



EarthCARE 2026 Science and Validation workshop

8–12 June 2026 | Rhodes House | Oxford, UK

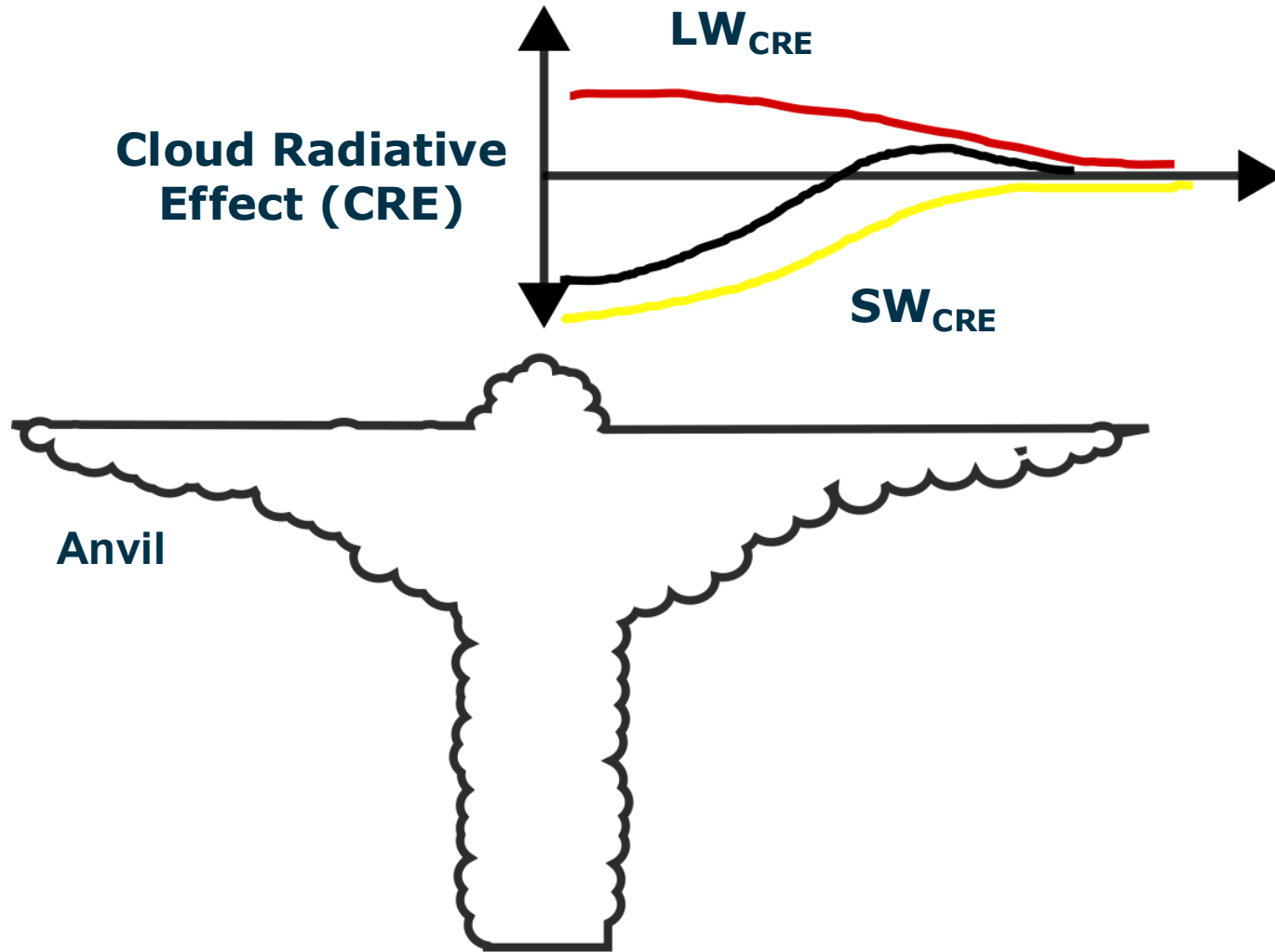
Linking convection to anvil opacity in EarthCARE

Mathilde Ritman¹, William Jones², Shannon Mason³, Philp Stier¹

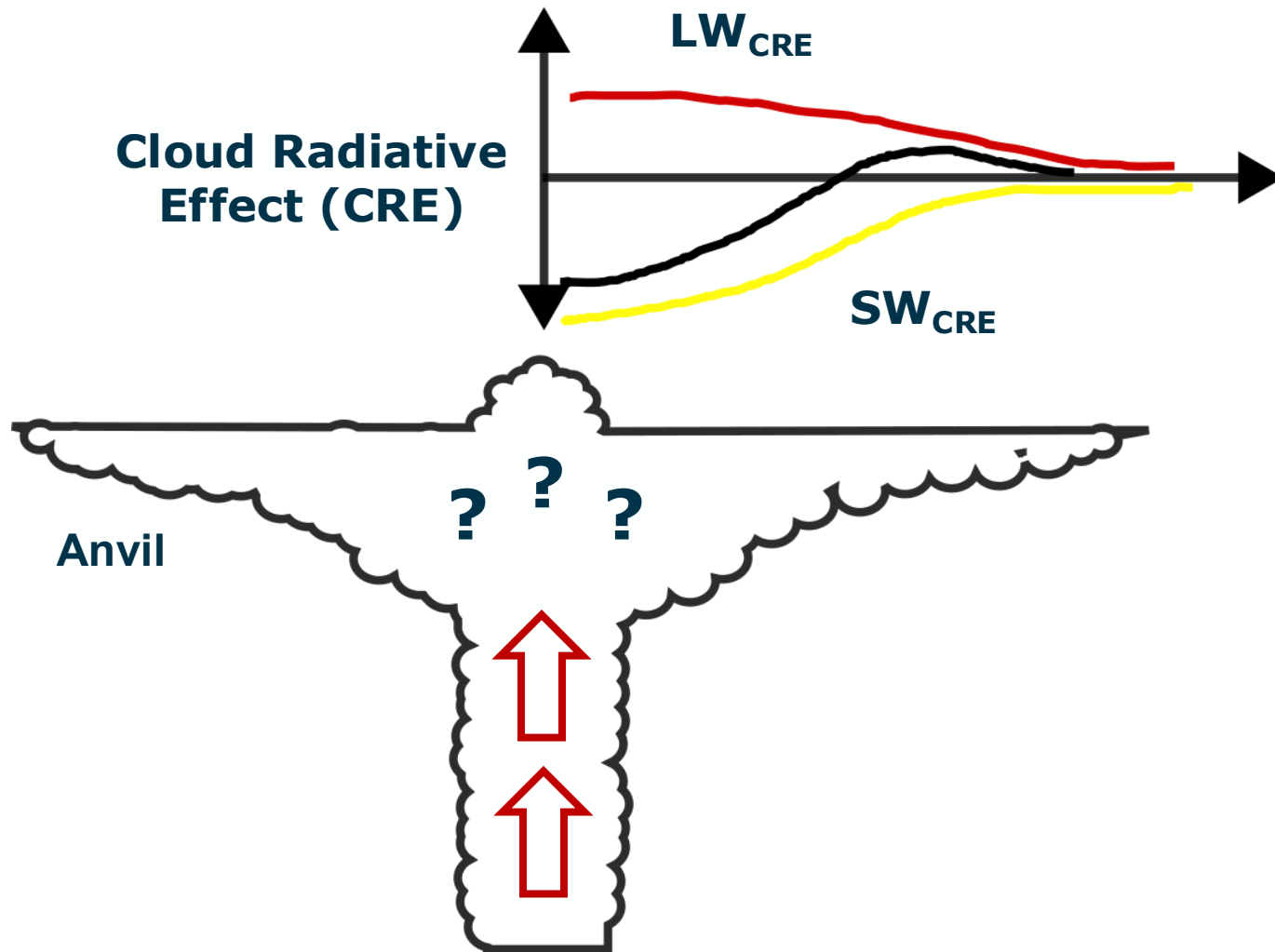
¹University of Oxford, ²European Space Agency, ³European Centre Medium-Range Weather Forecasts

Acknowledgements: ESA Cloud Climate Change Initiative (Cloud_cci) project, General Sir John Monash Foundation

Deep convective clouds matter for climate (and more)



Does convection change anvil opacity?



Does convection change anvil opacity?

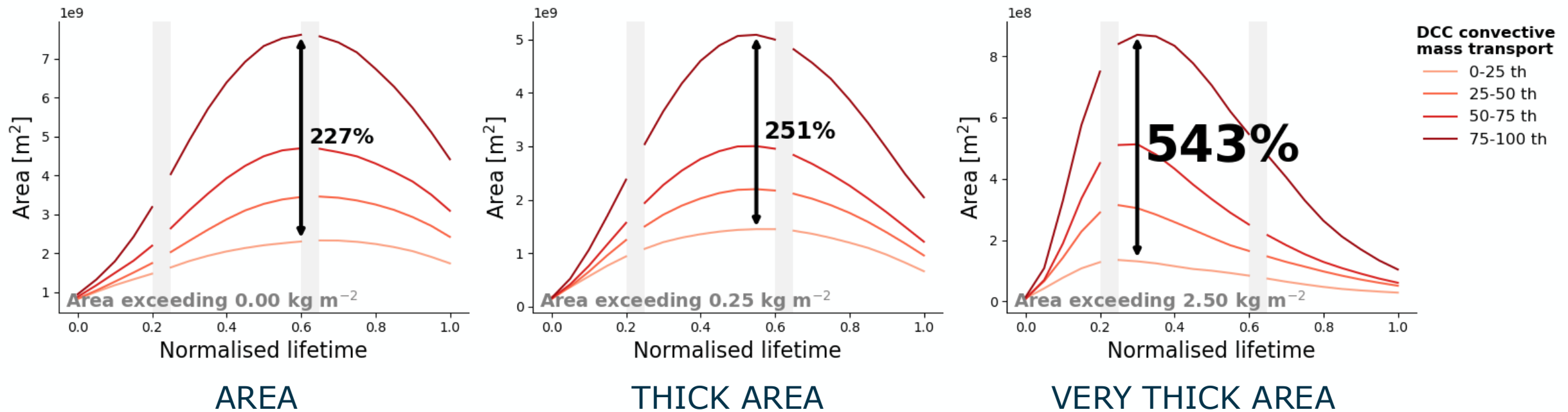


- We looked at this in **km-scale models**, using cloud tracking (Ritman et al. 2026)

Does convection change anvil opacity?



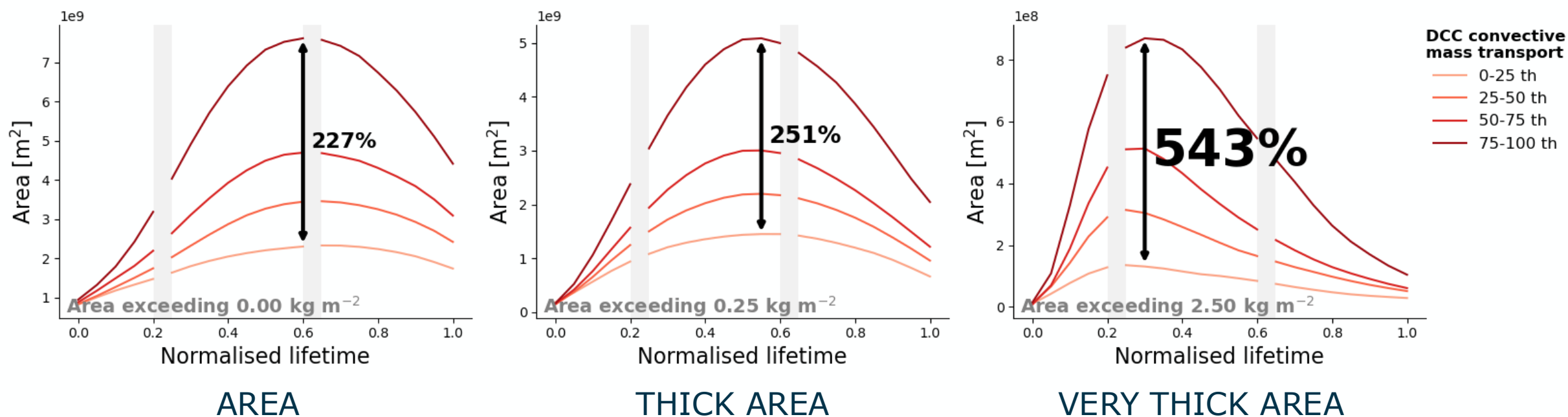
- We looked at this in **km-scale models**, using cloud tracking (Ritman et al. 2026)



Yes, more convection meant thicker anvils in ICON



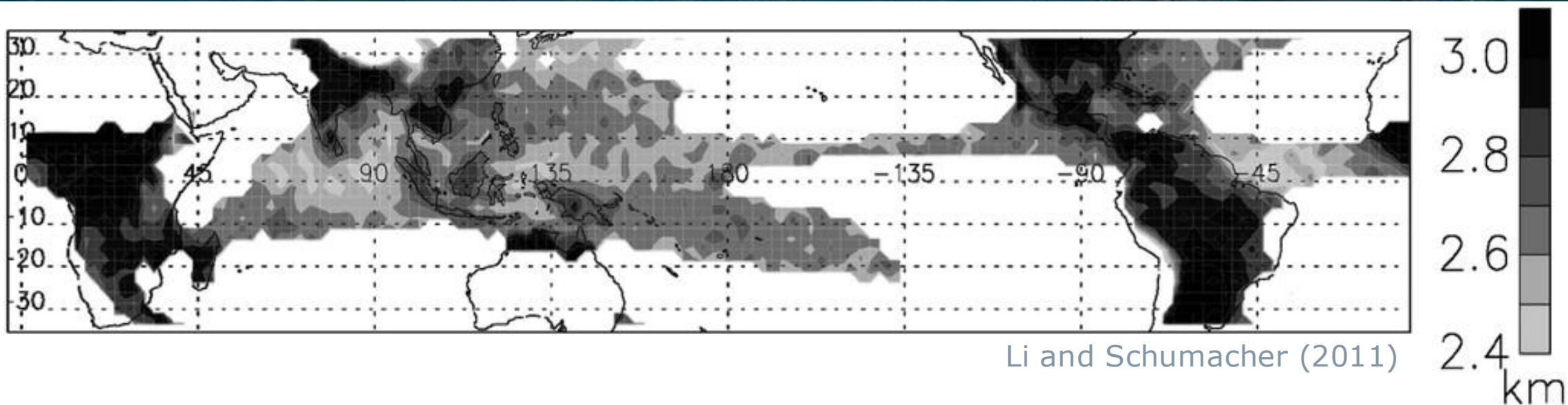
- We looked at this in **km-scale models**, using cloud tracking (Ritman et al. 2026)
- Yes, higher **convective mass fluxes meant thicker anvils** in the ICON model (Ritman et al., in prep)



What about in *real anvils*?

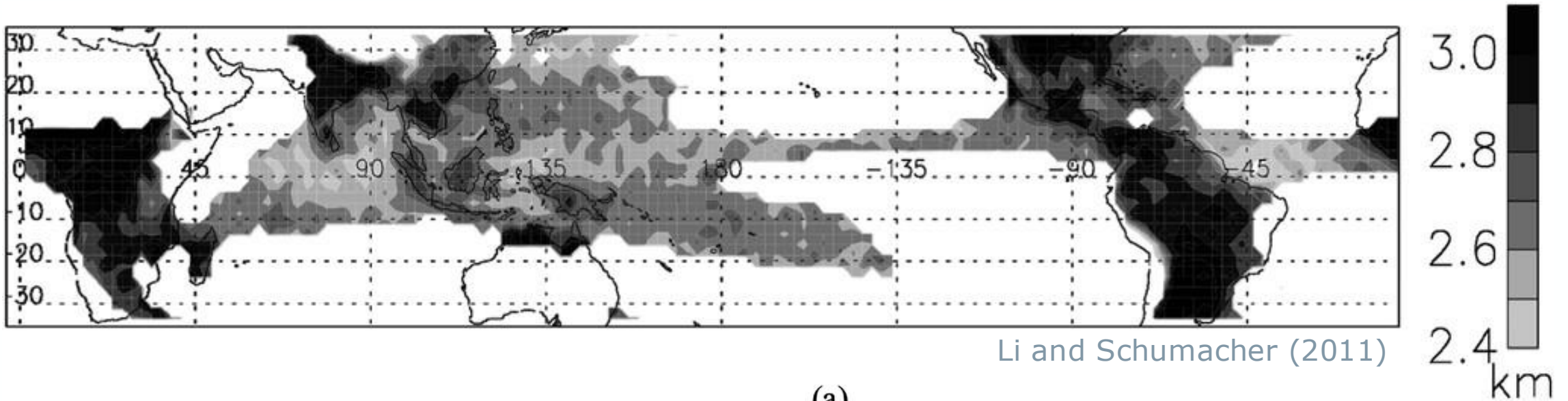


What about in *real* anvils?

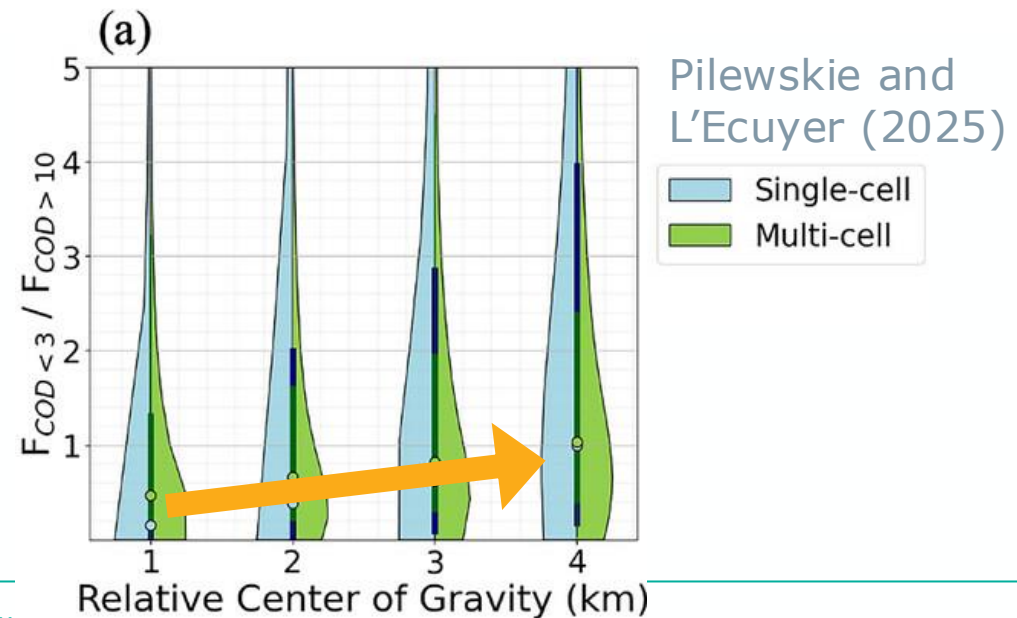


- Thicker anvils over land in TRMM

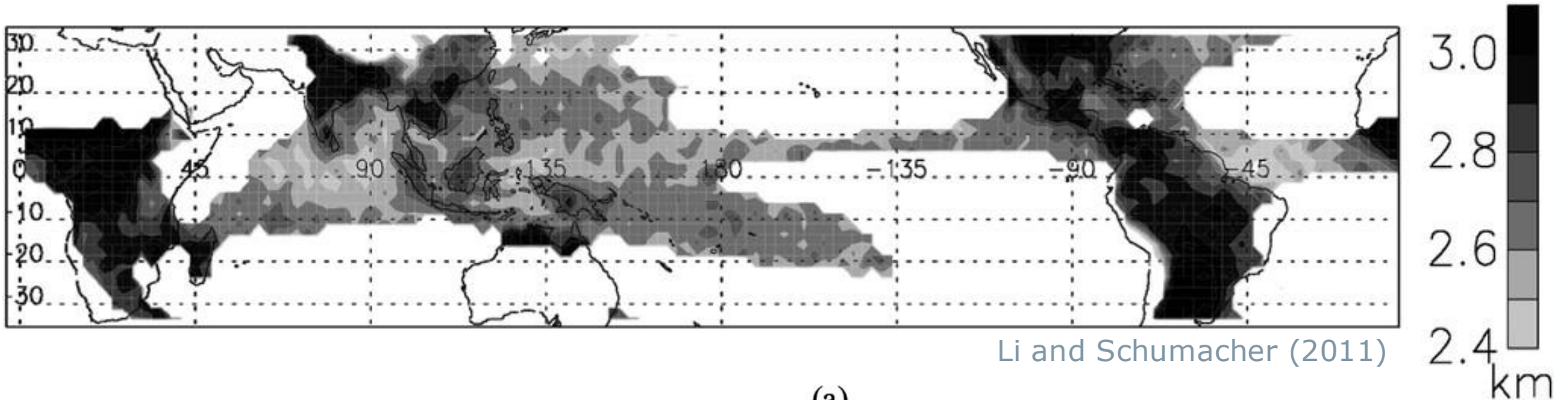
What about in *real* anvils?



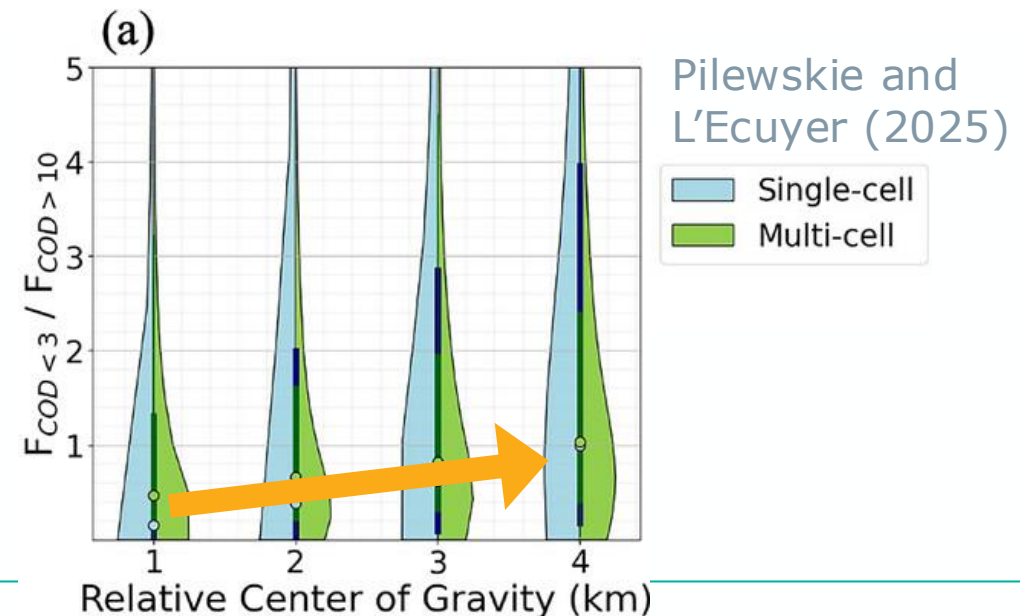
- Thicker anvils over land in TRMM
- Increase in thin anvil with more intense convection in CloudSat



What about in *real* anvils?



- Thicker anvils over land in TRMM
 - Increase in thin anvil with more intense convection in CloudSat
- **Some disagreement in observations**



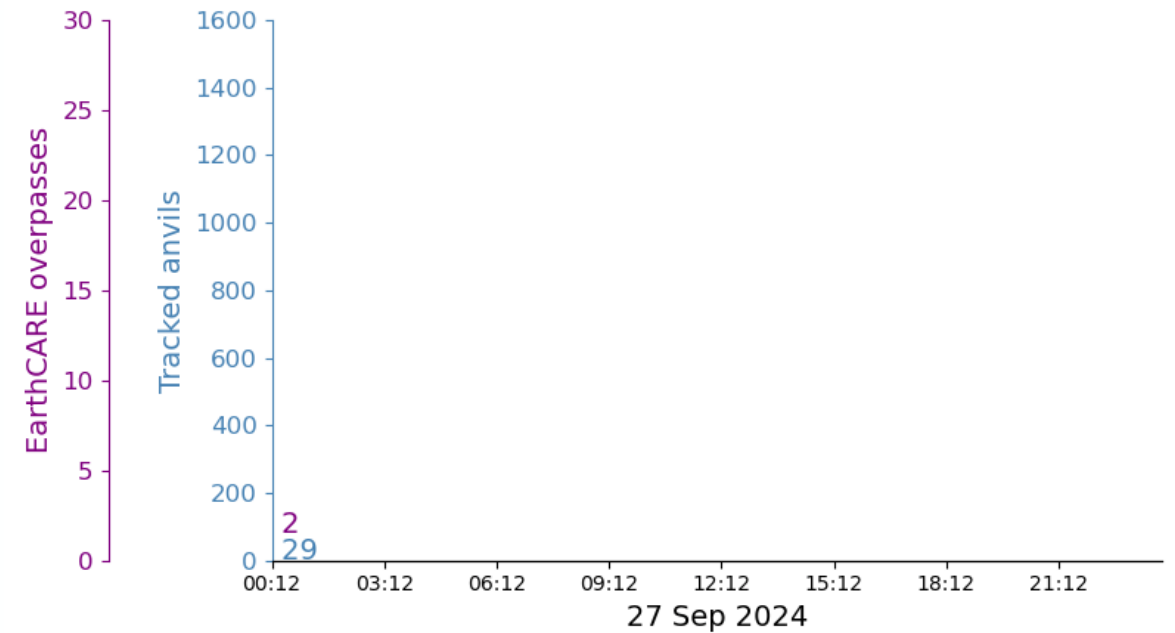
EarthCARE overpasses of deep convective clouds



27 Sep 2024 00:12 UTC



Tracked clouds in MSG-SEVERI, collocated with EarthCARE for ORCESTRA (William Jones 2026)

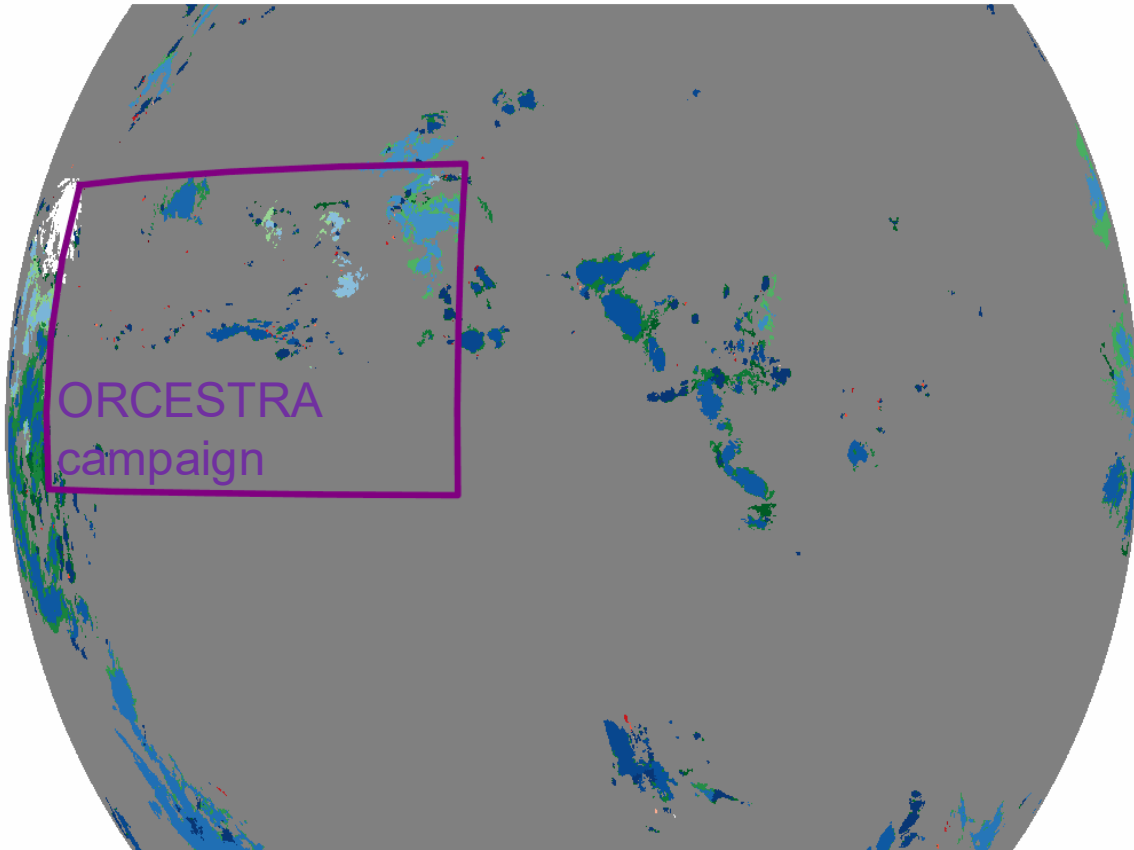


➤ **1059 collocated anvil clouds from mid-August to October**

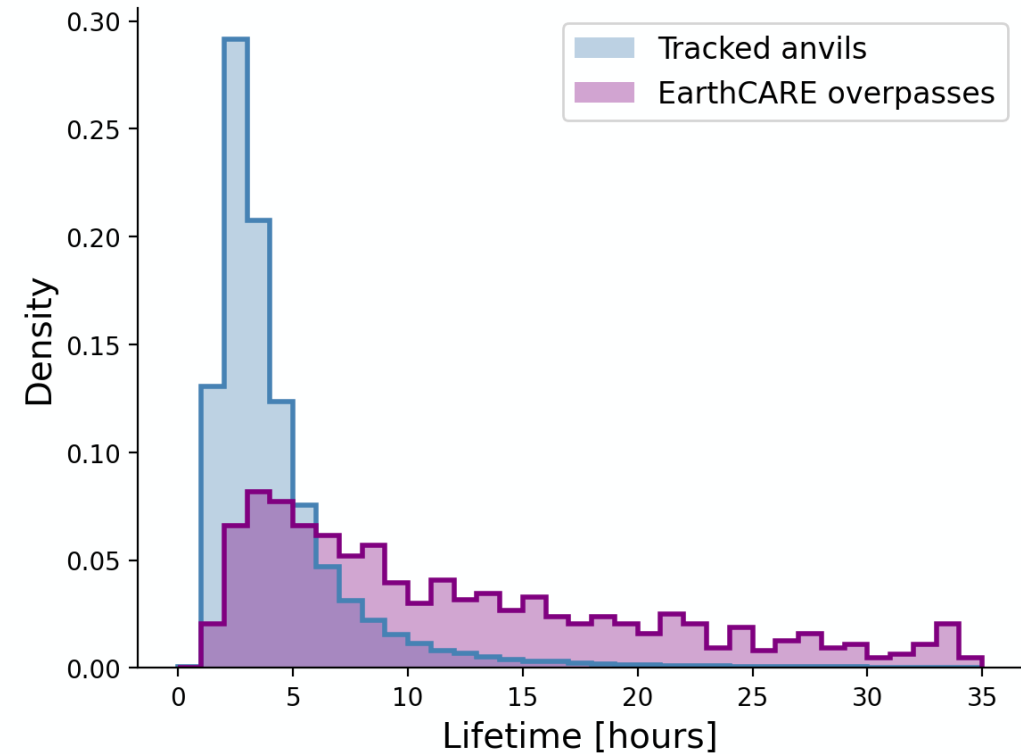
EarthCARE overpasses of deep convective clouds



27 Sep 2024 00:12 UTC

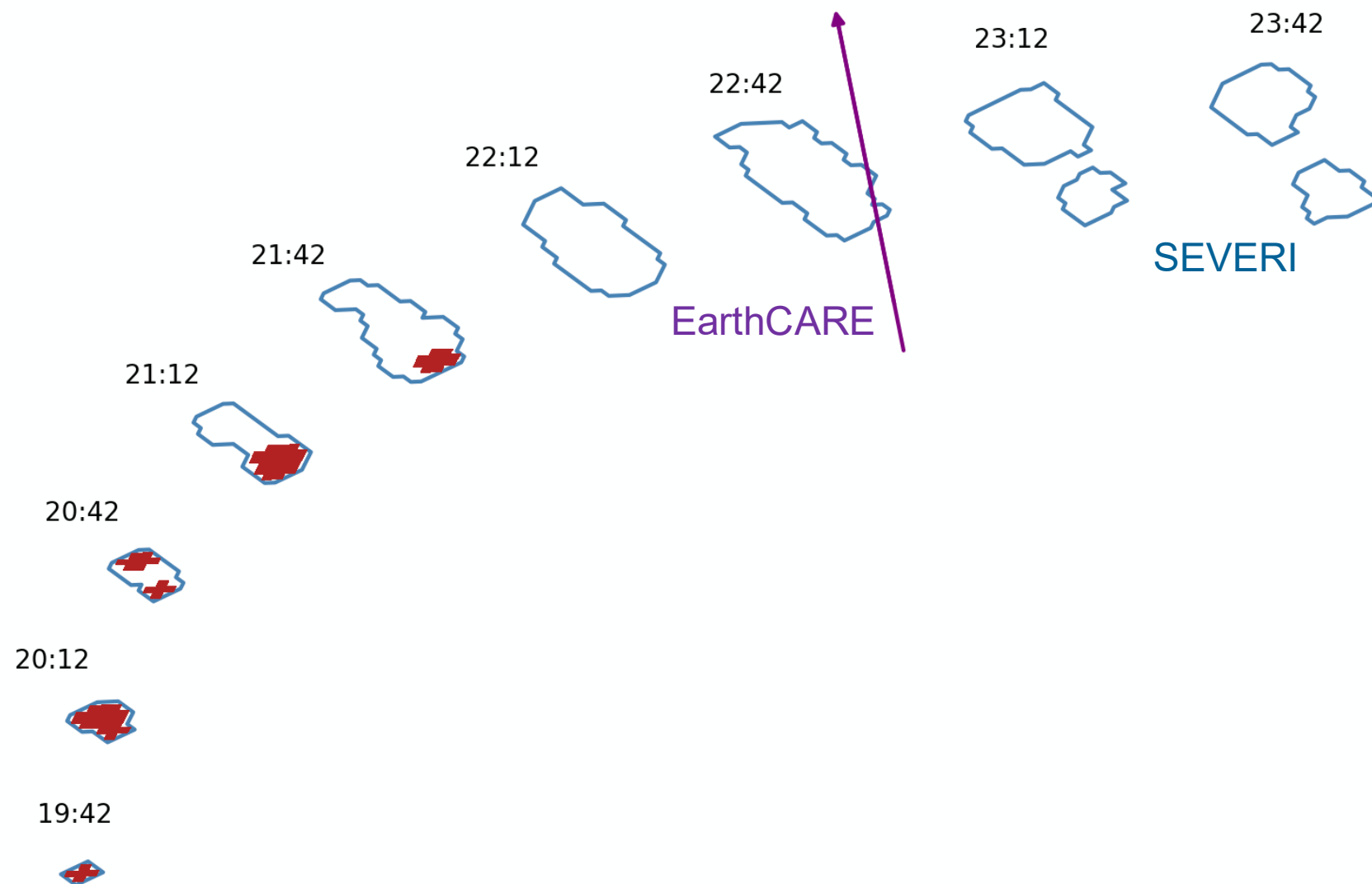


Tracked clouds in MSG-SEVERI, collocated with EarthCARE for ORCESTR (William Jones 2026)

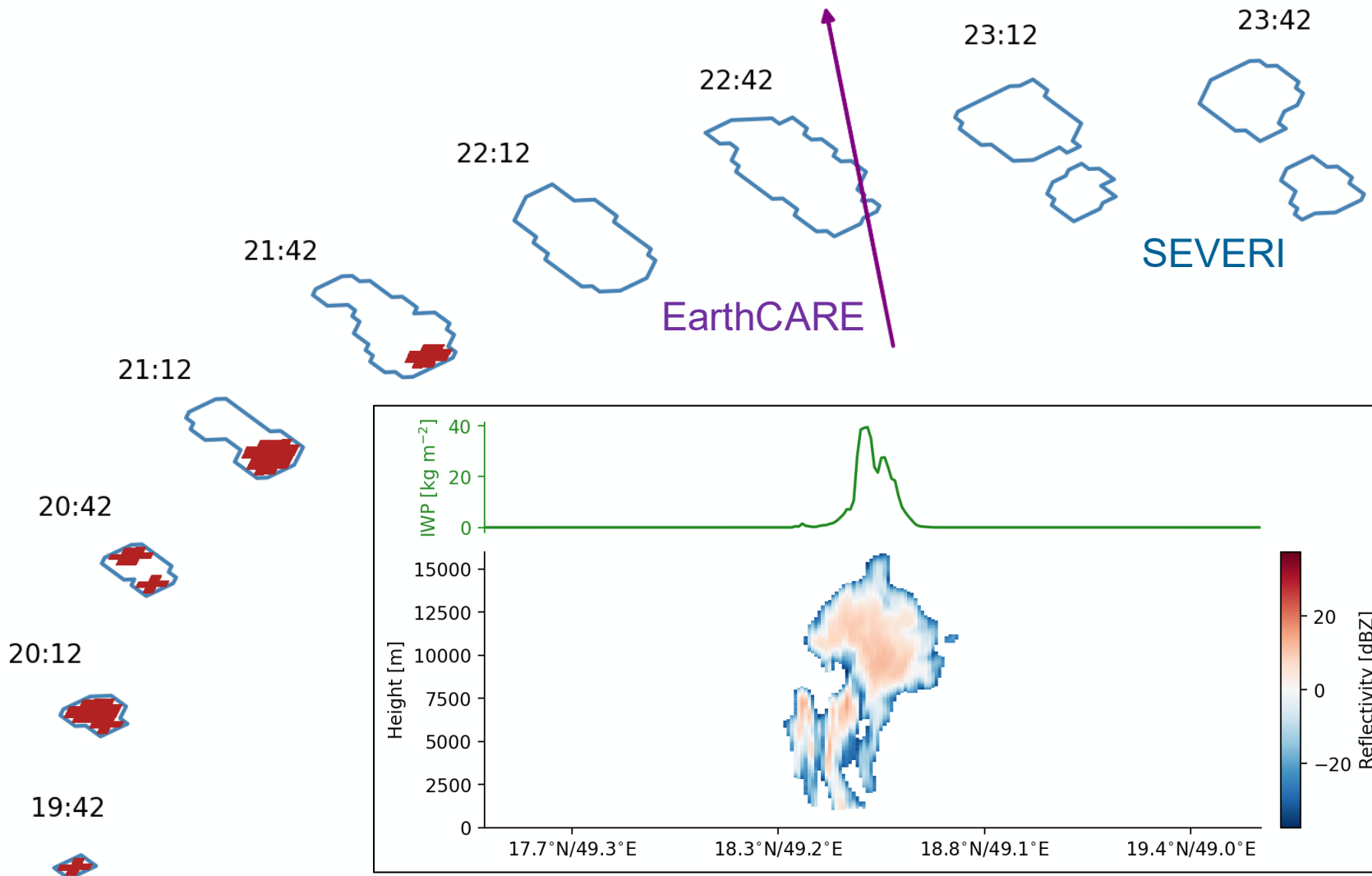


➤ Longer-lived systems are more likely to be seen by EarthCARE

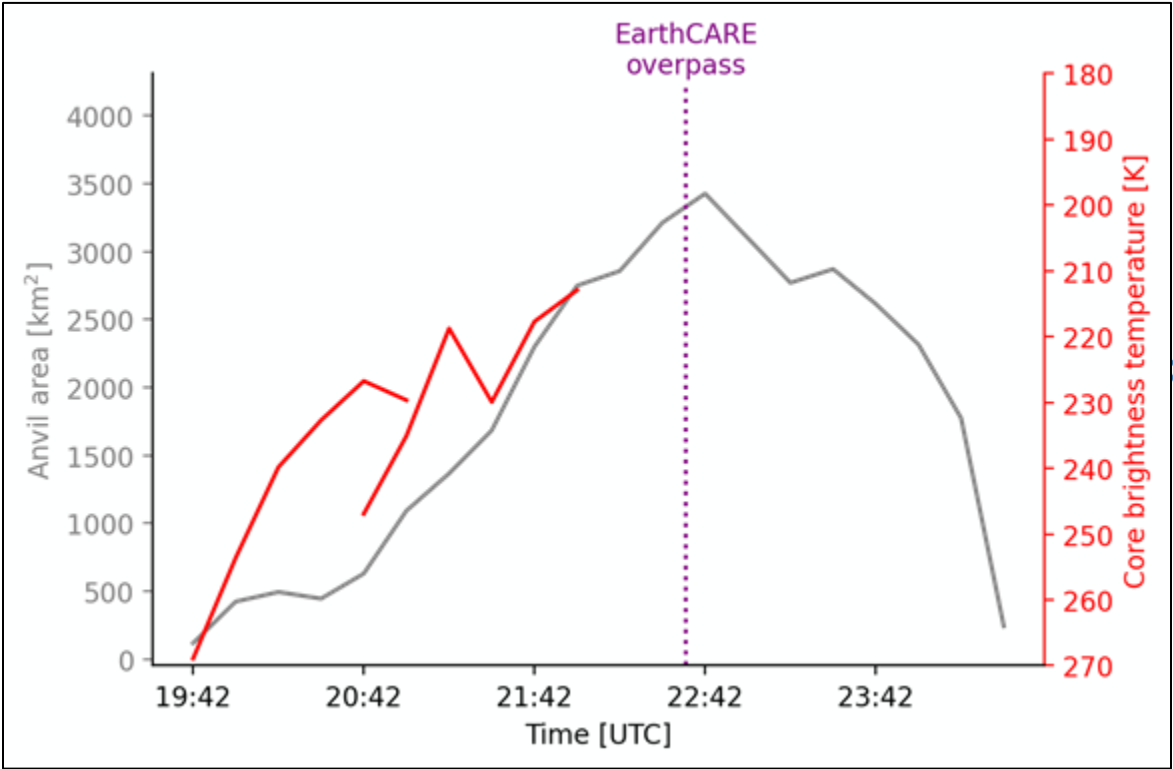
EarthCARE overpasses of deep convective clouds



EarthCARE overpasses of deep convective clouds



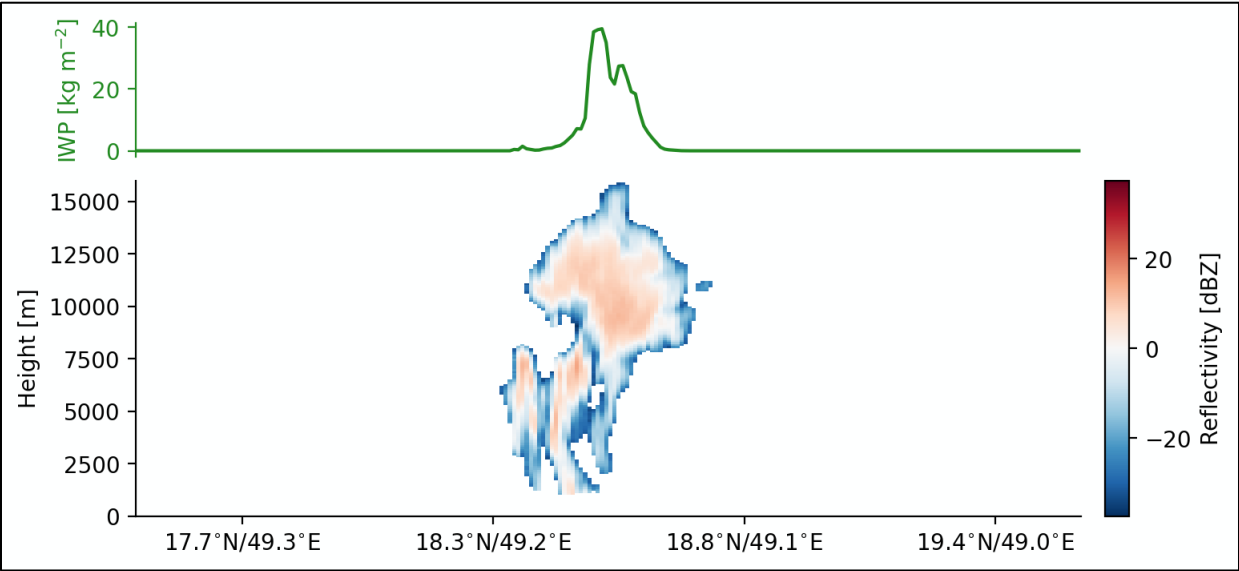
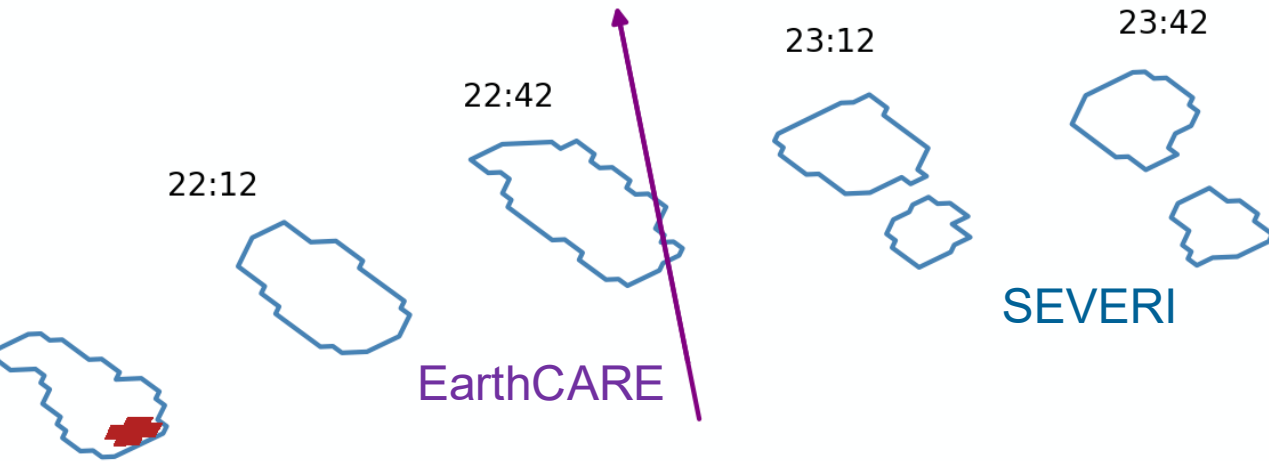
Convective history of EarthCARE deep convection



20:12



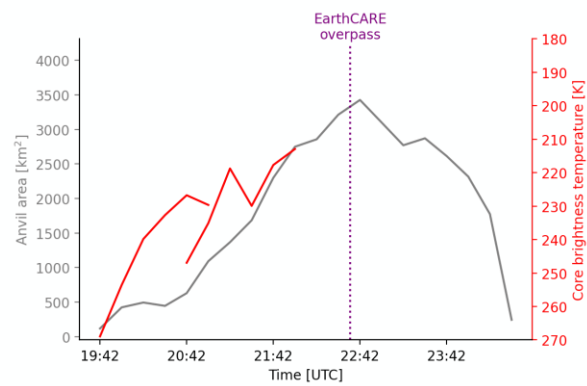
19:42



Convective history of EarthCARE deep convection



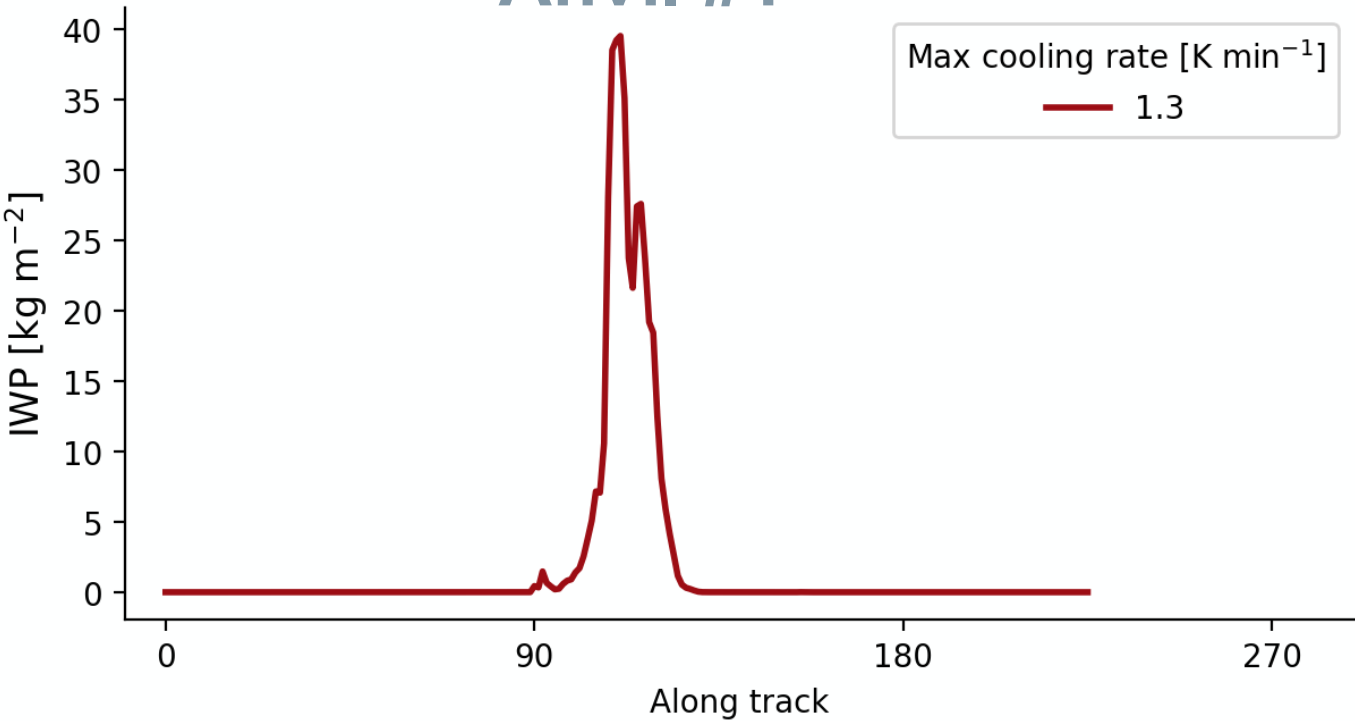
Anvil #1



Anvil #2

?

Anvil #1



Convective history of EarthCARE deep convection



Anvil #2

06:12

07:12

08:12

09:12

10:12

11:12

12:12

22:42

23:12

23:42

22:12

21:42

21:12

20:42

20:12

19:42

Anvil #1

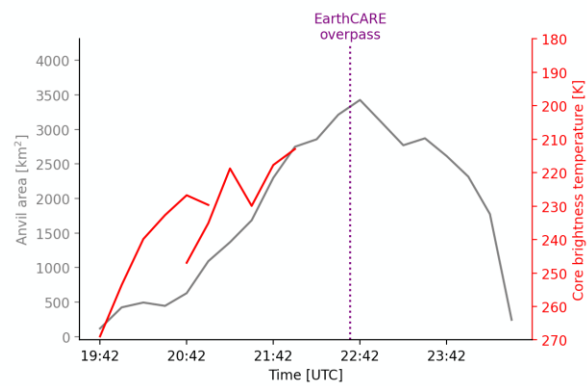
Similar?

- ✓ Near the convective area
- ✓ After initial development

Convective history of EarthCARE deep convection

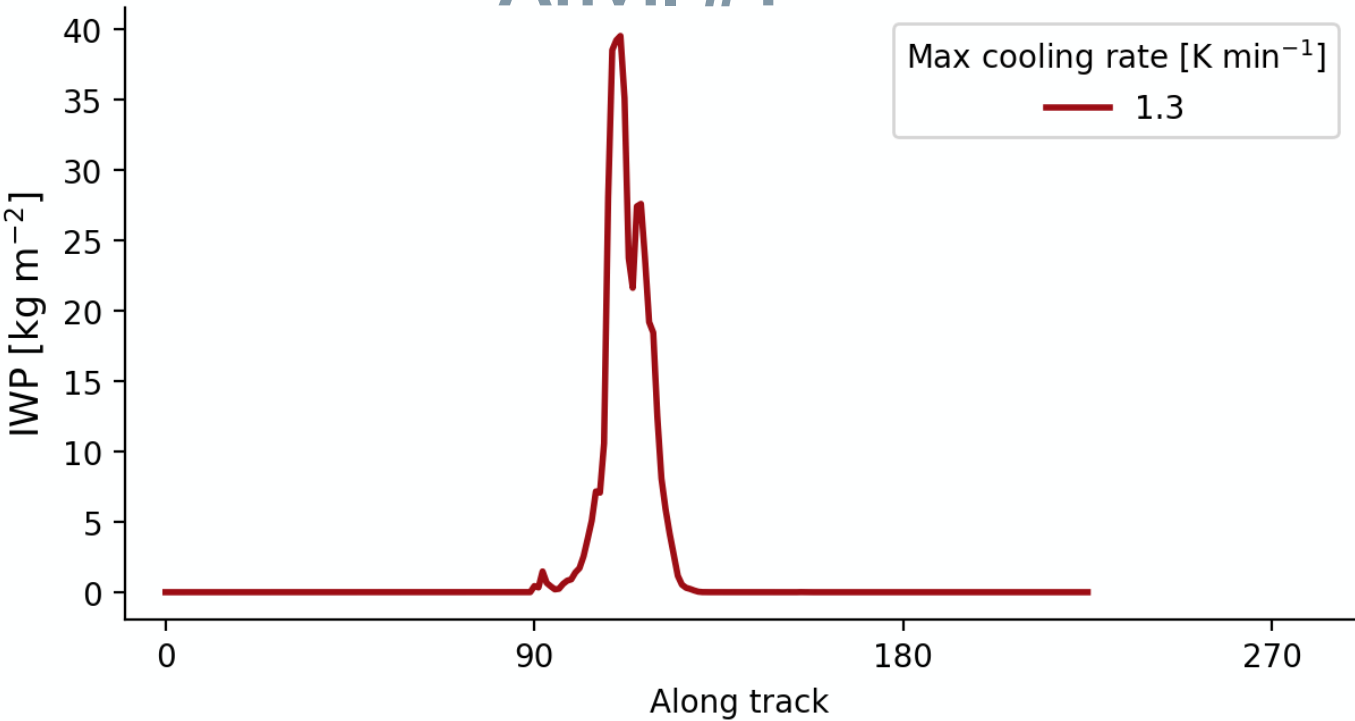


Anvil #1



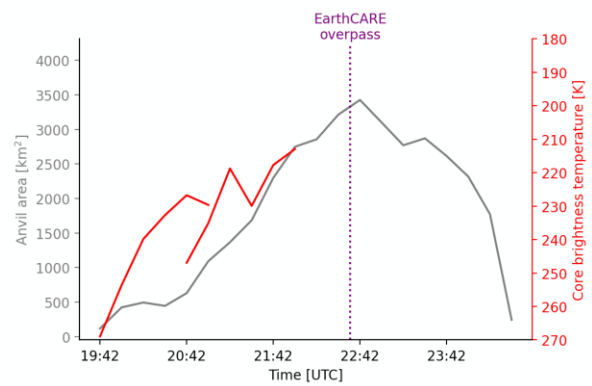
Anvil #2

Anvil #1

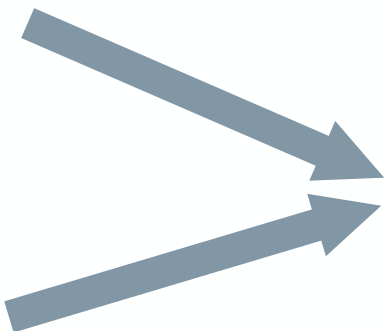
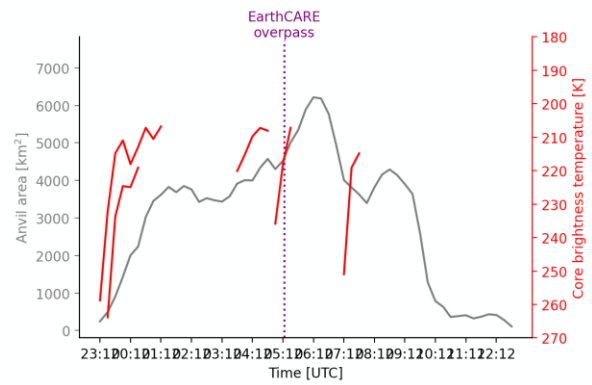


Convective history of EarthCARE deep convection

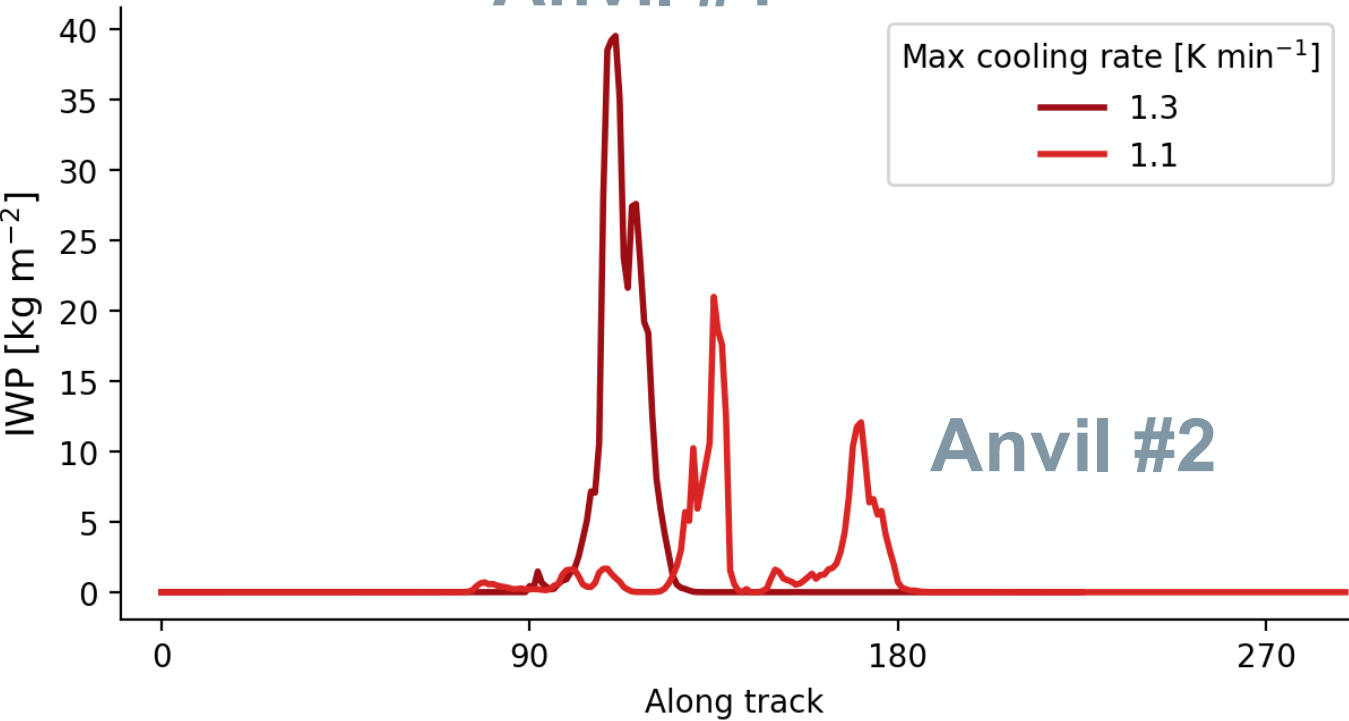
Anvil #1



Anvil #2



Anvil #1

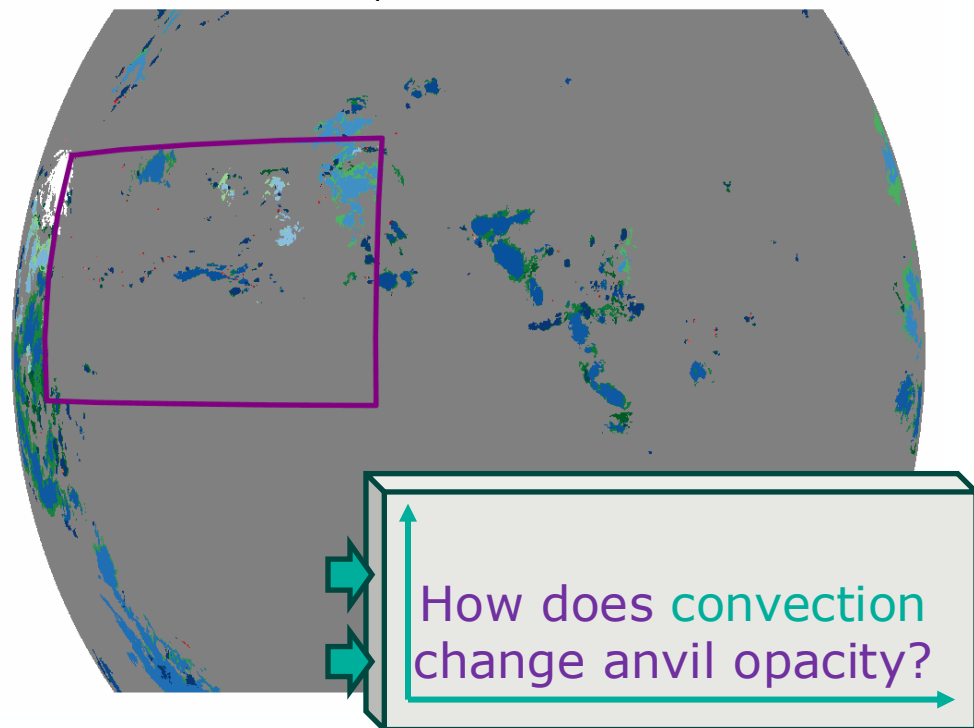


Anvil #2

So, how does convection control anvil opacity?



27 Sep 2024 00:12 UTC



Summary

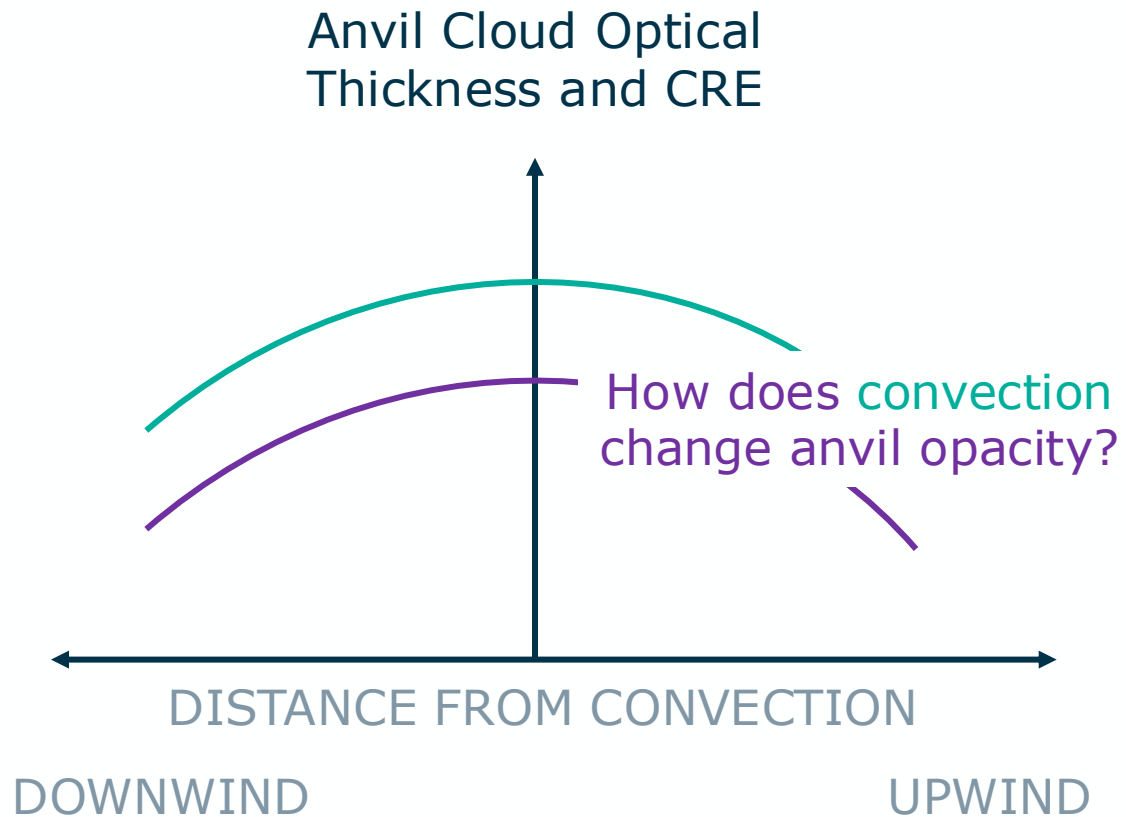
- Convective mass flux meant thicker clouds in the ICON km-scale model (Ritman et al., in prep.)
- New opportunity using collocated EarthCARE overpasses of deep convection (Will Jones 2026)

Thanks!

Mathilde.Ritman@physics.ox.ac.uk

With thanks to William Jones, Shannon Mason, Philp Stier and ESA Cloud Climate Change Initiative (Cloud_cci) project

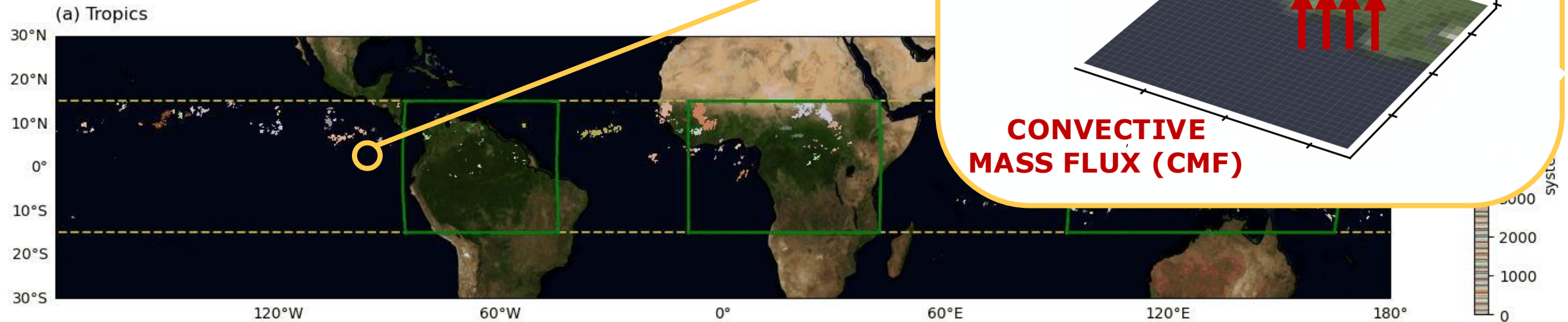
Can we fairly aggregate cloud structure?



Does convection change anvil opacity?



- We looked at this in **km-scale models**
- Using tracked* deep convective clouds in 3D



*Ritman et al., 2026

NextGEMs ICON global production runs, 1-4 July 2021