Competing radiative impacts of low-level and high-level clouds on an idealized extratropical cyclone

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We have known for a long time that diabatic heating from phase changes of water is crucial to cyclones (i.e., latent heating).

What about radiative heating, in particular from clouds?

Schäfer and Voigt, 2018 were the first to study how radiation impacts baroclinic lifecycles

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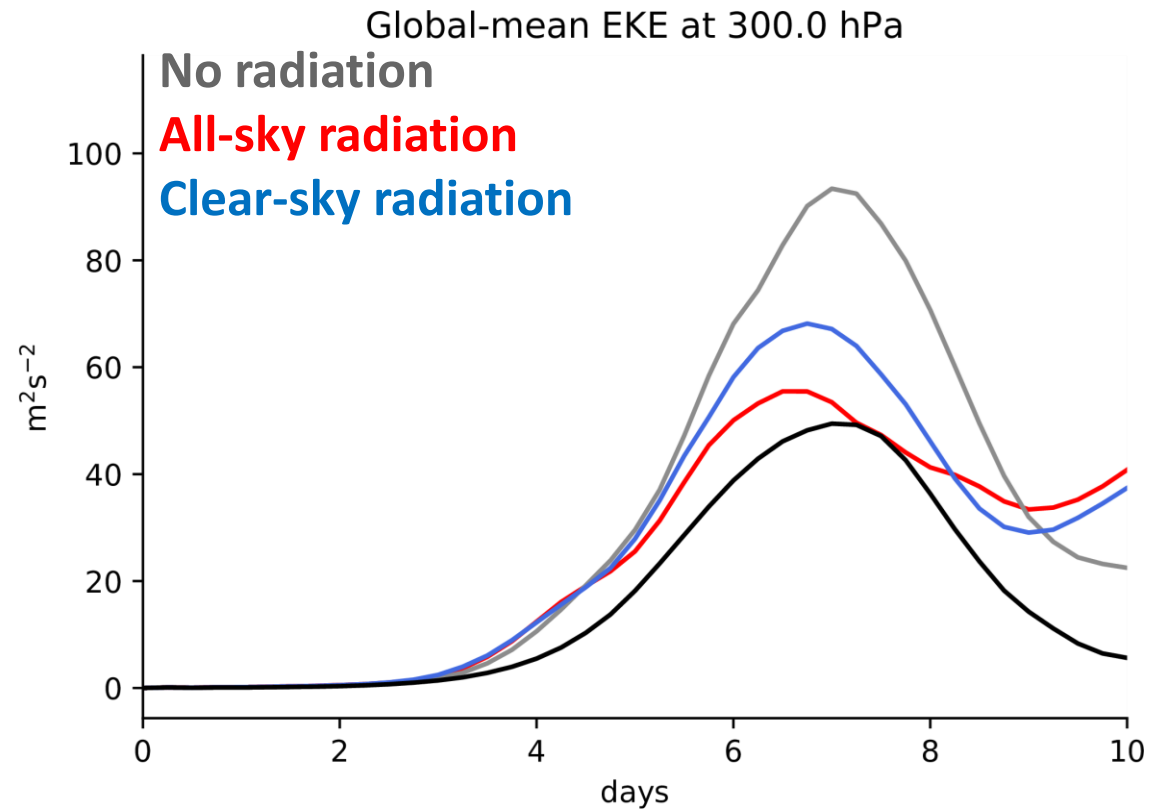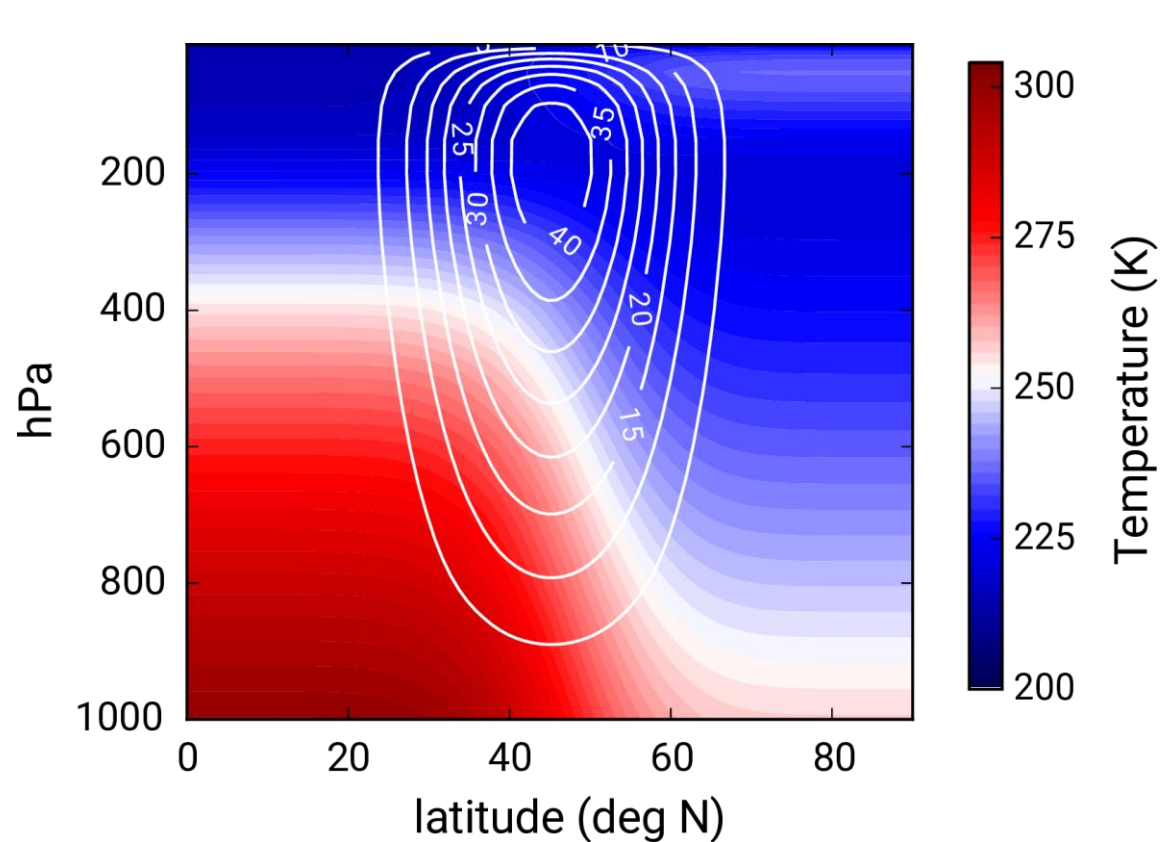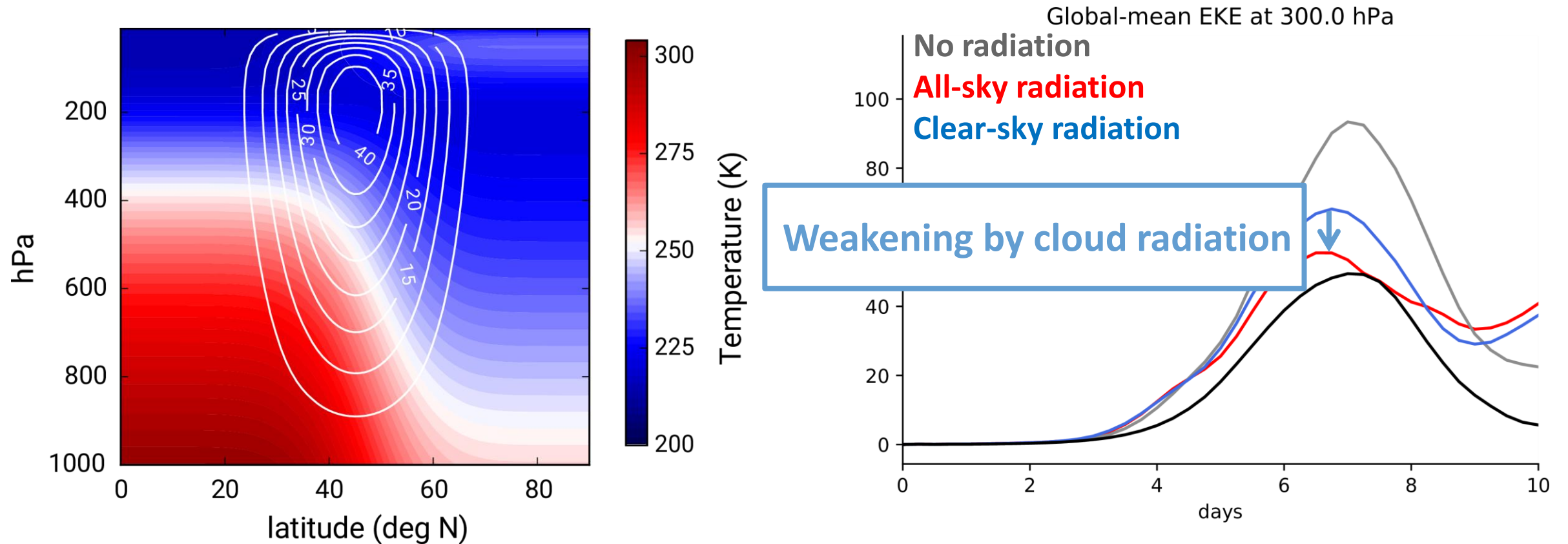### Radiation Weakens Idealized Midlatitude Cyclones

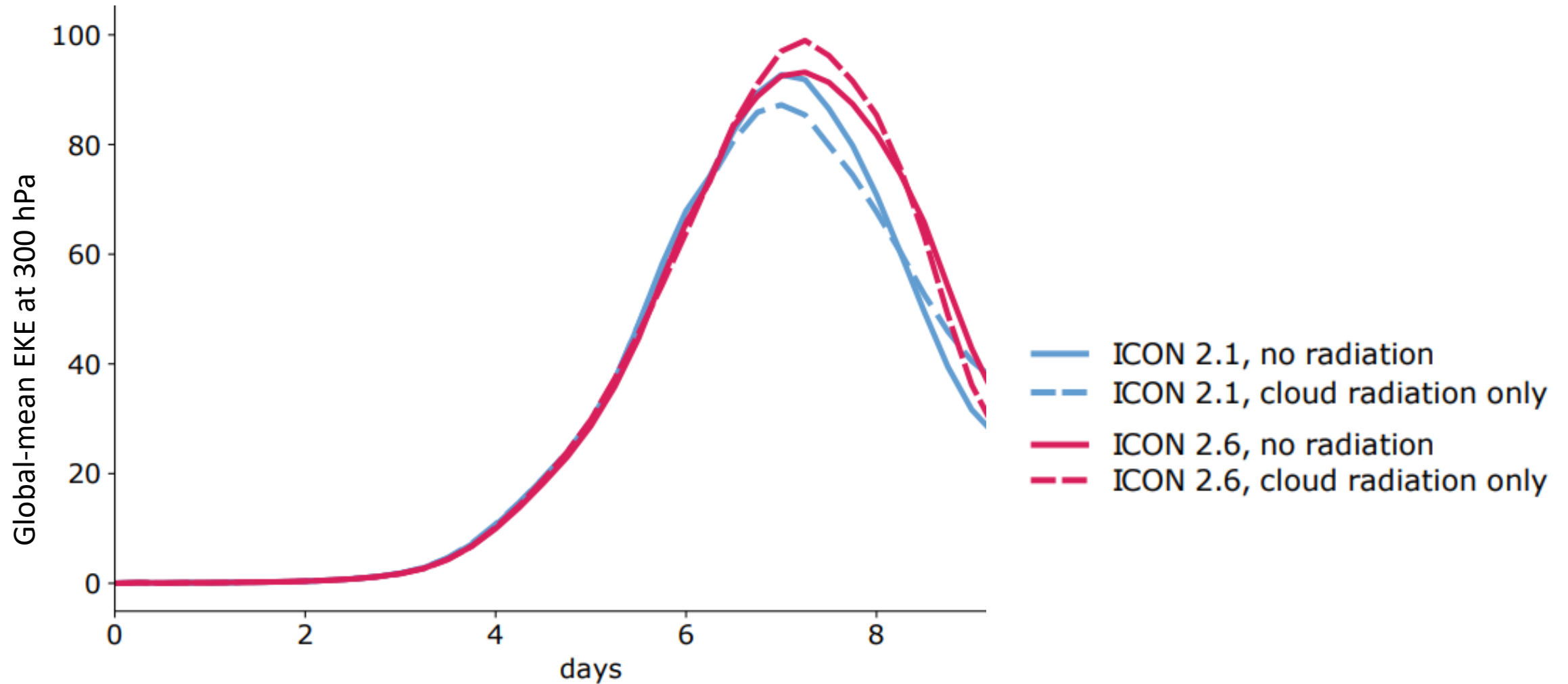Sophia A. K. Schäfer[1] and Aiko Voigt[1,2]

Key Points:

Schäfer and Voigt, 2018: cloud-radiative heating weakens idealized cyclones in ICON-NWP-2.1
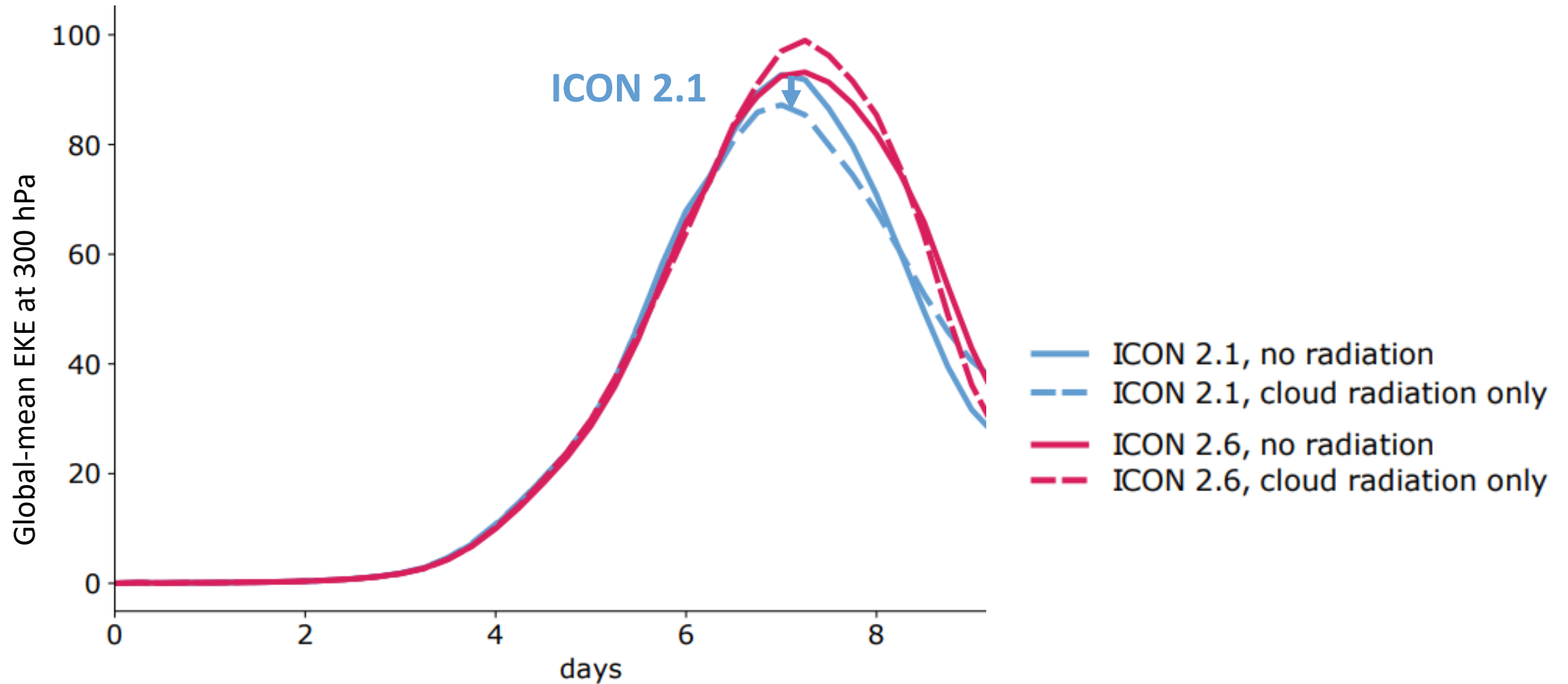
Schäfer and Voigt, 2018: cloud-radiative heating weakens idealized cyclones in ICON-NWP-2.1
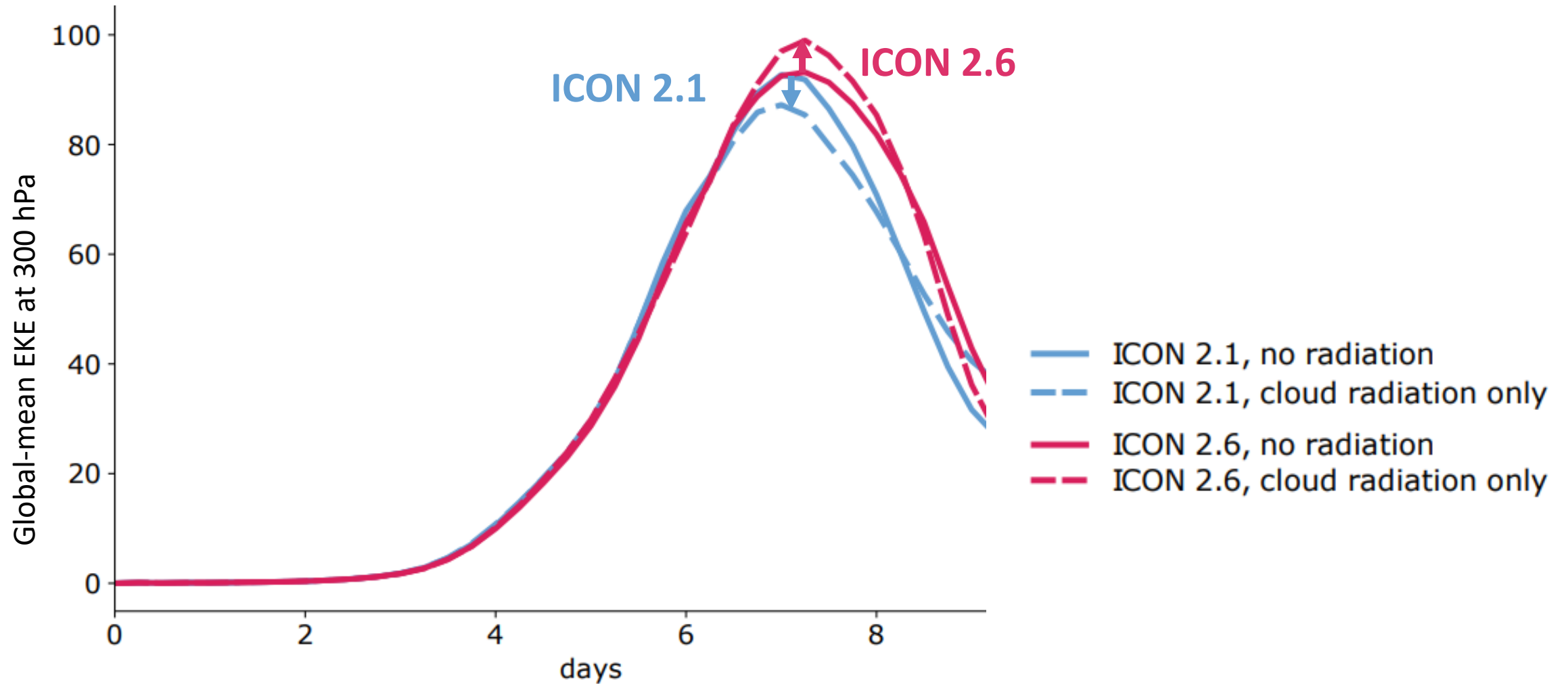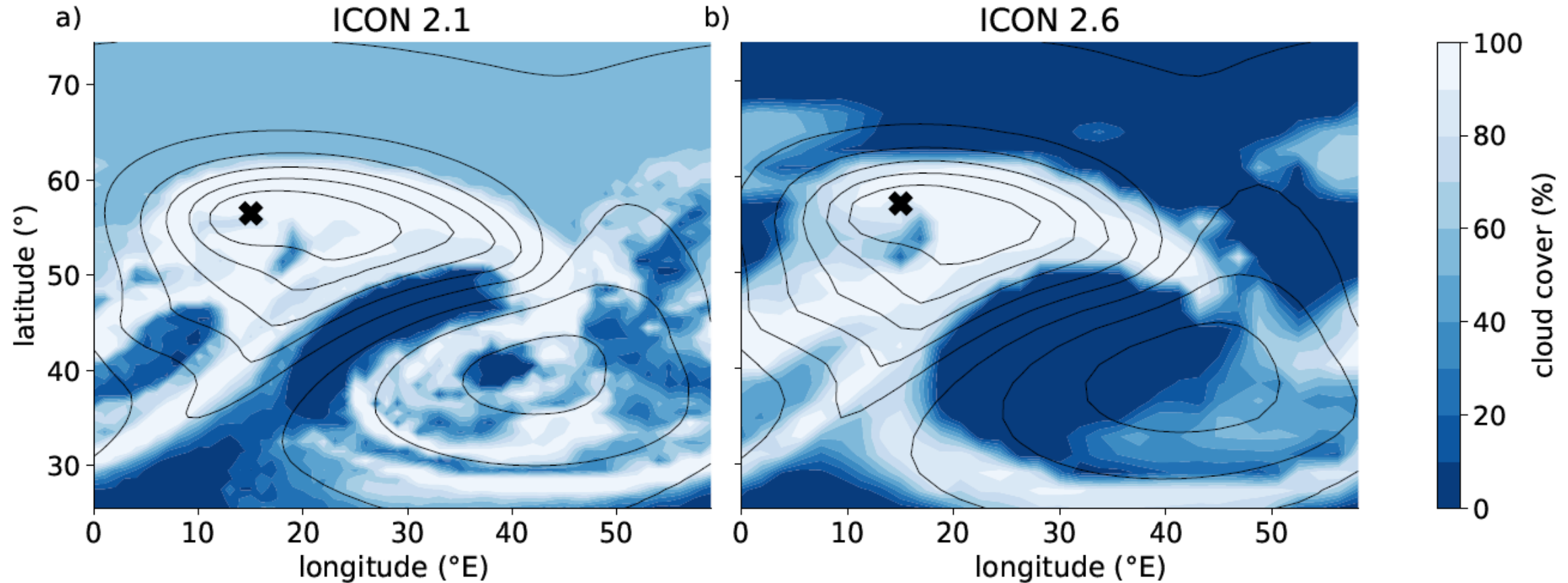
Cloud-radiative impact on idealized midlatitude cyclones changes sign between ICON-NWP version 2.1 and 2.6

Cloud-radiative impact on idealized midlatitude cyclones changes sign between ICON-NWP version 2.1 and 2.6
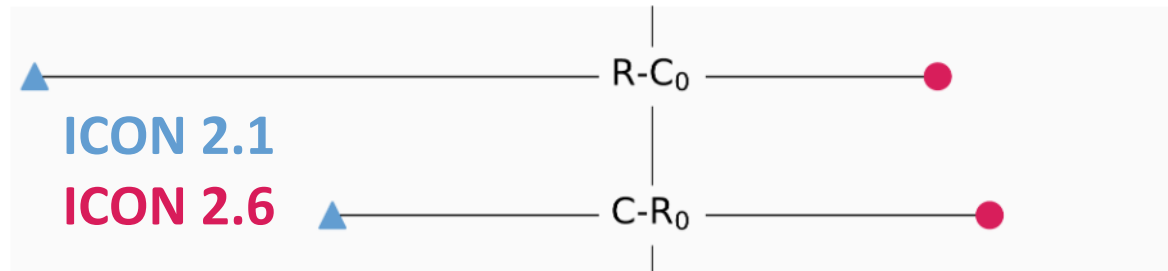
Cloud-radiative impact on idealized midlatitude cyclones changes sign between ICON-NWP version 2.1 and 2.6

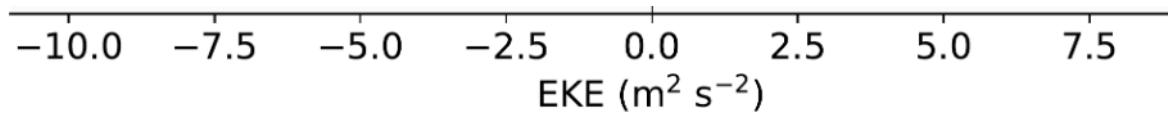# (One) Reason: ICON 2.1 has many more low-level clouds

Result: competition between PBL and free tropospheric clouds

Weaker cyclone ⟷ Stronger cyclone
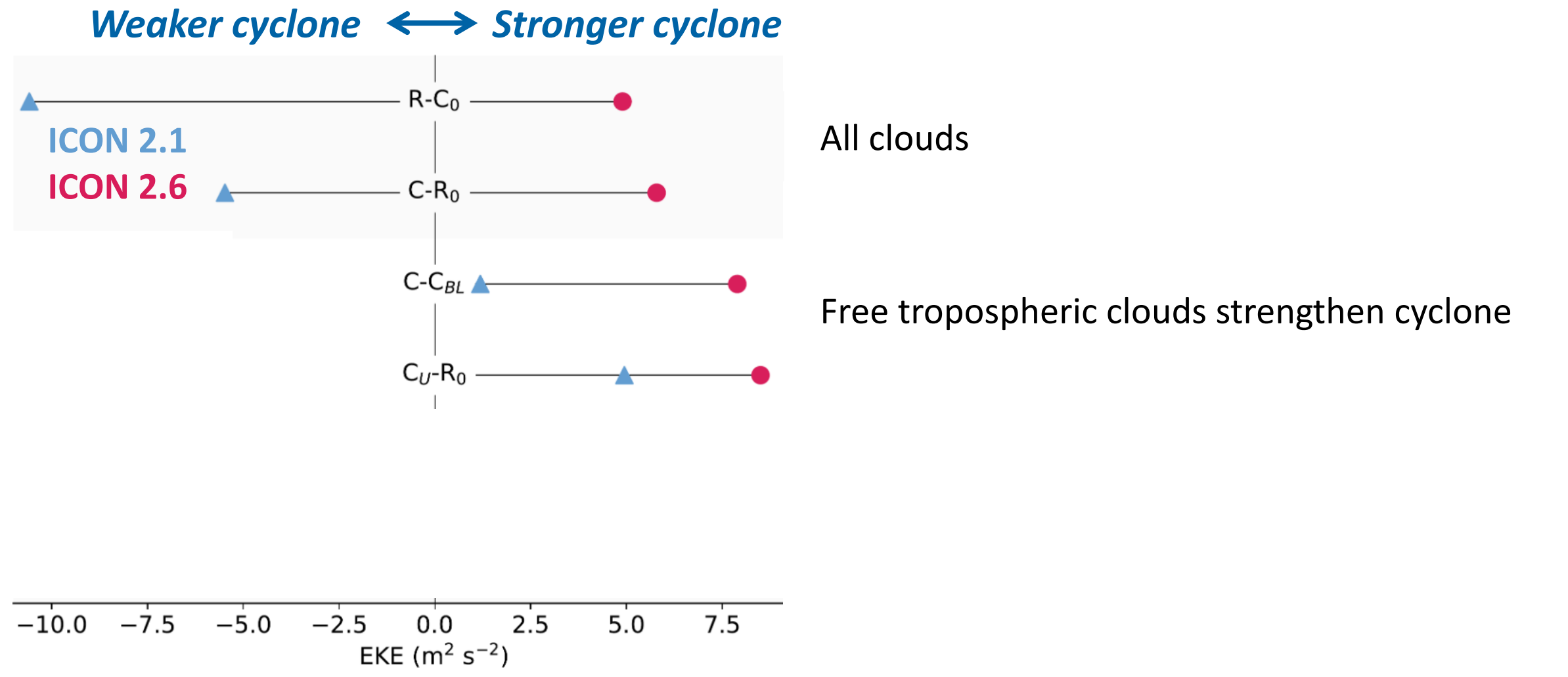

ICON 2.1
ICON 2.6

All clouds

Result: competition between PBL and free tropospheric clouds

Weaker cyclone ⟷ **Stronger cyclone**

ICON 2.1
ICON 2.6

All clouds

Free tropospheric clouds strengthen cyclone

Result: competition between PBL and free tropospheric clouds

Weaker cyclone ⟵⟶ **Stronger cyclone**

ICON 2.1
ICON 2.6

All clouds

Free tropospheric clouds strengthen cyclone

PBL clouds weaken cyclone