

From clouds and convection to weather and climate: how can EarthCARE improve predictions and our understanding of climate sensitivity?

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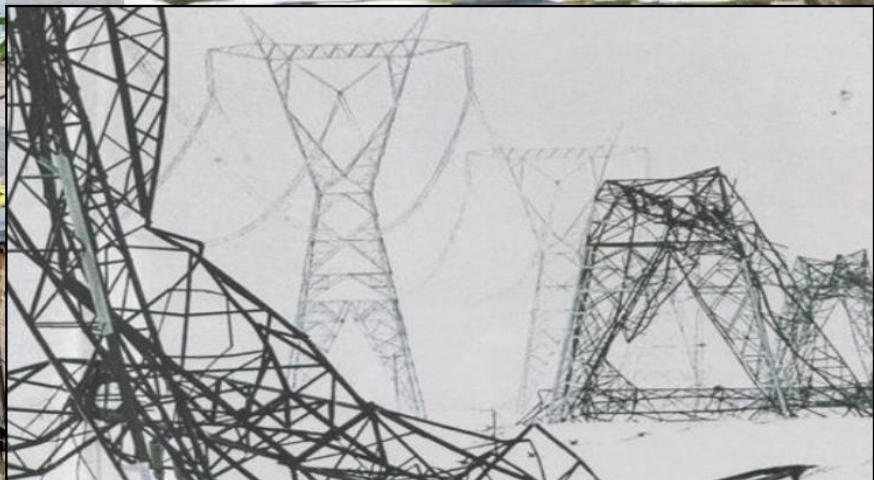
Mark Richardson

Kaori Sato

Science Grand Challenges Panel Discussion #1



- How can “big science questions” be tackled/addressed by novel capabilities of EarthCARE to maximize the scientific value of EarthCARE?
- Theme of this session: “From clouds and convection to weather and climate: How can EarthCARE improve predictions and our understanding of climate sensitivity?”
- First, panel members are invited to give introductory words on what they think are key priorities and/or challenges in using EarthCARE measurement to address the grand challenge above. Then, discussion is open to all the participants.
- Possible issues/points/items to be considered:
 - Process understanding: Which process? How to analyse EarthCARE data?
 - Model evaluation/constraint: How? Traditional GCMs vs Global km models?
 - How to link cloud/convection processes to prediction/climate sensitivity?
 - Others



EarthCARE: A Step Change in Observing Cloud Processes

Why EarthCARE matters?

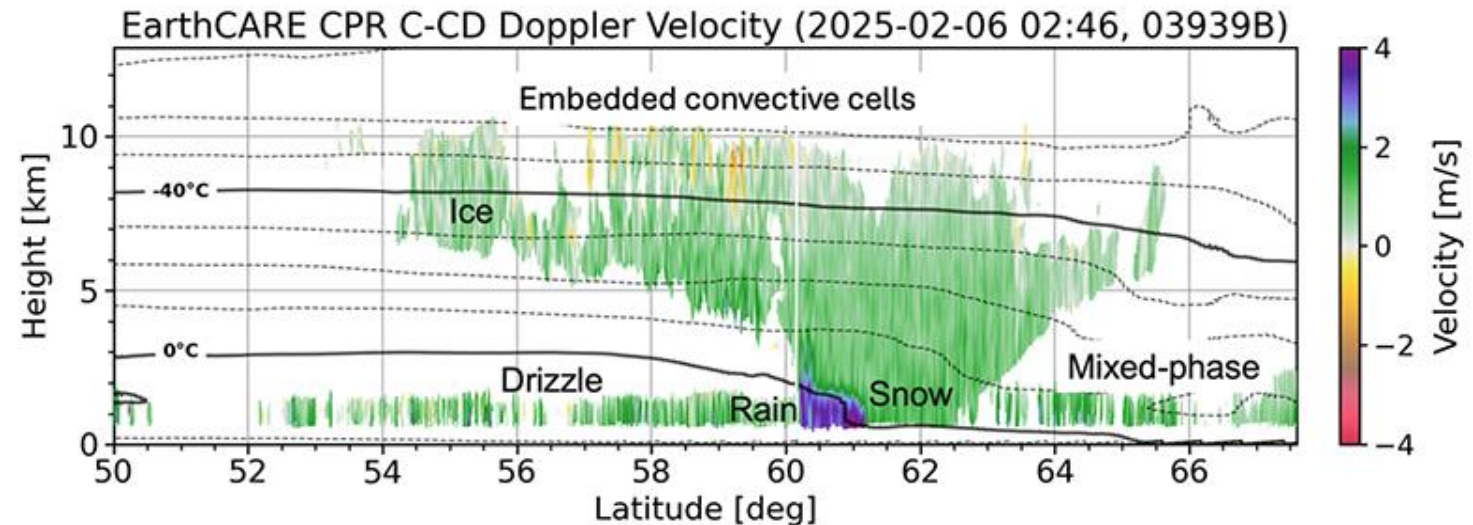
The first satellite mission to observe cloud structure, microphysics, dynamics, aerosols, and radiation simultaneously.

First spaceborne Doppler cloud radar

Vertical air motion Cloud dynamics
Turbulence and gravity waves

Improved cloud process observations

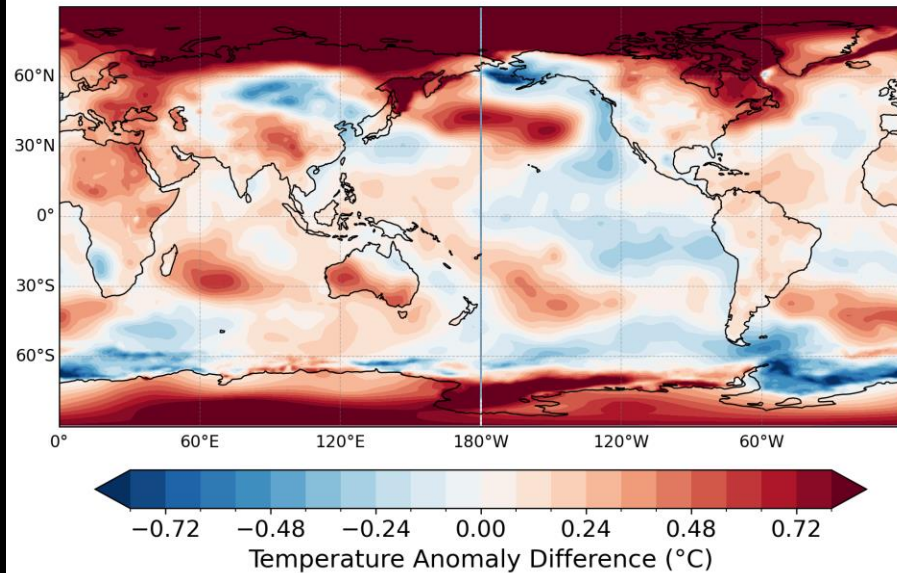
- Warm-rain initiation
- Convective activity & Turbulence



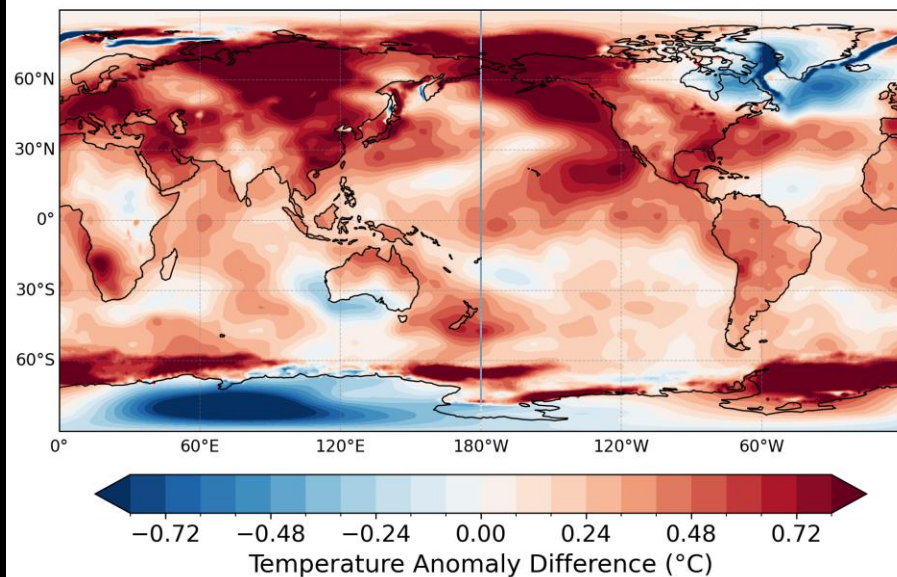
EarthCARE moves cloud observations from cloud structure to cloud dynamics.

“Pattern Effect” – long, homogeneous records needed

Berkeley Earth: Mean (2005-2014) minus Mean (1995-2004)



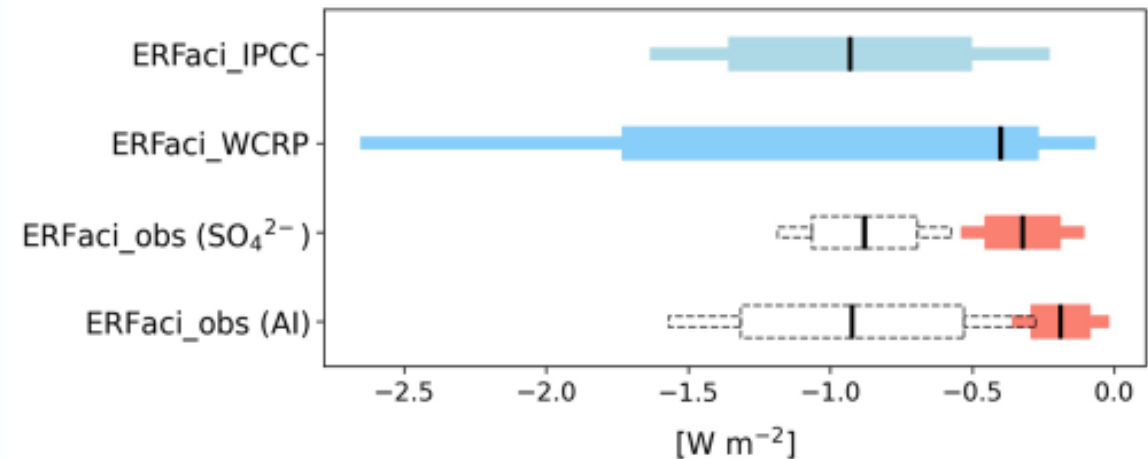
Berkeley Earth: Mean (2015-2024) minus Mean (2005-2014)



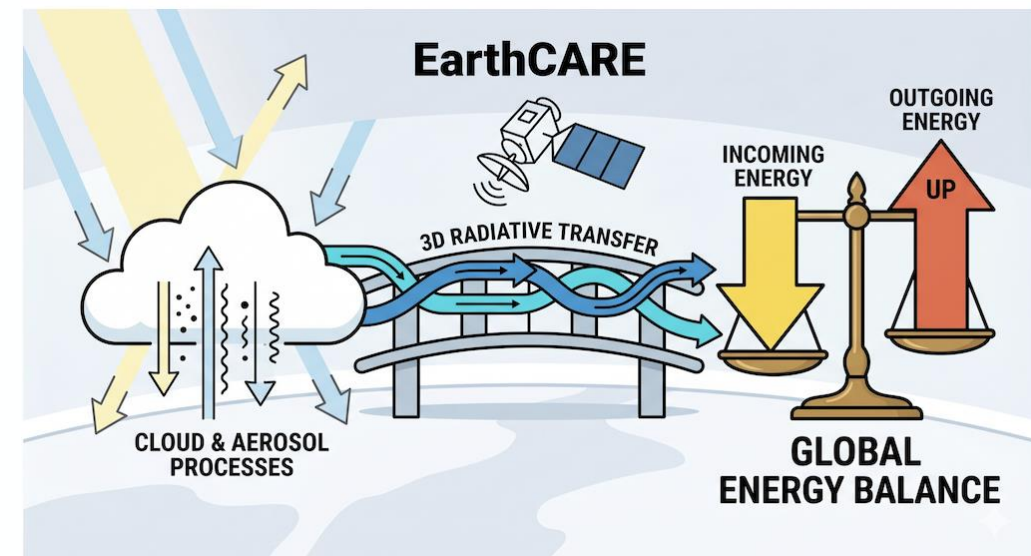
ACM-CAP - Aerosol Effective Radiative Forcing

Observational constraints suggest a smaller effective radiative forcing from aerosol-cloud interactions

Chanyoung Park, Brian J. Soden, Ryan J. Kramer, Tristan S. L'Ecuyer, and Haozhe He



EarthCARE can bridge physics to wide scale – 3D RT, ML, ...



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