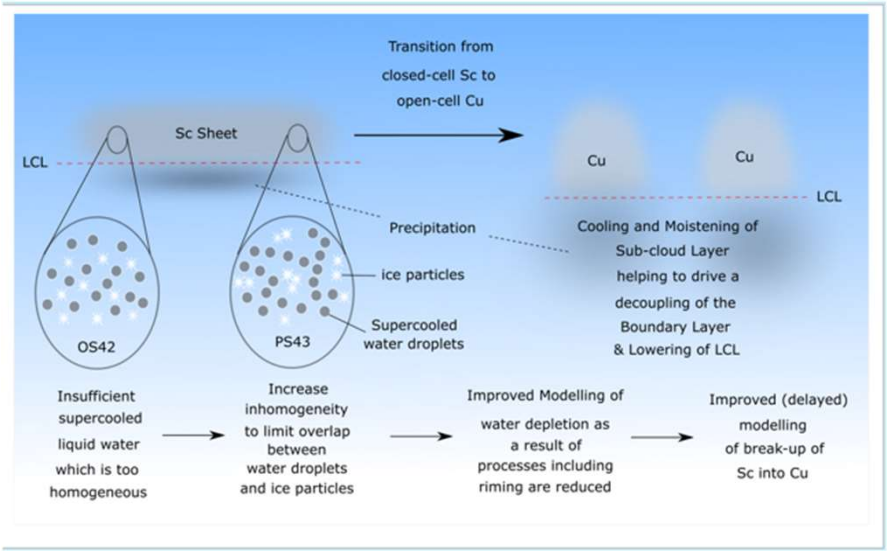
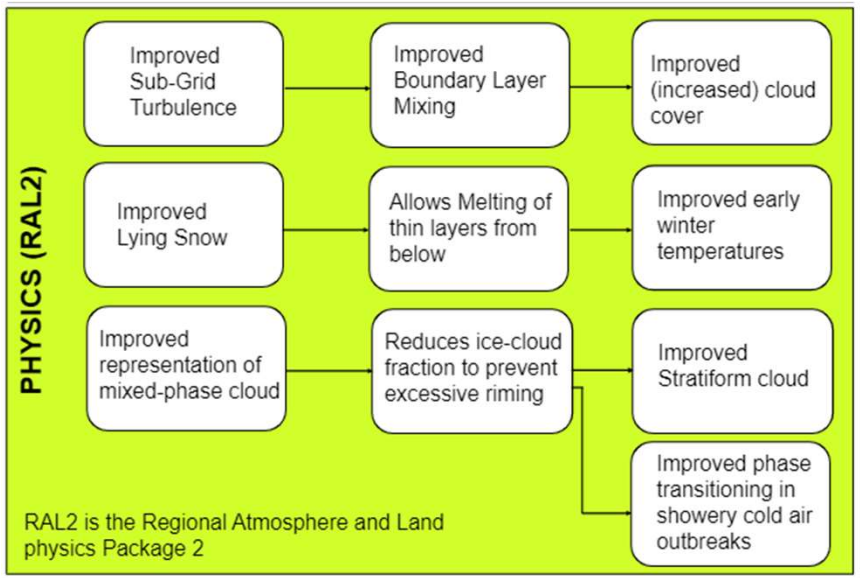
PS43

- **Introduction of the Regional Atmosphere and Land 2 (RAL2) physics package.**





Abel et al. (2017) The Role of Precipitation in Controlling the Transition from Stratocumulus to Cumulus Clouds in a Northern Hemisphere Cold-Air Outbreak, J. Atmos. Sci. 74, 2293-2314 (2017)

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PS44 UKV Land Surface Data Assimilation (LSDA) system

Replaces use of near-surface temperature increments from atmospheric DA applied to land-surface with direct soil-, skin- and snow-temperature analyses

Permits LSDA temperature increments over all the land surface of the model including frozen and snow-covered areas.

Observation errors have been reviewed.

New bias correction for satellite soil wetness product (ASCAT). Improvements when observed regime is far from its climate mean. e.g. dry summer over Europe in 2018, reduced cool bias in maximum temperatures

New snow assimilation Optimal Interpolation (OI) scheme. Run once daily (06 UTC cycle). Observations used are ground station snow depth and state of ground reports and MSG-SEVIRI snow cover product from the EUMETSAT H-SAF (H31).

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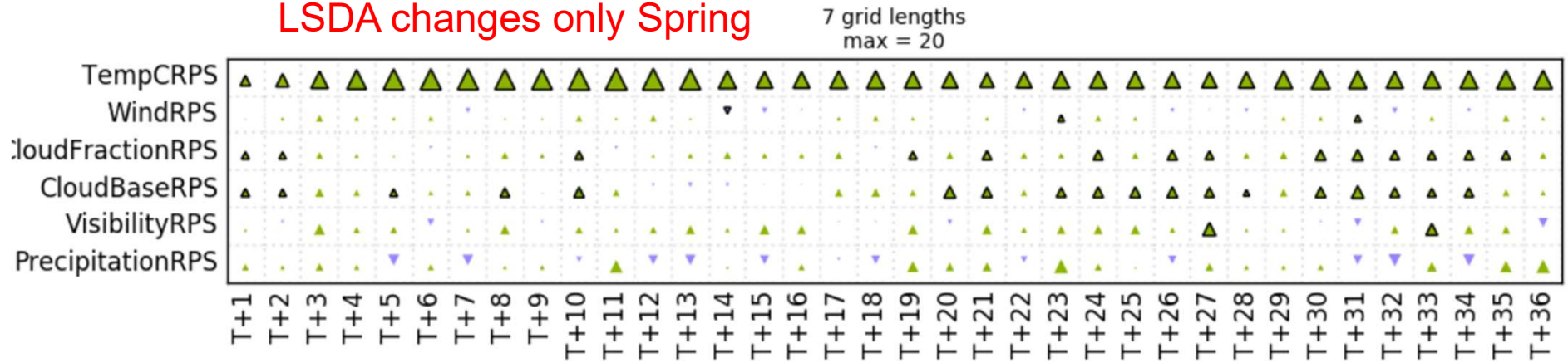
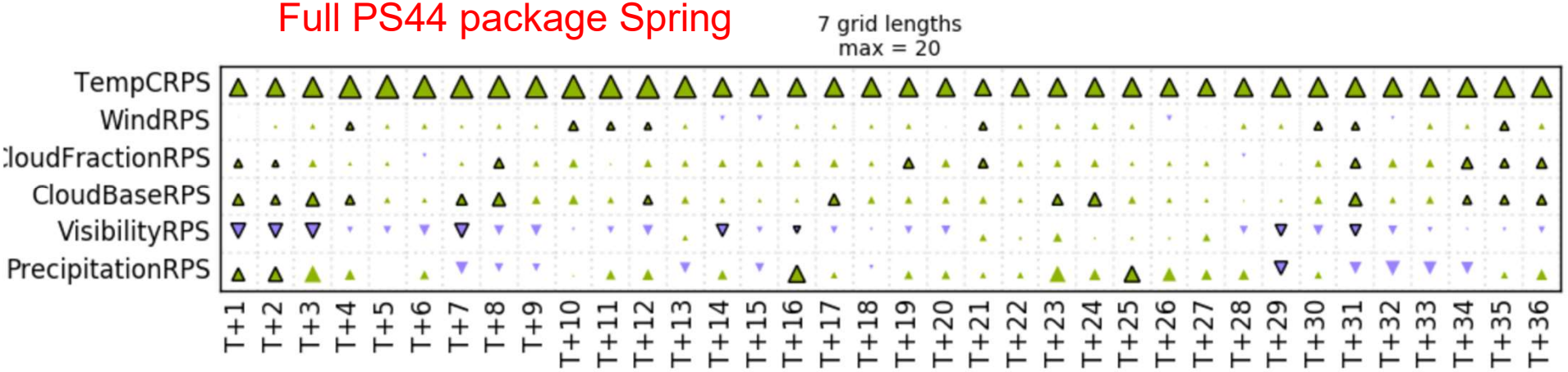
PS44 UKV trials: Impact on forecast skill (01/04/20 - 31/05/20).

LSDA changes only Spring



Full PS44 package Spring



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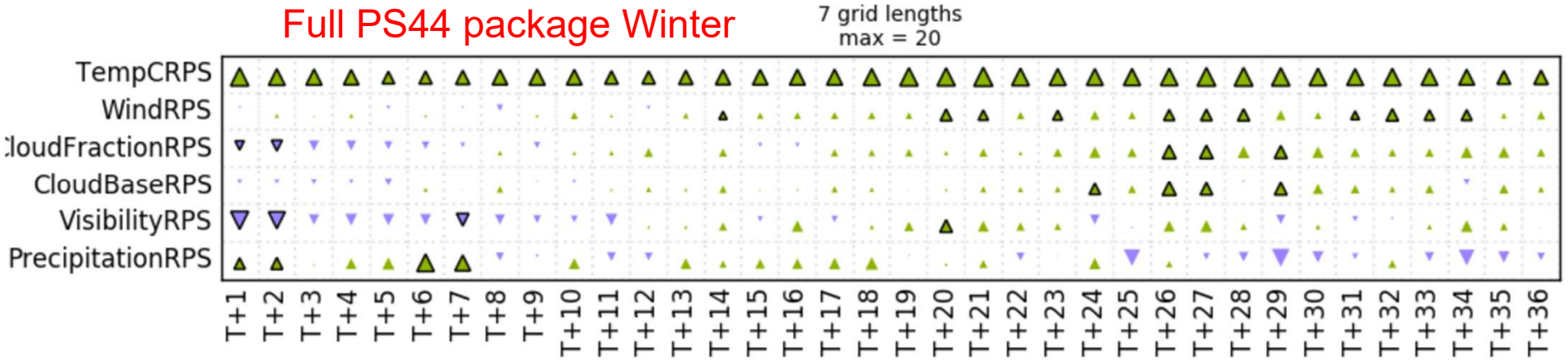
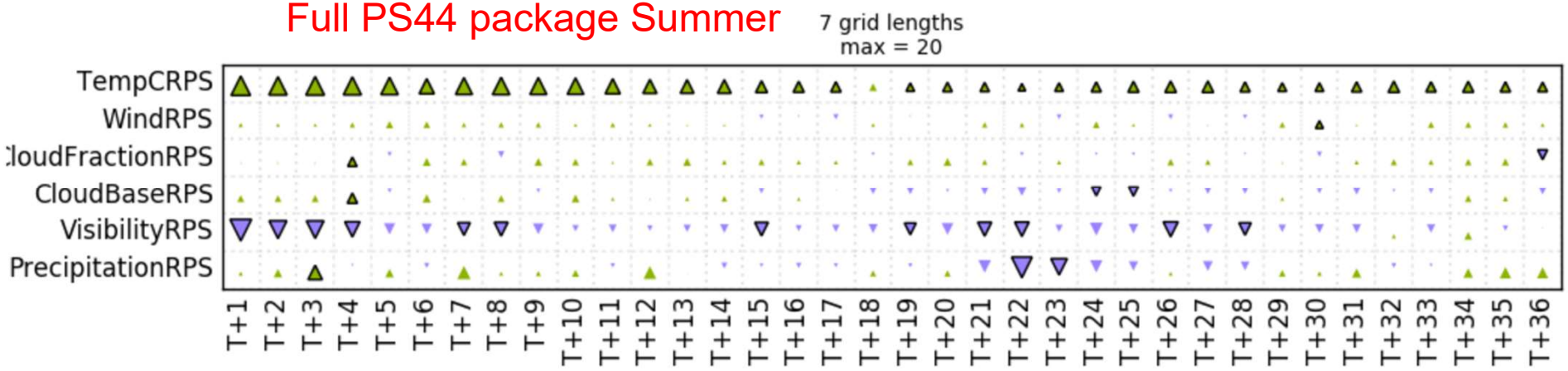
PS44 UKV trials: Impact on forecast skill (01/12/18 - 17/01/19, 15/06/19 - 19/08/19) .

Full PS44 package Winter



Full PS44 package Summer



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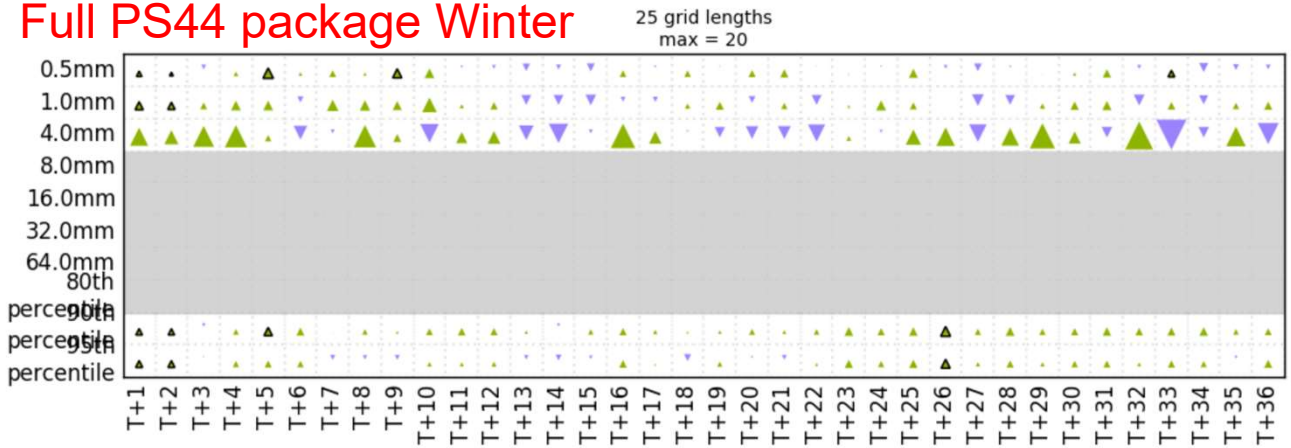
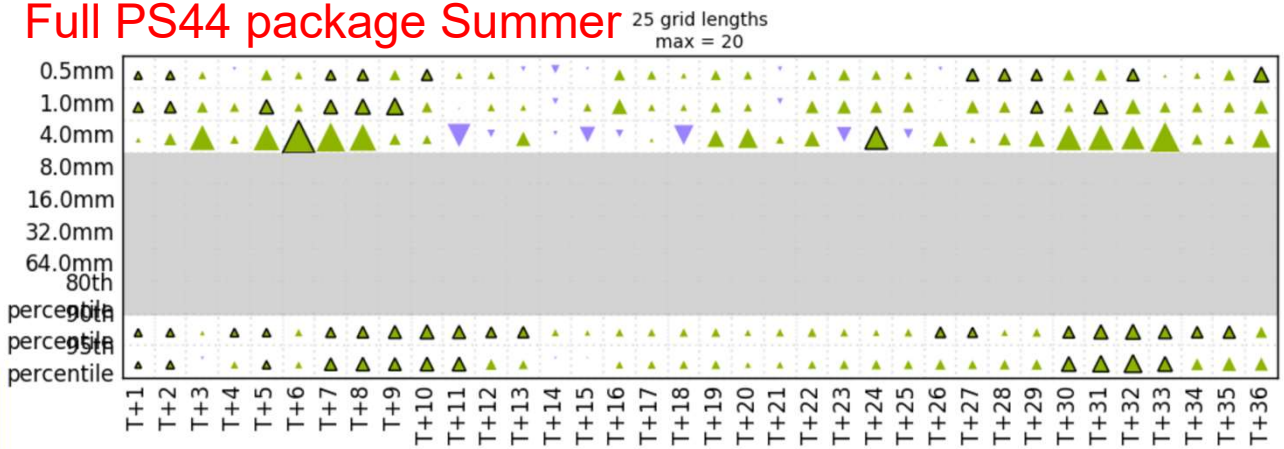
PS44 UKV: Impact on Hourly precipitation FSS (01/12/18 - 17/01/19, 15/06/19 - 19/08/19)

Larger improvement in Summer than Winter

Full PS44 package Winter



Full PS44 package Summer



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PS45

Current timescales: Start trials Autumn 2020, to go operational in Autumn 2021

Changes to be trialled:

- Time-varying SSTs. Currently, the UKV has a constant SST (obtained from OSTIA) set at the 09Z cycle. We are proposing to update the forecast hourly with SSTs obtained from daily AMM15 ocean model forecasts (by creating an ancillary of hourly SST up to D+5 days and then using this ancillary to update the SST throughout the run).
- Data assimilation: Two major changes:
- 1) Radar reflectivity assimilation
- 2) Add large-scale glm-ukv differences to the background trajectory in UKV 4DVar analyses. Recent work has suggested that UKV forecasts might be improved by constraining its larger scales to be closer to those of the driving global model forecasts. Currently, these scales are only constrained at the lateral boundaries.

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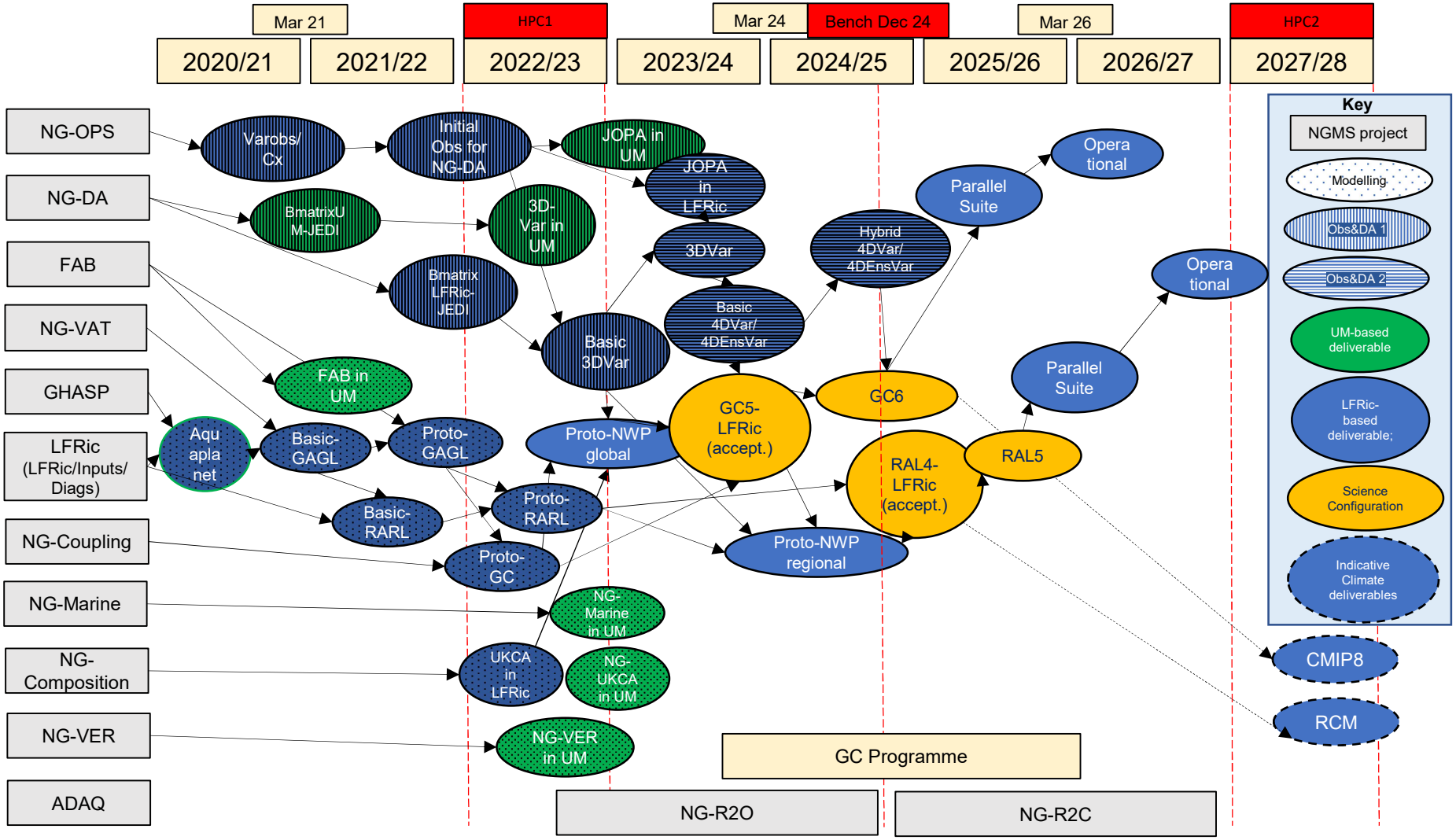
PS46 and PS47

PS46 Current timescales: First half of 2022

- Upgrade suites to Cylc8 (technical upgrade)

PS47 Current timescales: Second half of 2022

- Port of models to new HPC


Mar 21
HPC1
Mar 24
Bench Dec 24
Mar 26
HPC2
2020/21
2021/22
2022/23
2023/24
2024/25
2025/26
2026/27
2027/28
NG-OPS
NG-DA
FAB
NG-VAT
GHASP
LFRic (LFRic/Inputs/ Diags)
NG-Coupling
NG-Marine
NG-Composition
NG-VER
ADAQ
Varobs/ Cx
Initial Obs for NG-DA
JOPA in UM
JOPA in LFRic
BmatrixU M-JEDI
3D-Var in UM
3DVar
Hybrid 4DVar/ 4DEnsVar
Parallel Suite
Opera tional
Bmatrix LFRic-JEDI
Basic 3DVar
Basic 4DVar/ 4DEnsVar
Opera tional
FAB in UM
Parallel Suite
Aqu apla net
Basic-GAGL
Proto-GAGL
Proto-NWP global
GC5-LFRic (accept.)
GC6
RAL4-LFRic (accept.)
RAL5
Basic-RARL
Proto-RARL
Proto-NWP regional
Proto-GC
NG-Marine in UM
UKCA in LFRic
NG-UKCA in UM
NG-VER in UM
CMIP8
RCM
GC Programme
NG-R2O
NG-R2C
Key
NGMS project
Modelling
Obs&DA 1
Obs&DA 2
UM-based deliverable
LFRic-based deliverable;
Science Configuration
Indicative Climate deliverables

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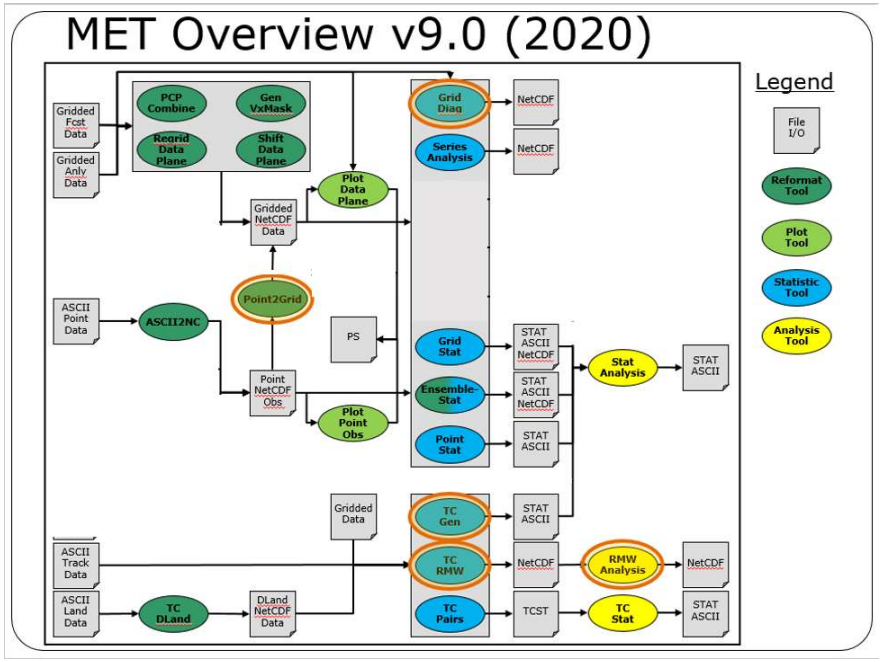
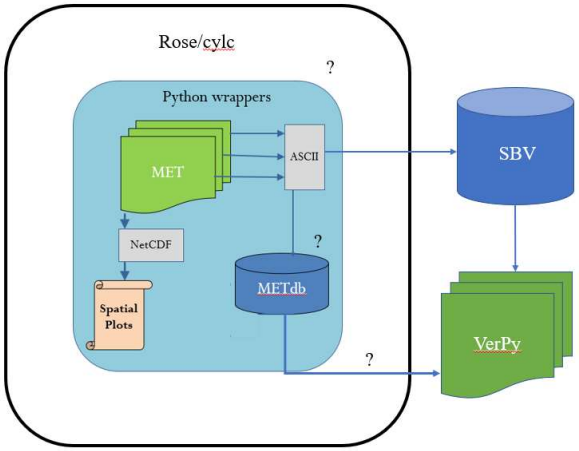
NG-Ver



Replacement of VER system with MET/METplus (open source on github).

Two-year contract with NCAR now in place.



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Timescales (tentative - to be confirmed)

Mar 2021	Mar 2022	Mar 2023	Mar 2024	Mar 2025	Mar 2026	Mar 2027	Mar 2028
Basic RA-RL	Proto RA-RL			Proto NWP	Oper LFRic global	Oper LFRic regional	LFRic RCM

LFRic LAM nested in UM driving model.

Smagorinsky, prognostic aerosol, stochastic physics.

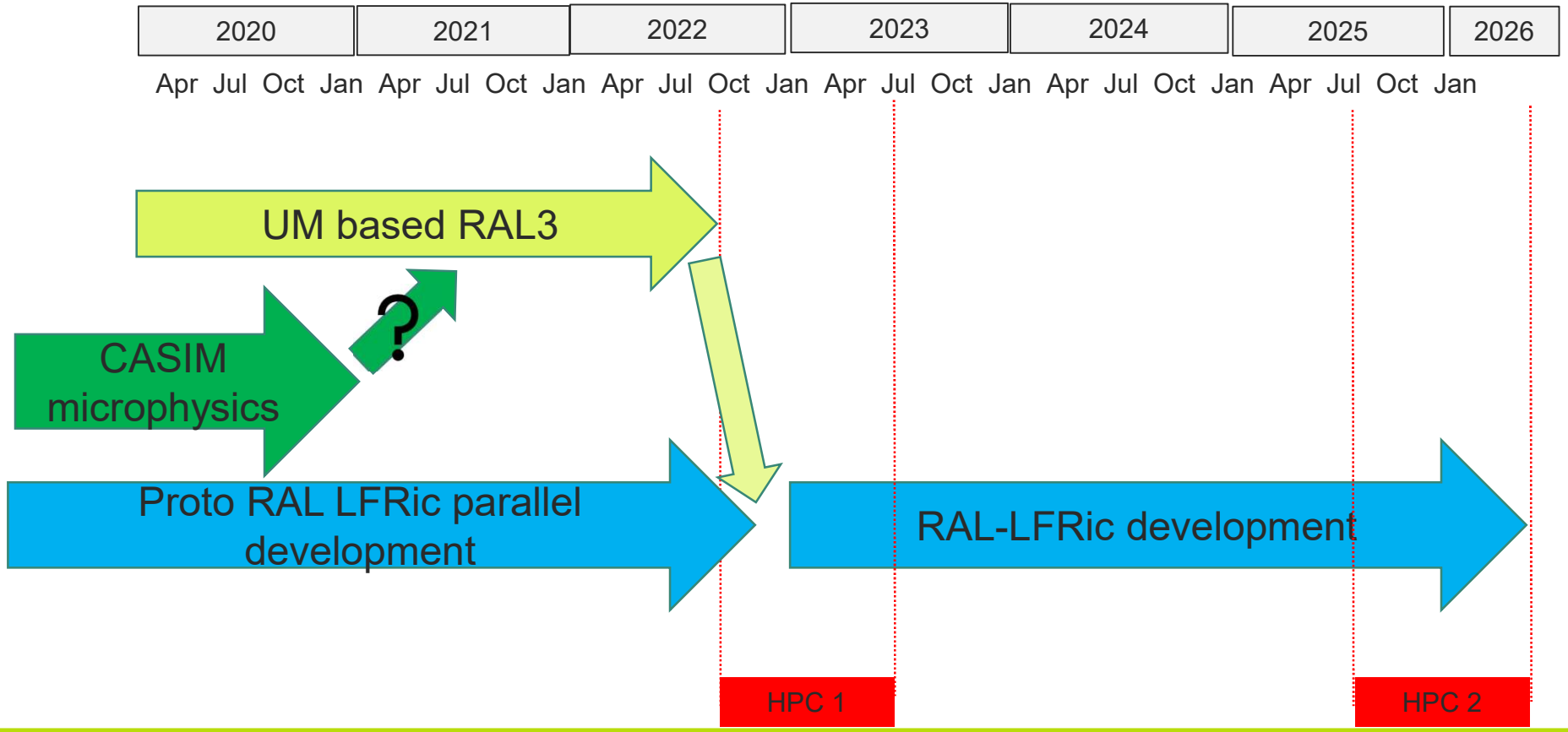
Suites with cycling data assimilation.

UM LAM nested in global LFRic.

LFRic LAM nested in global LFRic.

Regional climate model.

RAL3: the last UM-based science configuration?



More info in the following talks…

Monday	Tuesday	Wednesday	Thursday	Friday
Jonathan Wilkinson Review Talks: Upper Air physics Lightning parametrization and forecasting	**Marco Milan** Data Assimilation Spectral nudging in hourly 4DVAR	**Marion Mittermaier** Verification Feature-based verification methods to verify chlorophyll-a blooms	**Anke Finnenkoetter** Upper Air Physics UM physics developments	**Humphrey Lean** Link with Applications Met Office High resolution developments and Paris 2024 RDP
Tara Jenson (NCAR) Review Talks: Verification METplus	**Christine Johnson** Dynamics Next generation LAMs	**Bob Tubbs and Gareth Dow** DA break out Satellite DA and Observing systems	**Adam Clark and Brett Roberts** (NOAA/NSSL) Predictability break out HWT Evaluation	
	Cristina Charlton-Perez Surface aspects Met Office surface activities	**Aurore Porson** Predictability Met Office ensemble work		

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Thank you for listening!

Any questions?