# The impact of updated regional and global model configurations on the spread/skill of MOGREPS-UK

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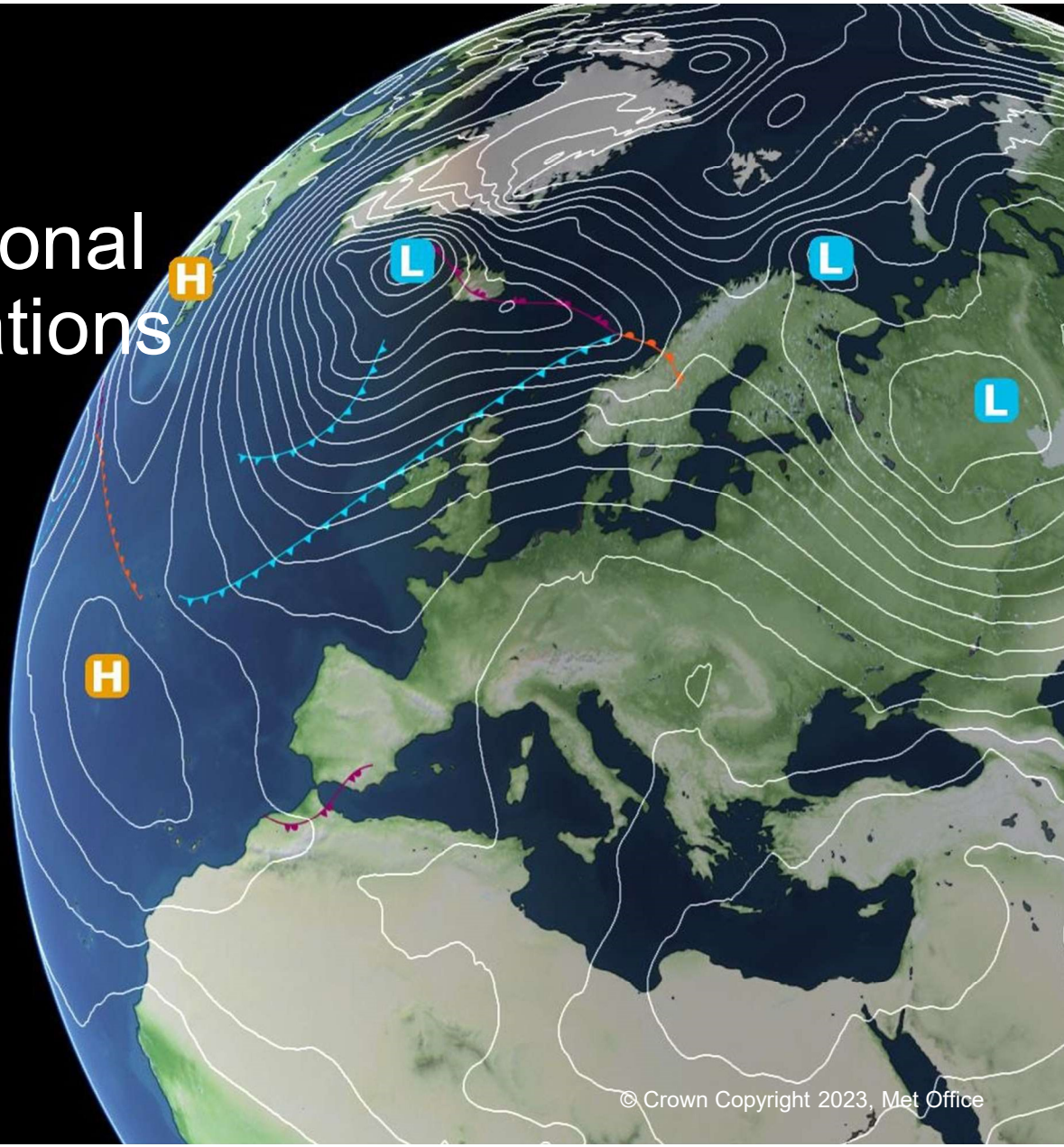


# Background

- Improving the lack of spread of the convective-scale ensemble is one of the top priorities of the Met Office. Efforts are being made to understand and tackle this issue from many angles (also see national poster by Marco Milan et al.).
- Here we focus on the impact of changing the science configuration used in both the regional model and the driving global model.
- These changes are part of the underlying forecast model development process and not aimed to improve the spread specifically.
  - Aimed for PS47 implementation (2024/2025)
  - This is the operational upgrade prior to the one where we retire the deterministic forecast models (as mentioned by Nigel Roberts before lunch)

# Regional changes

Met Office RAL3.1 Release (Regional Atmosphere Land configuration)

**Science developments included in RAL3**

- Unification of tropical and mid-latitude configurations and of global and regional land surface parameters
- Bimodal cloud scheme replaces diagnostic cloud scheme in mid-latitudes and replaces prognostic cloud scheme in the tropics
- New mulit-moment microphysics schemes (CASIM) replaces single moment three-phase scheme.
- Revised turbulent drag and boundary layer parametrizations

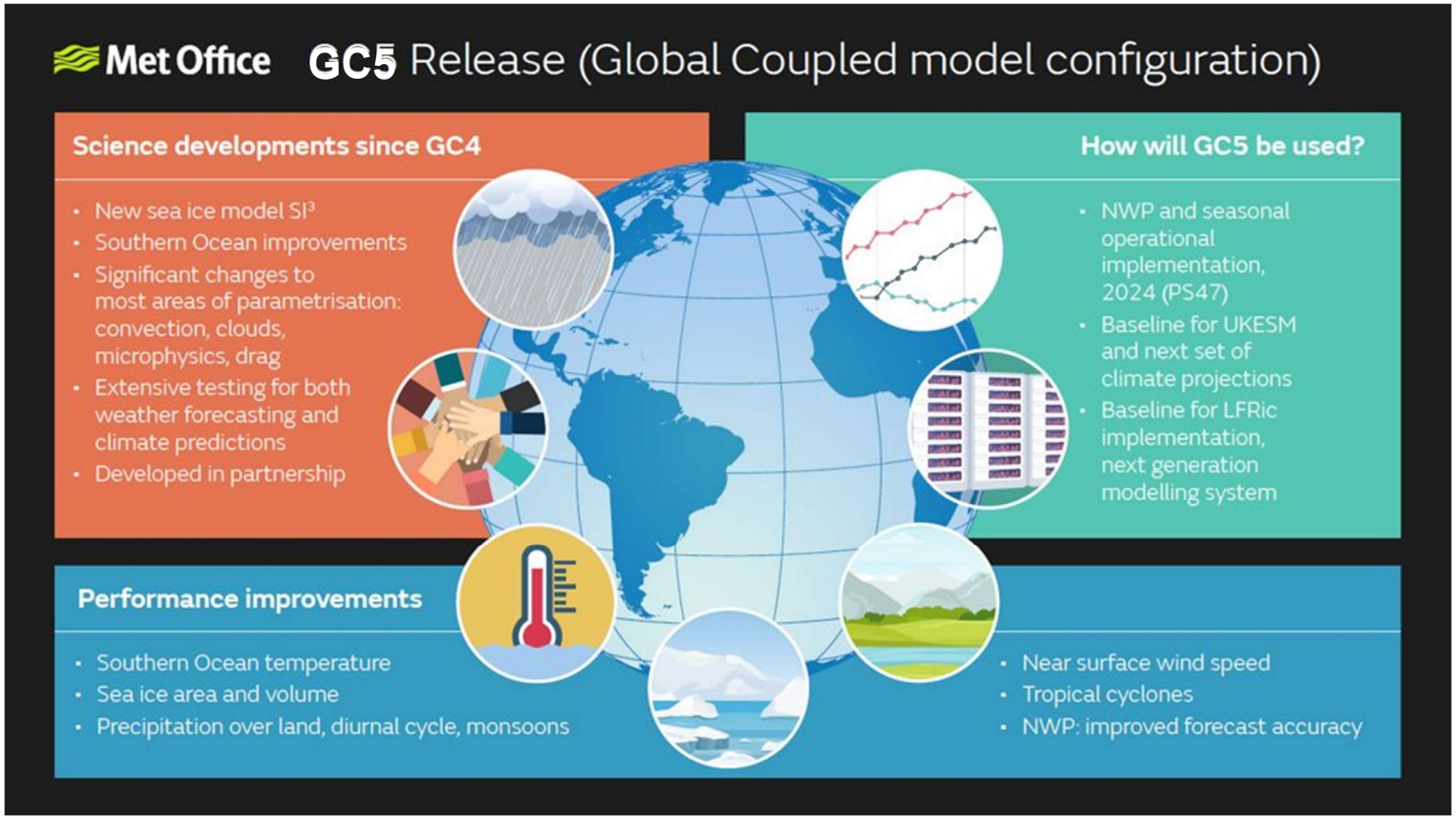
**RAL3.1 vs RAL3**

- Fix unphysical behaviour by RAL3
- “radar hole problem” identified by BoM.

**RAL3.2, RAL3.2 +**

- Testing underway.
- Details yet to be finalised…

# Global changes




**GC4** = current global model forecast configuration
**GC5** = upgrade due for operational implementation alongside RAL3.x

# Experiments

| Regional Model Science | Global Model Science | Comments |
|---|---|---|
| RAL2M | GC4 | Current operational configuration |
| RAL3.1 | GC4 | |
| RAL3.1 | GC5 | Vn0.0 future operational configuration |
| RAL3.2+ | GC5 | Additional science fixes based on UKV trialling.<br>STILL TO BE RUN |
| RAL3.2+ + CASIM RP | GC5 | Additional random parameters for CASIM.<br>Being developed by Anne Mccabe.<br>STILL TO BE RUN |
| RAL3.2+ + CASIM RP<br>+ consistent UKV analysis | GC5 | Replace current GC4/RAL2M UKV analysis with<br>GC5/RAL3.2+ UKV analysis<br>STILL TO BE RUN |

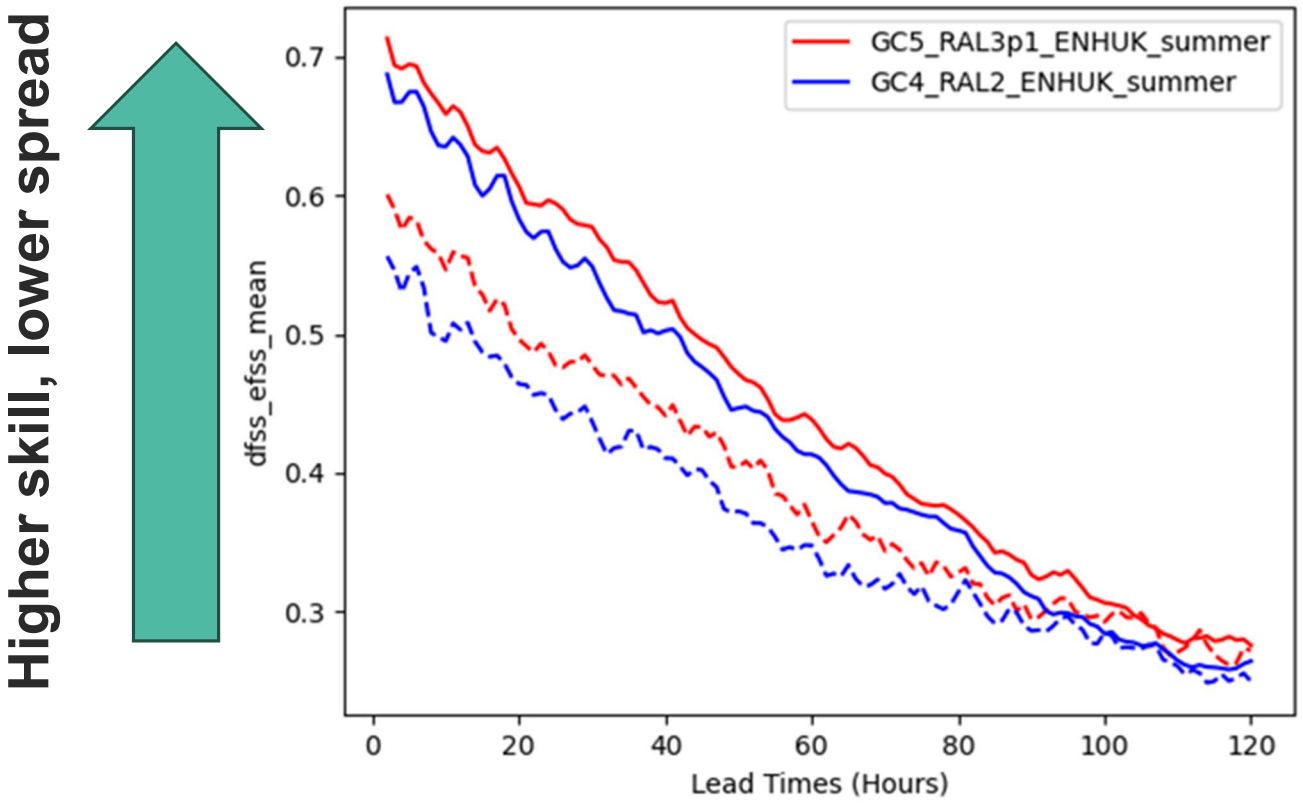
- Hourly cycling, 3 members per hour.
- Initial conditions = Current operational UKV analysis + driving global ensemble member perturbation
- RAL3.1 = L90,  RAL2M = L70

Summer: 01/06/21 – 30/06/21  Winter: 01/12/21 – 12/01/22

# RAL3.1 vs RAL2M

GC5 vs GC4

**Summer (15 days)**




RAL3.1/GC5 has:-

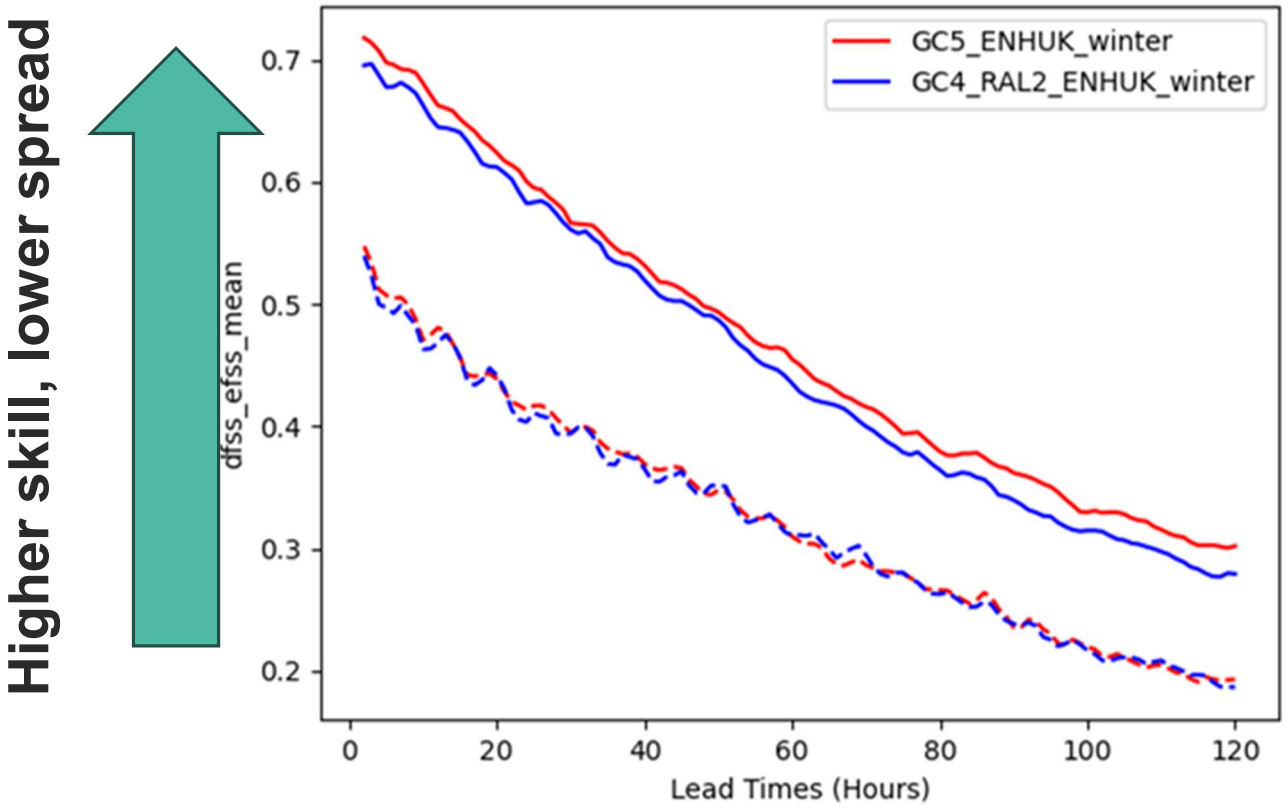
- has higher dFSS (solid lines) **less spread**.
- has higher eFSS (dashed lines) **more skill**

Spatial spread-error hourly precipitation – 95$^{th}$ percentile

# RAL3.1 vs RAL2M

GC5 vs GC4

**Winter (42 days)**




RAL3.1/GC5 has:-

- has higher dFSS (solid lines) **less spread**.
- has similar eFSS (dashed lines) **no change in skill**

Spatial spread-error hourly precipitation – 95$^{th}$ percentile

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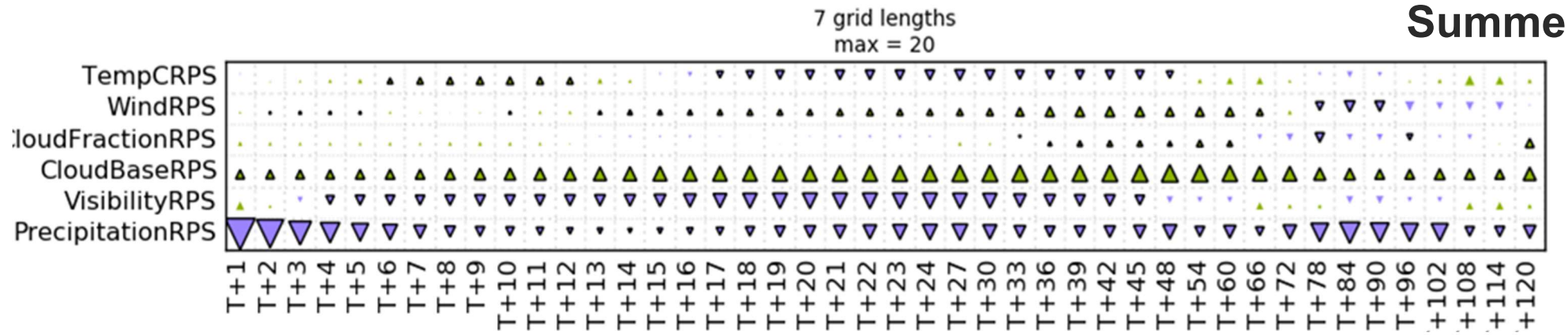
# RAL3.1 vs RAL2M

GC5 vs GC4

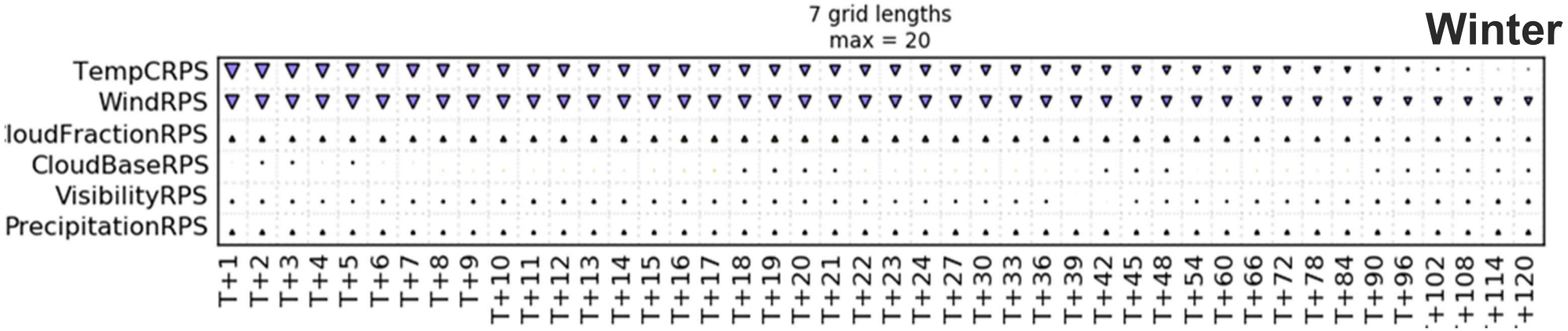
▲ GC5/RAL3.1 better

▼ GC4/RAL2M better

## Summer



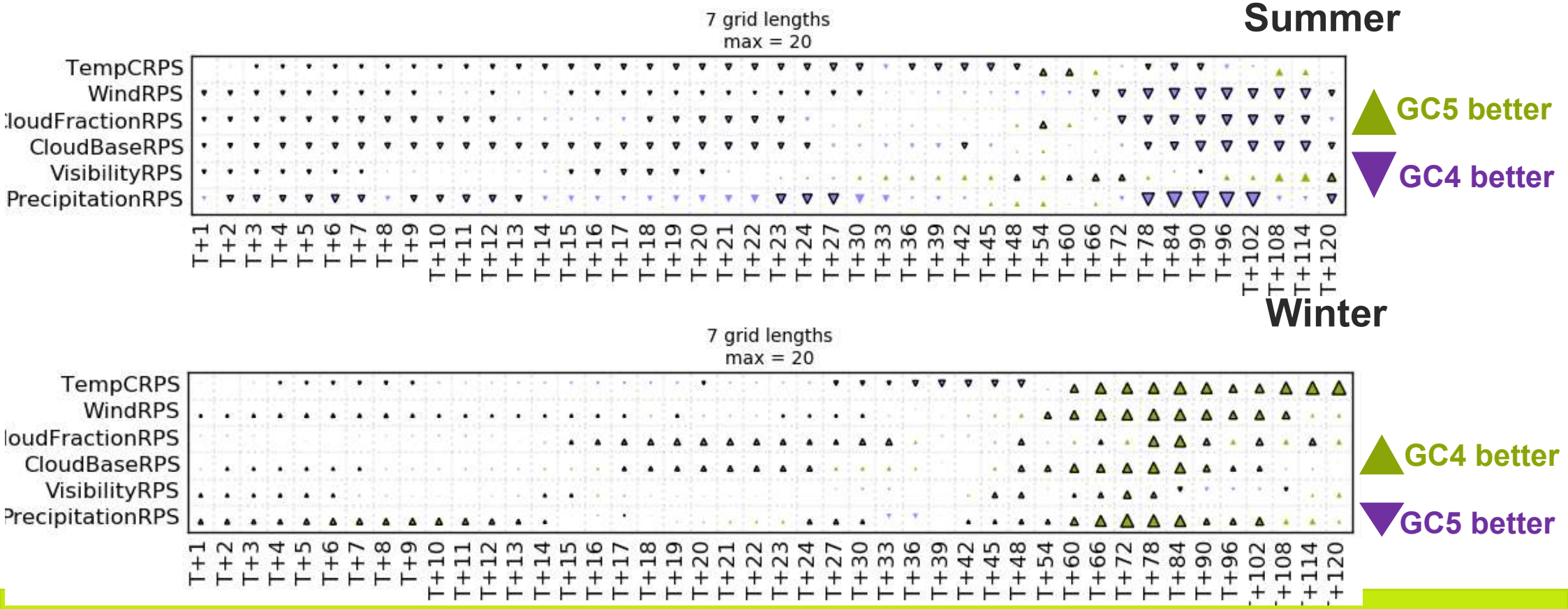

## Winter




**CRPS**

# RAL3.1

GC5 vs GC4




**CRPS**

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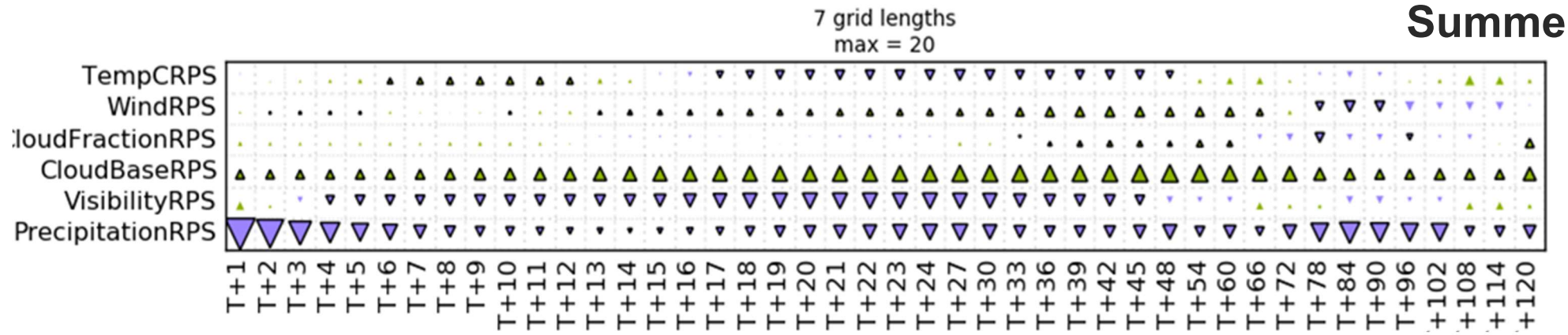
# RAL3.1 vs RAL2M

GC5 vs GC4

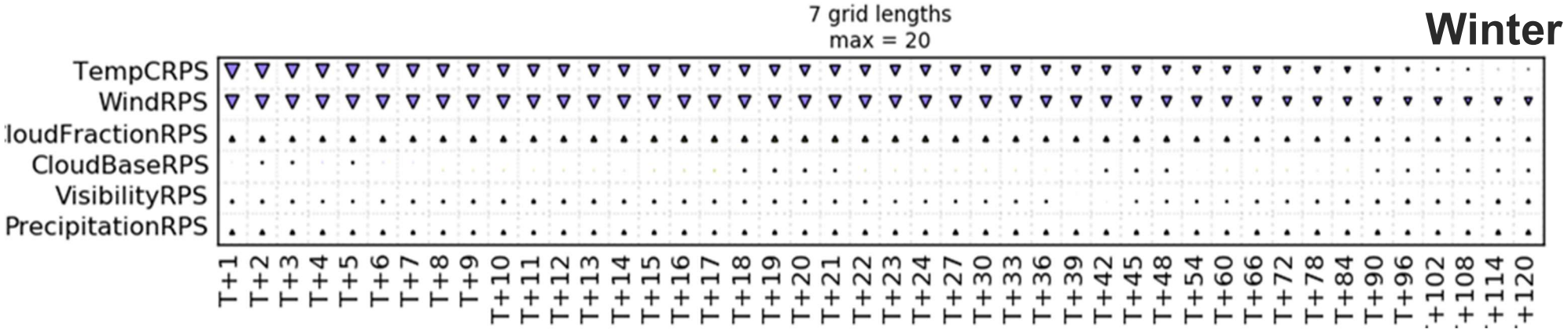
▲ GC5/RAL3.1 better

▼ GC4/RAL2M better

## Summer




## Winter




**CRPS**

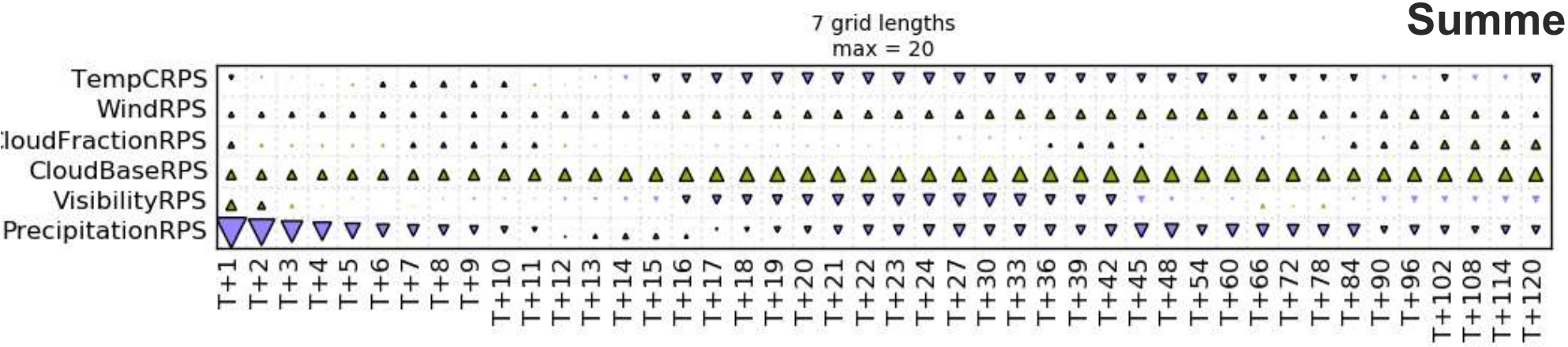
# RAL3.1 vs RAL2M

GC4

▲ RAL3.1 better

▼ RAL2M better

**Summer**




**CRPS**

# Conclusions and future work

- Slightly reduced spread with RAL3.1 and GC5, with improved skill in summer and essentially unchanged skill in winter.

- CRPS scores show that the impact of RAL3.1 is larger than the impact of GC5, except at later lead times
  - Relative performance reflects the increasing influence of LBCs at later lead times.
- Current CRPS scores also suggest a general reduction in MOGREPS-UK performance.
  - Perhaps a reflection of current “deterministic first” approach to development of operational forecast systems.
  - Alternative development strategy for the subsequent operational upgrade (removing the deterministic models) described by Nigel Roberts earlier.
- Further testing about to begin, which will hopefully improve the CRPS scores.
  - RAL3.2+
  - Adding in Random Parameter perturbations to the CASIM microphysics
  - Centring around the GC5 + RAL3.2+ UKV analysis.

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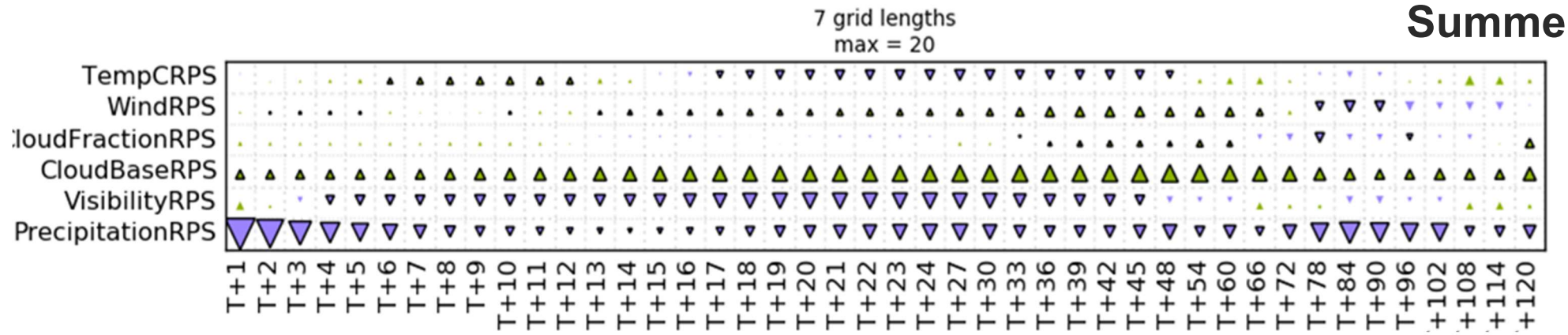
# RAL3.1 vs RAL2M

GC5 vs GC4

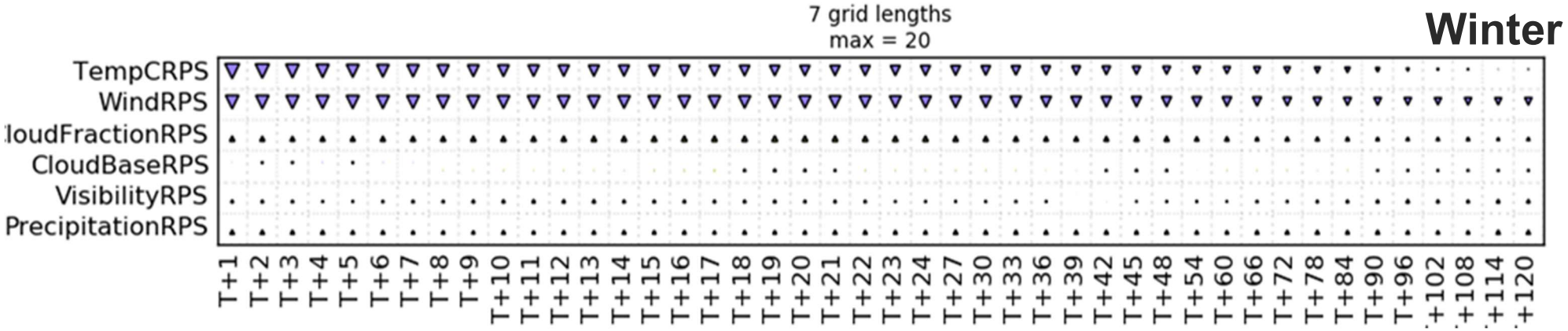
▲ GC5/RAL3.1 better

▼ GC4/RAL2M better

## Summer




## Winter




**CRPS**

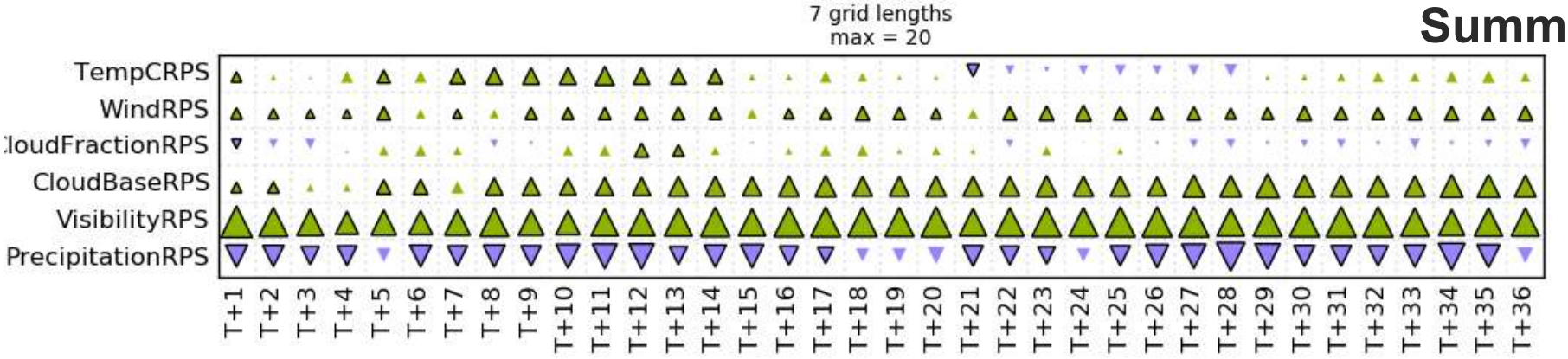
Met Office **UKV** RAL3.1 vs RAL2M

GC4

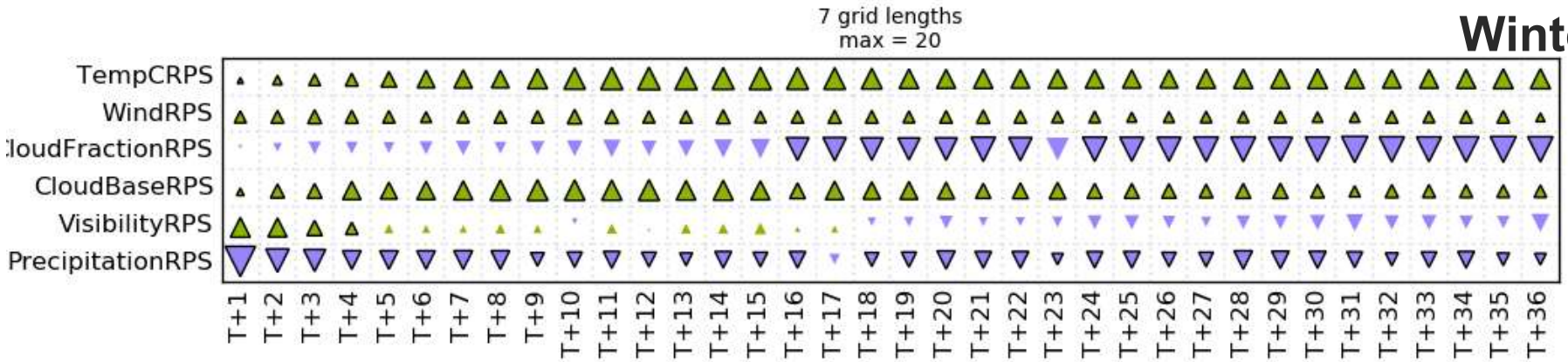
**RAL3.1 better**

**RAL2M better**

**Summer**




**Winter**




**RPS**

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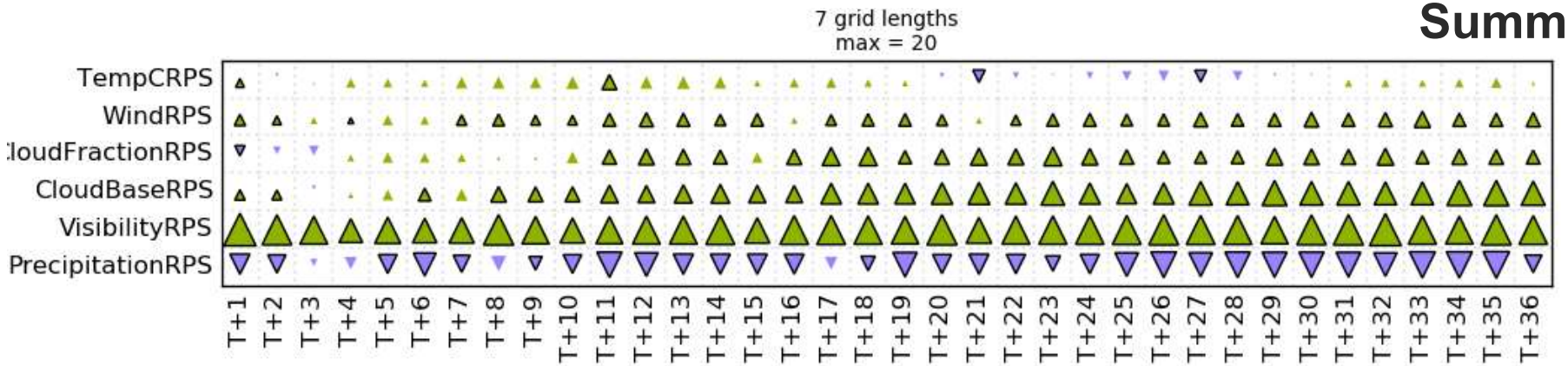
# RAL3.2+ vs RAL2M

GC4

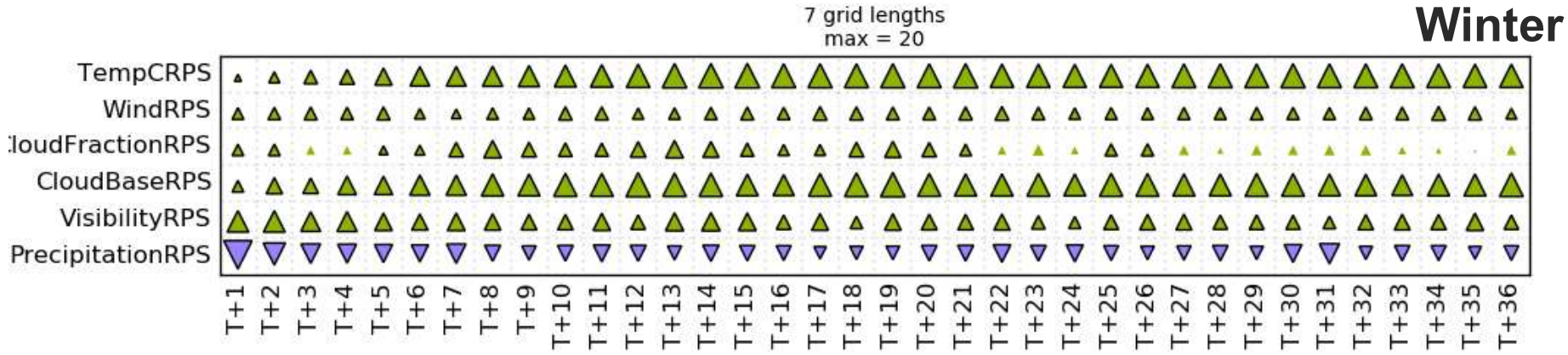
▲ **RAL3.2+ better**

▼ **RAL2M better**

**Summer**




**Winter**




**RPS**

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Thanks for your attention!

For any questions:
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