

Importance of minor-looking treatments in cloud physics for GCM simulations

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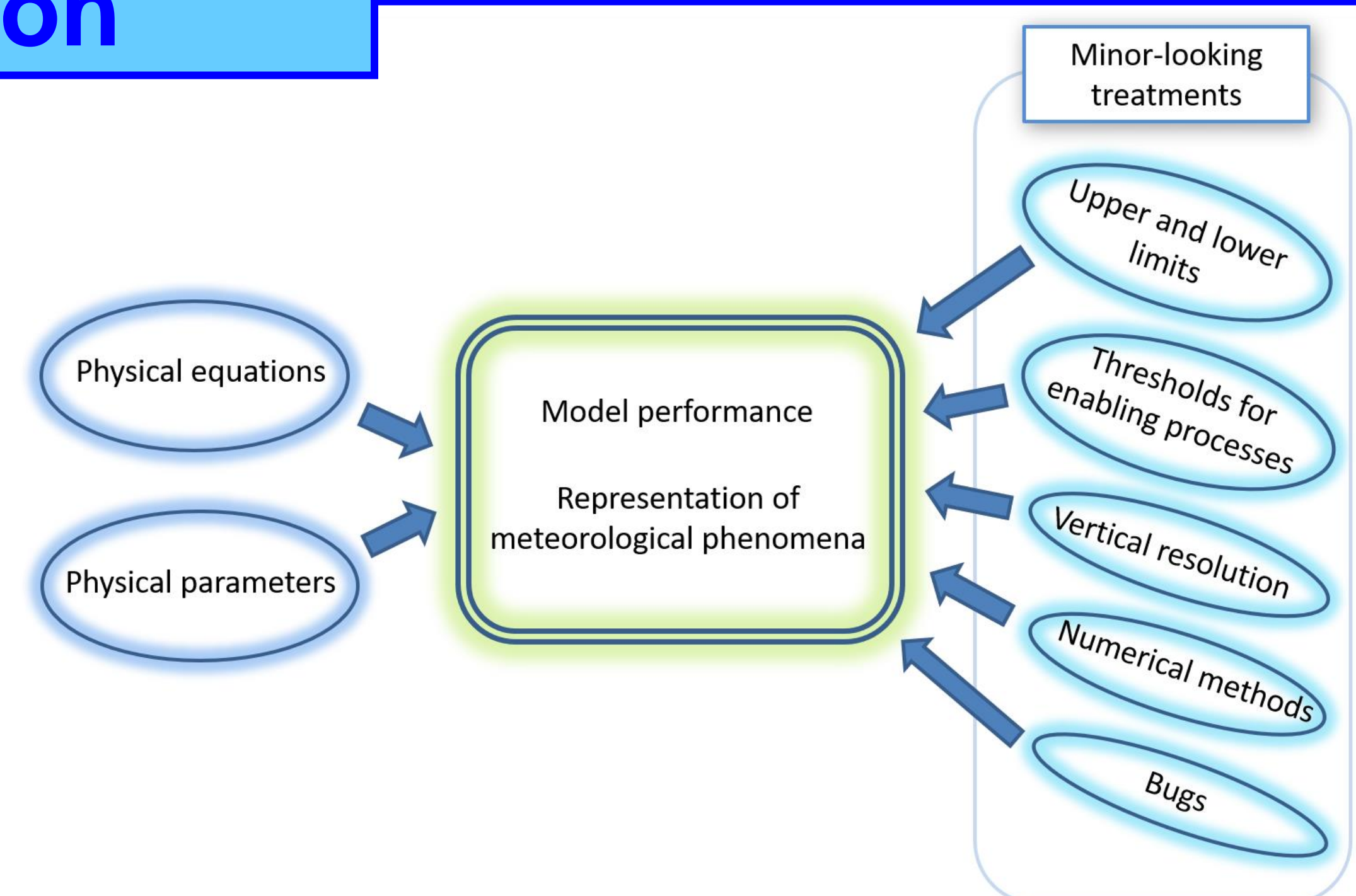
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Introduction

Clouds, cloud properties, cloud radiative effect, and cloud feedback in Global Climate Models (GCMs) are determined not only by cloud processes or schemes on physics basis but also by implementation details. Modelers know very well that parameter tuning can drastically control clouds in GCMs. However, parameter tuning is not the only implementation detail that can drastically affect the performance and the representation of clouds in GCMs.

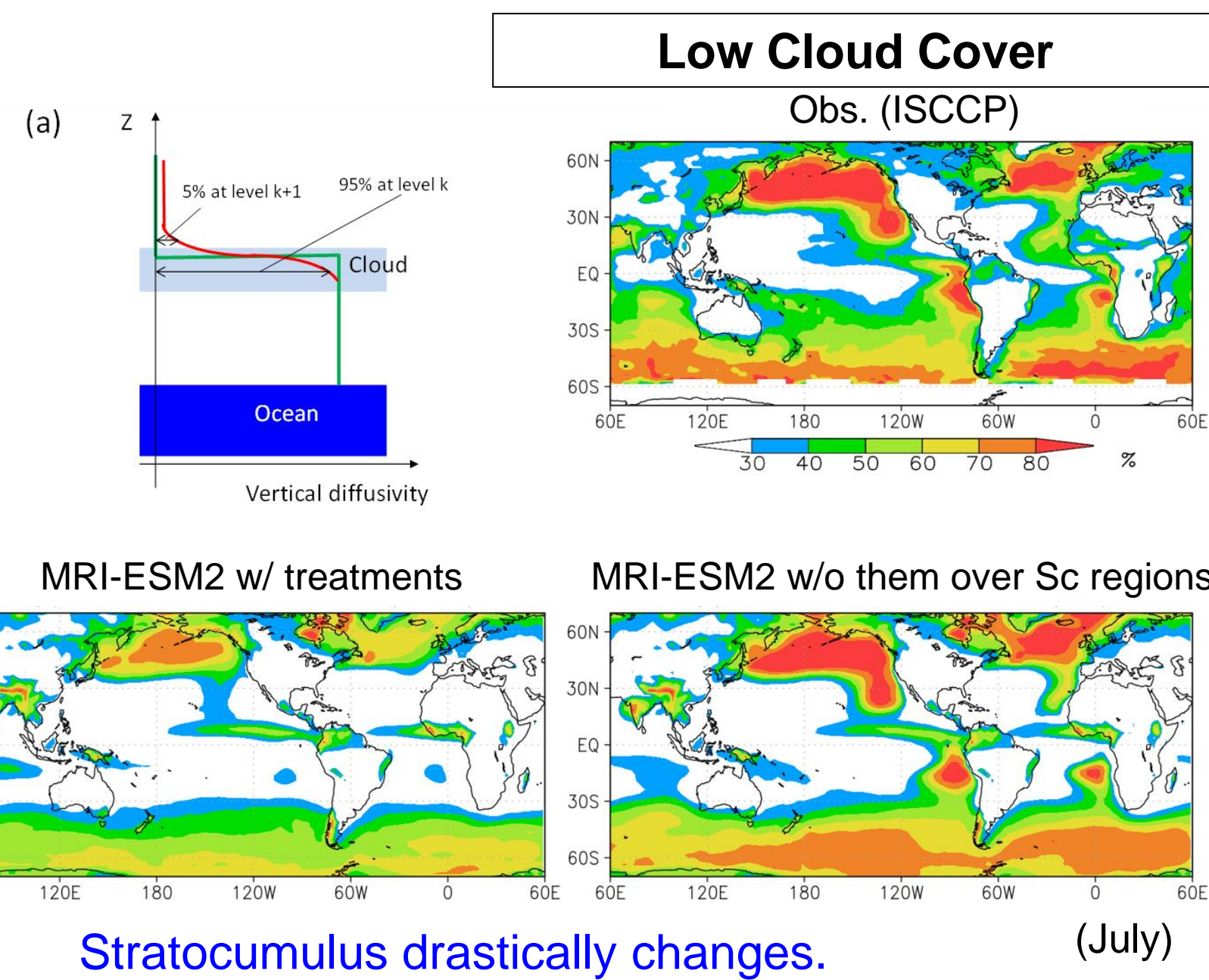
"Minor-looking treatments" often exert a critical control on clouds in models; they include lower and upper limits of parameters, thresholds of variables that control the enabling or disabling of a specific process, whether two schemes can work together or only one scheme works exclusively, and numerical methods including the order of calling various physics schemes.

We comprehensively summarize examples of various minor-looking treatments (Kawai et al. 2022).

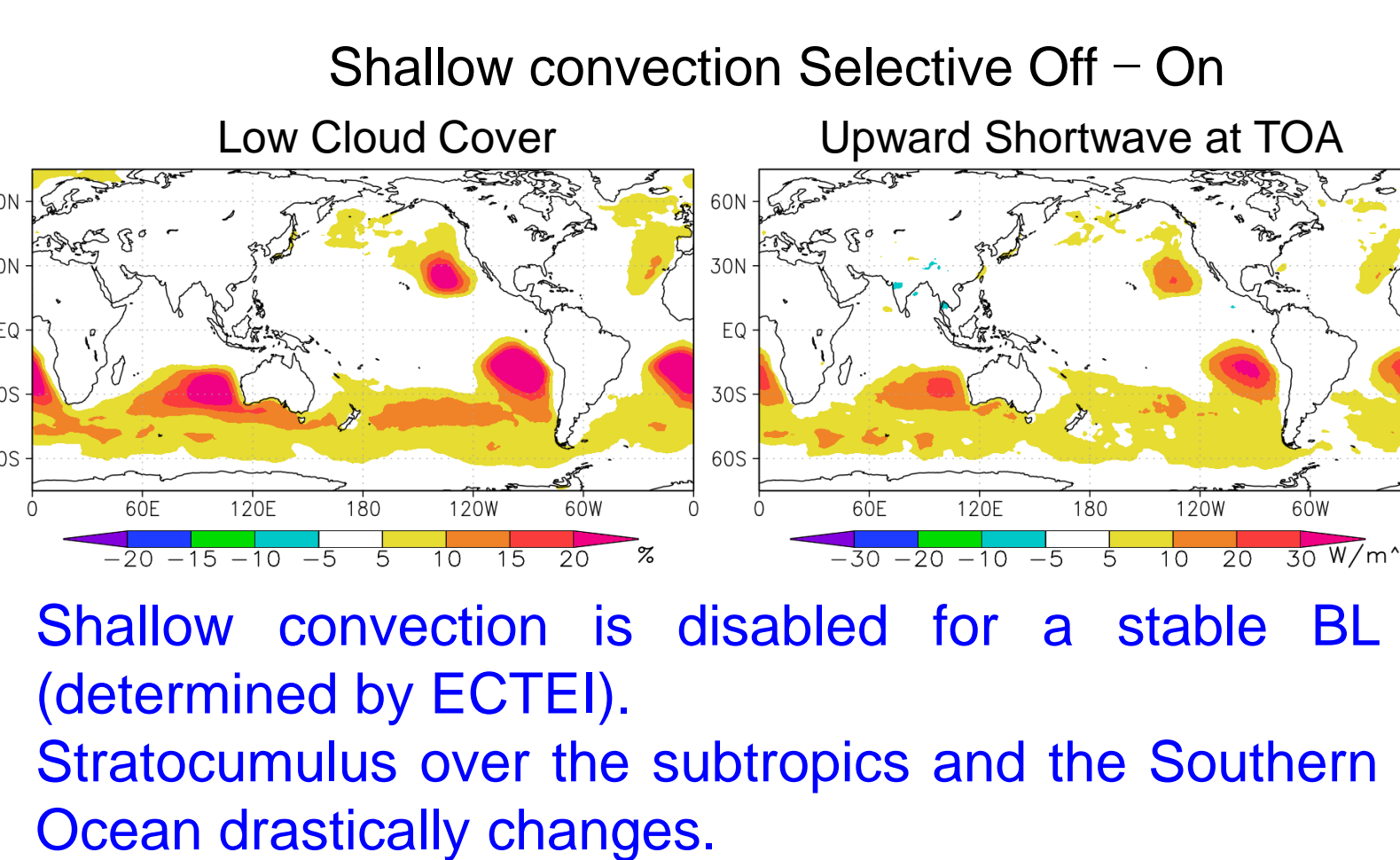


Examples of Minor-looking treatments

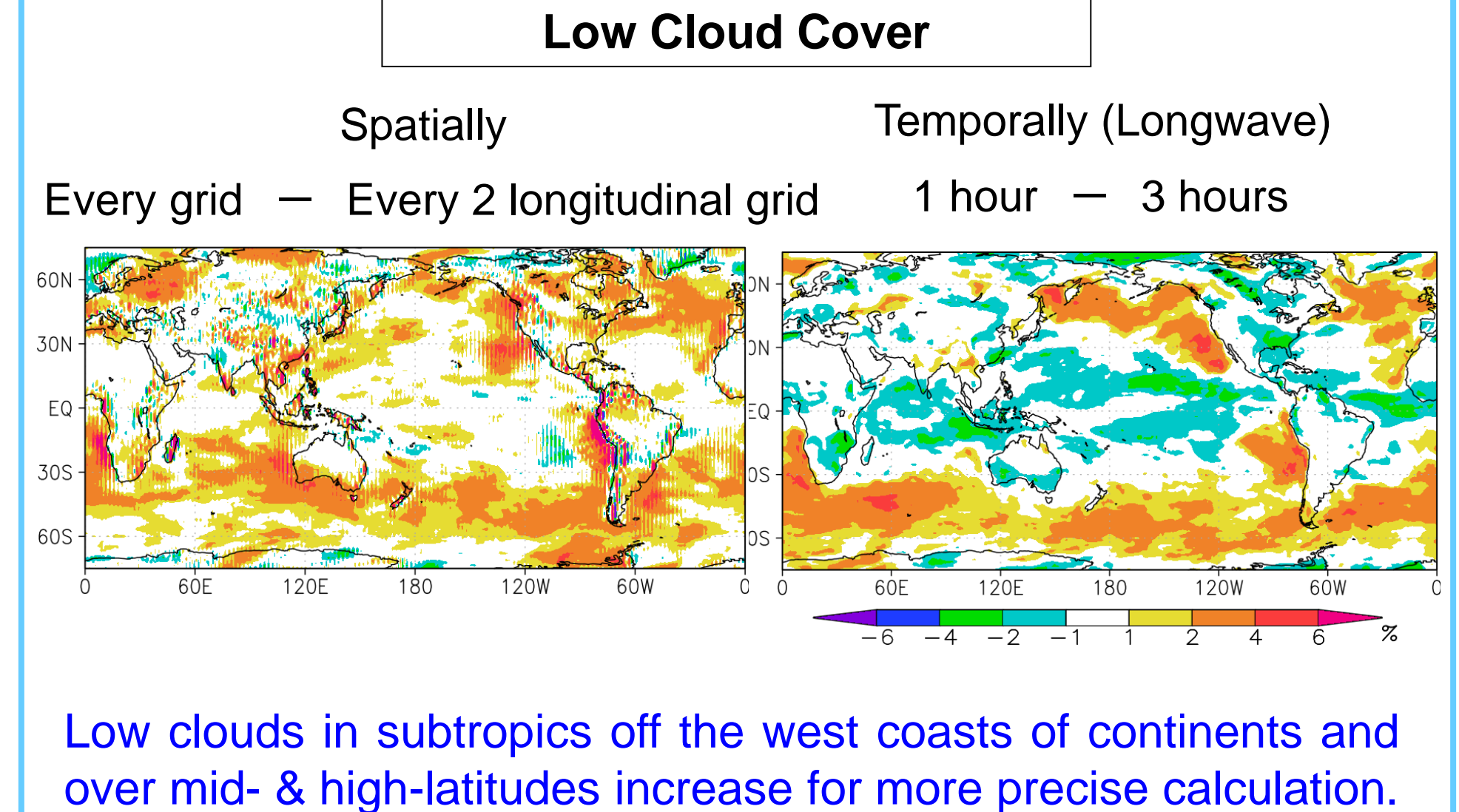
Lower limit & smoothing of vertical diffusivity



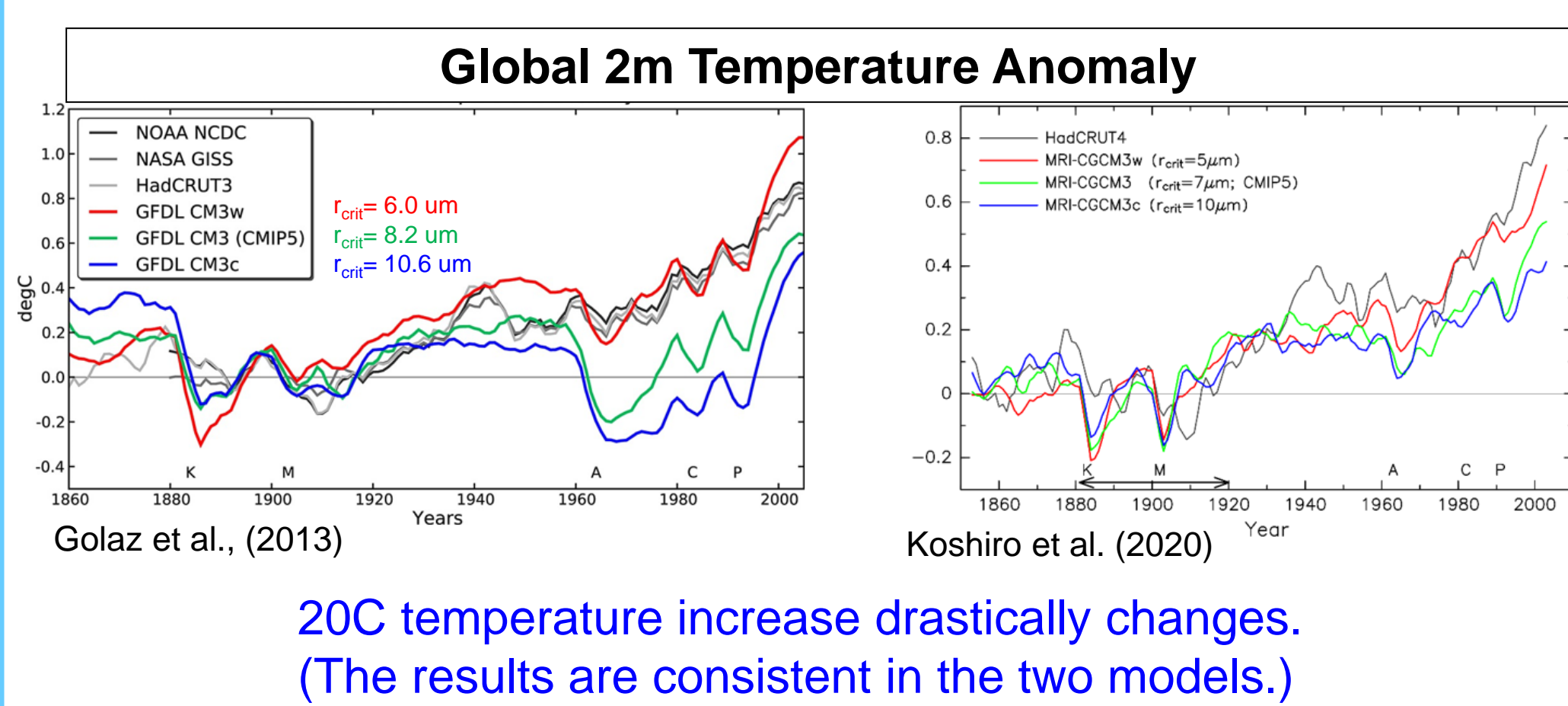
Conditionally disabling shallow convection



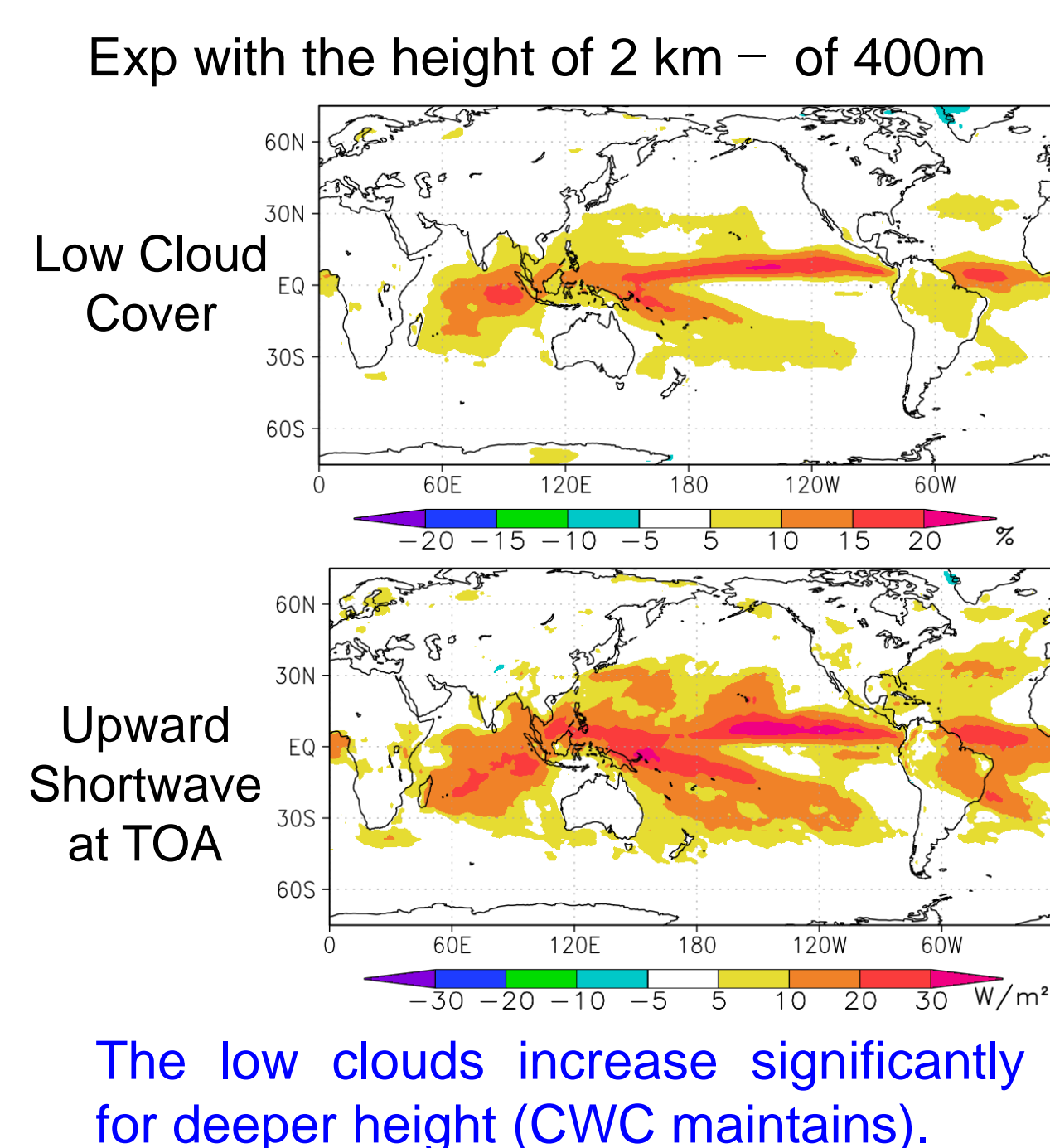
Reduced calculation of radiation process



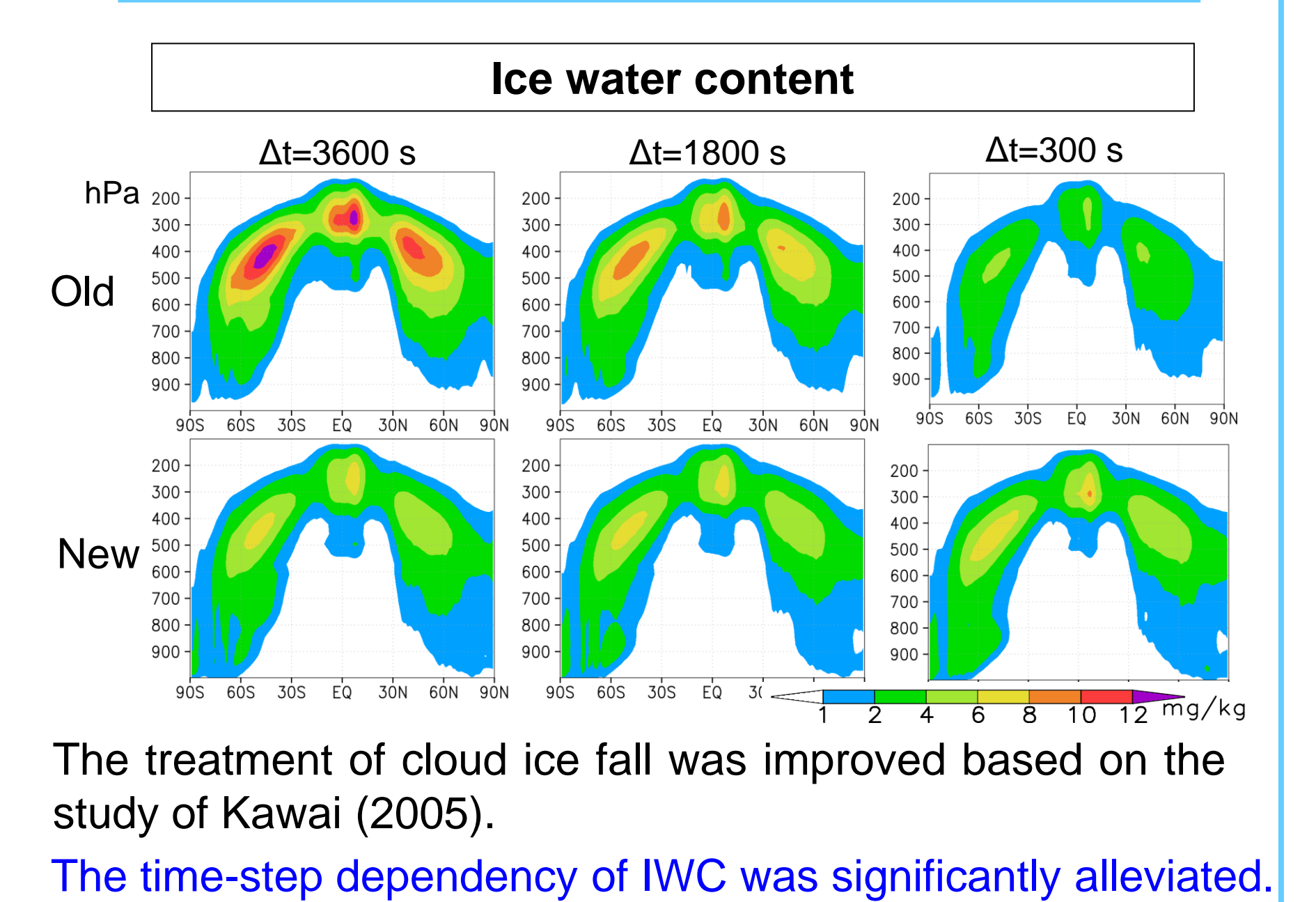
Droplet radius threshold for autoconversion



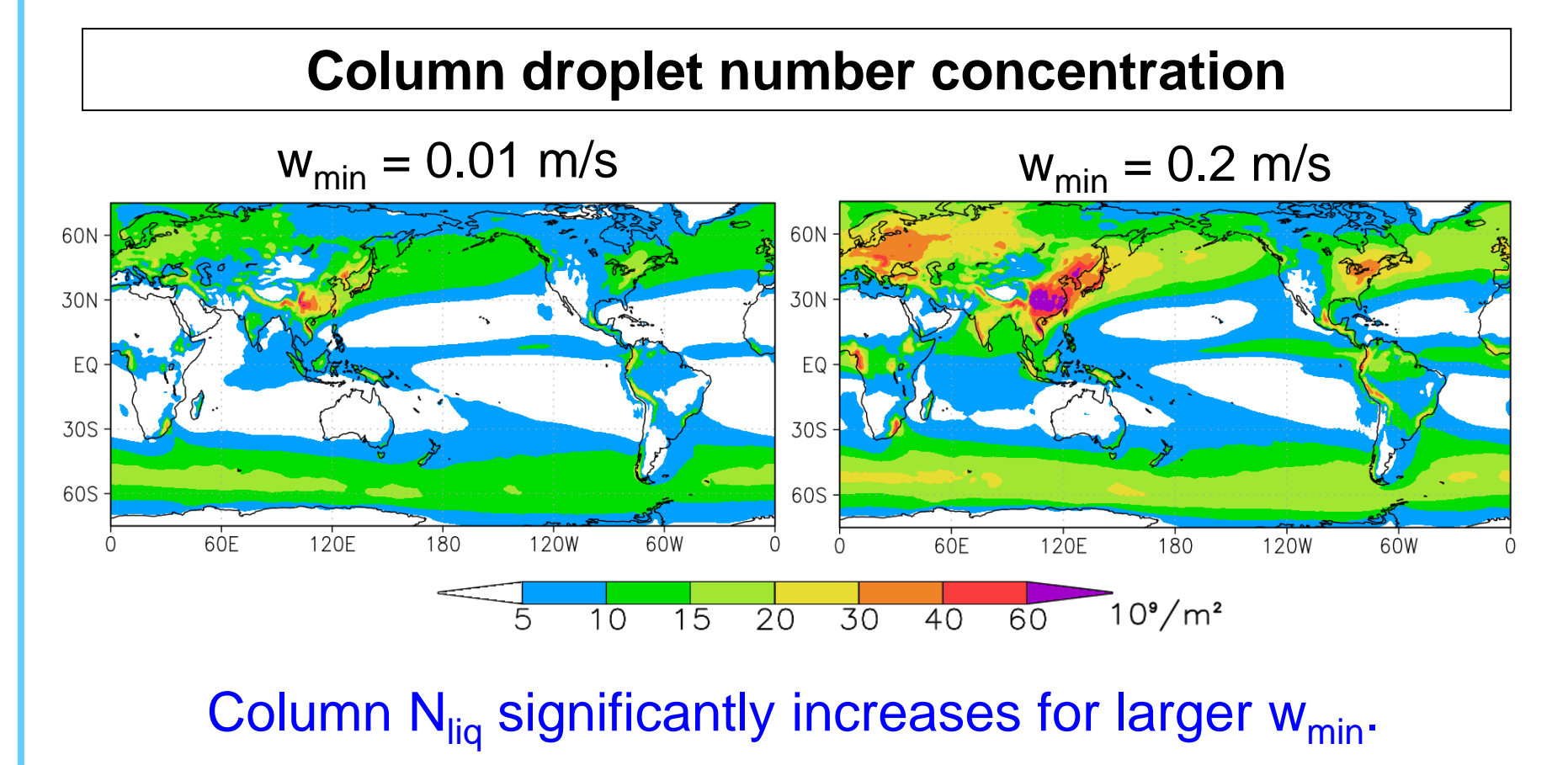
Minimum height of permitting convective precipitation



Calculation method of cloud ice fall



Lower limit of turbulence updraft speed for aerosol activation calculation



Summary

- The impacts of such minor-looking treatments on clouds are sometimes comparable to or even larger than those obtained by introducing advanced parameterizations based on theory and observation.
- Minor-looking treatments should be discussed more, and the details as well as the tuning process should be described and shared in the climate modeling community in as much detail as possible.

See Kawai et al. (2022) for more examples.

Acknowledgements

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References

Kawai, H., K. Yoshida, T. Koshiro, and S. Yukimoto, 2022: Importance of Minor-Looking Treatments in Global Climate Models. *J. Adv. Model. Earth Syst.*, **14**, e2022MS003128, <https://doi.org/10.1029/2022MS003128>.