Long-term evaluation of regional models

Nicole van Lipzig, Kwinten Van Weverberg, Erwan Brisson and many others

http://ees.kuleuven.be/geography/rcs/

Belgium

Decadal COSMO-CLM simulations driven by ERA-Interim for Belgium at 2.8 km [Brisson, Van Weverberg, Stengel, van Lipzig et al., 2015]

© Erwan Brisson
Light gray: Ice
Dark gray : Graupel
Red: Snow
Blue: Rain + Cloud water

Surface contours:
Updraft (red); Downdraft (blue)

How well are clouds represented in convection permitting models?

CMSAF EUMETSAT CLAAS (Cloud property dAtAset using SEVIRI)

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Decadal COSMO-CLM simulations driven by ERA-Interim for Belgium at 2.8 km [Brisson, Van Weverberg, Stengel, van Lipzig et al., 2015]
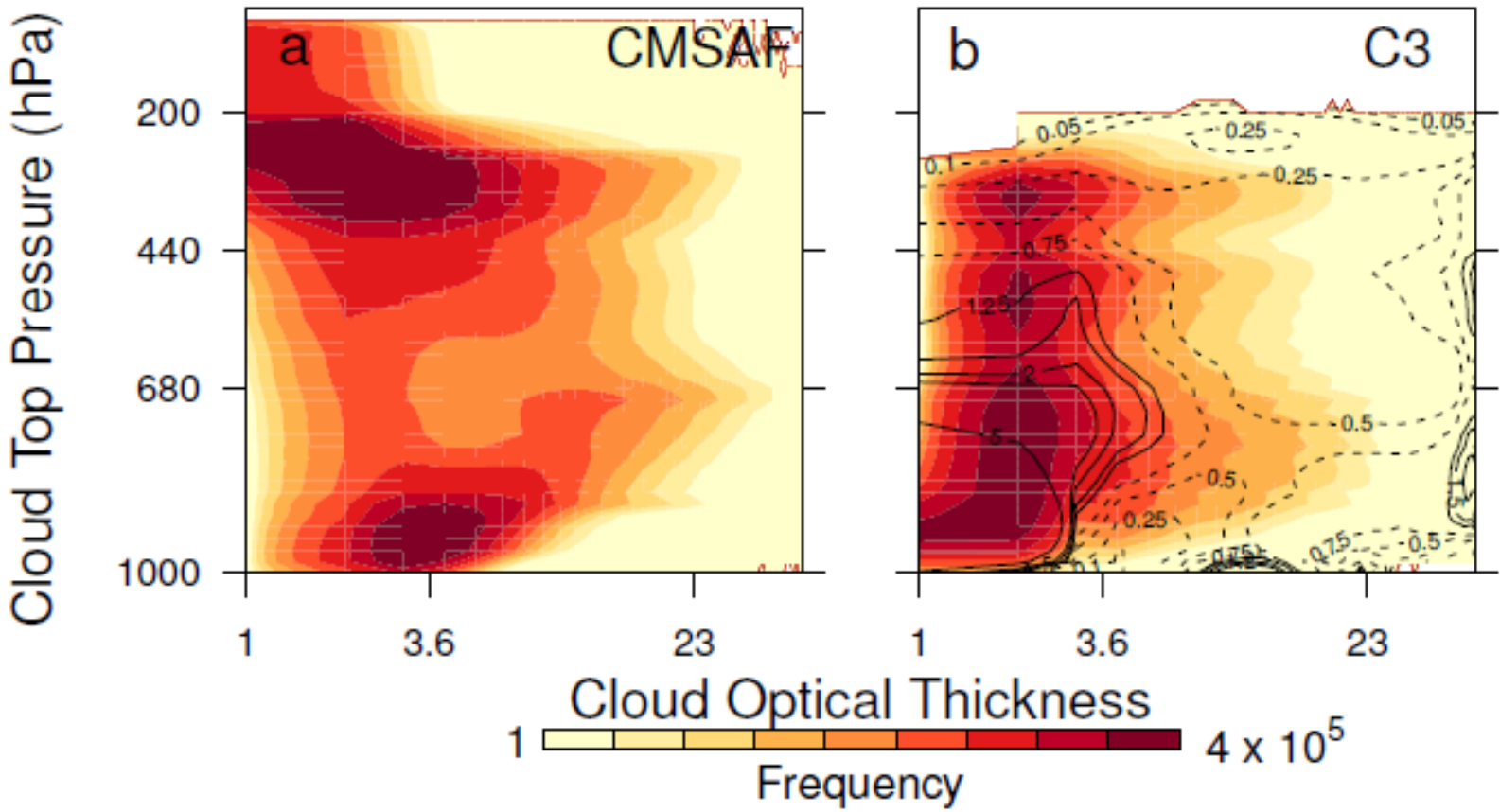- Daily cycle well represented
- Cloud fraction and cloud optical thickness underestimated
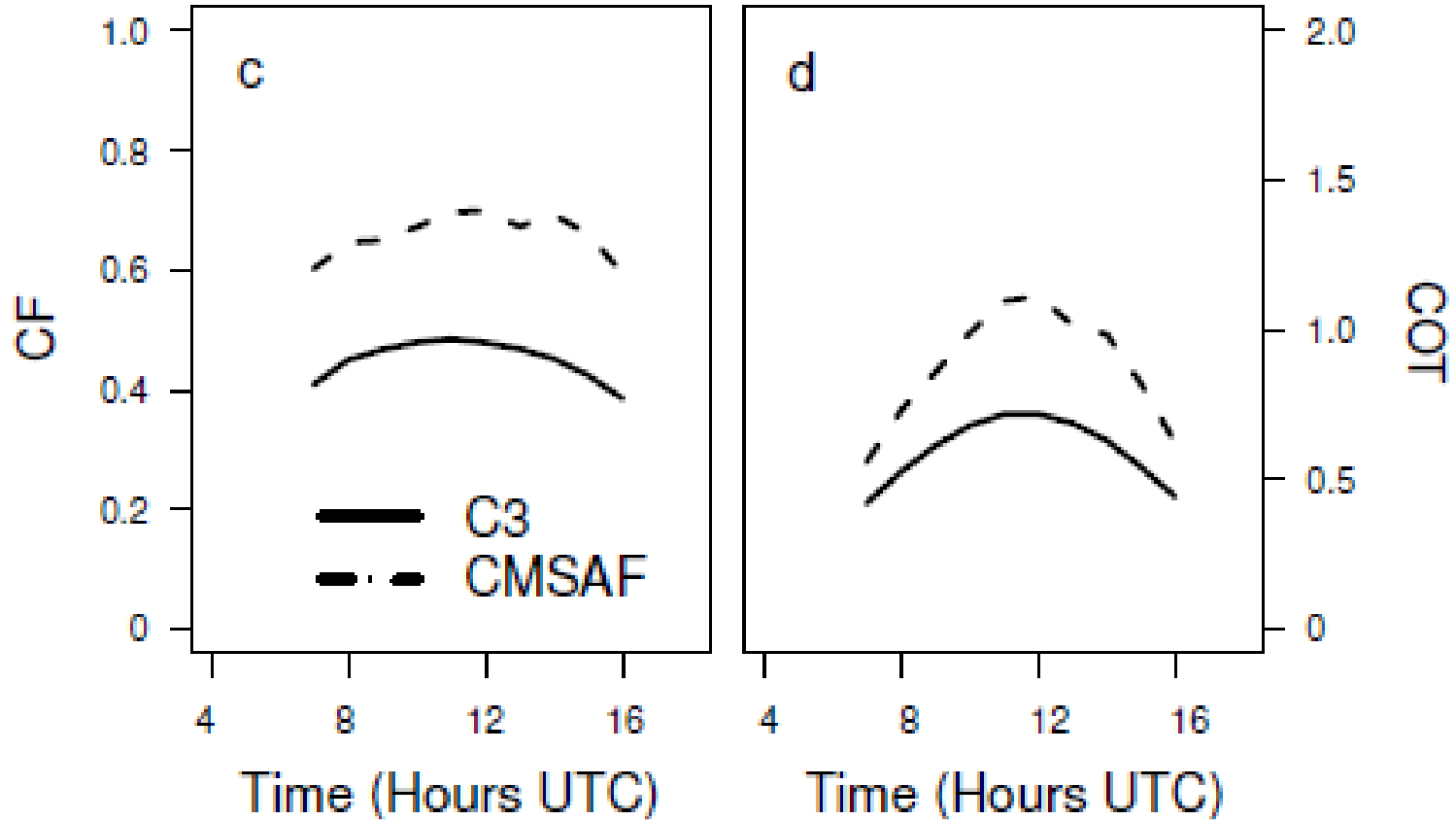
[Brisson, Van Weverberg, Stengel, van Lipzig et al., 2015]
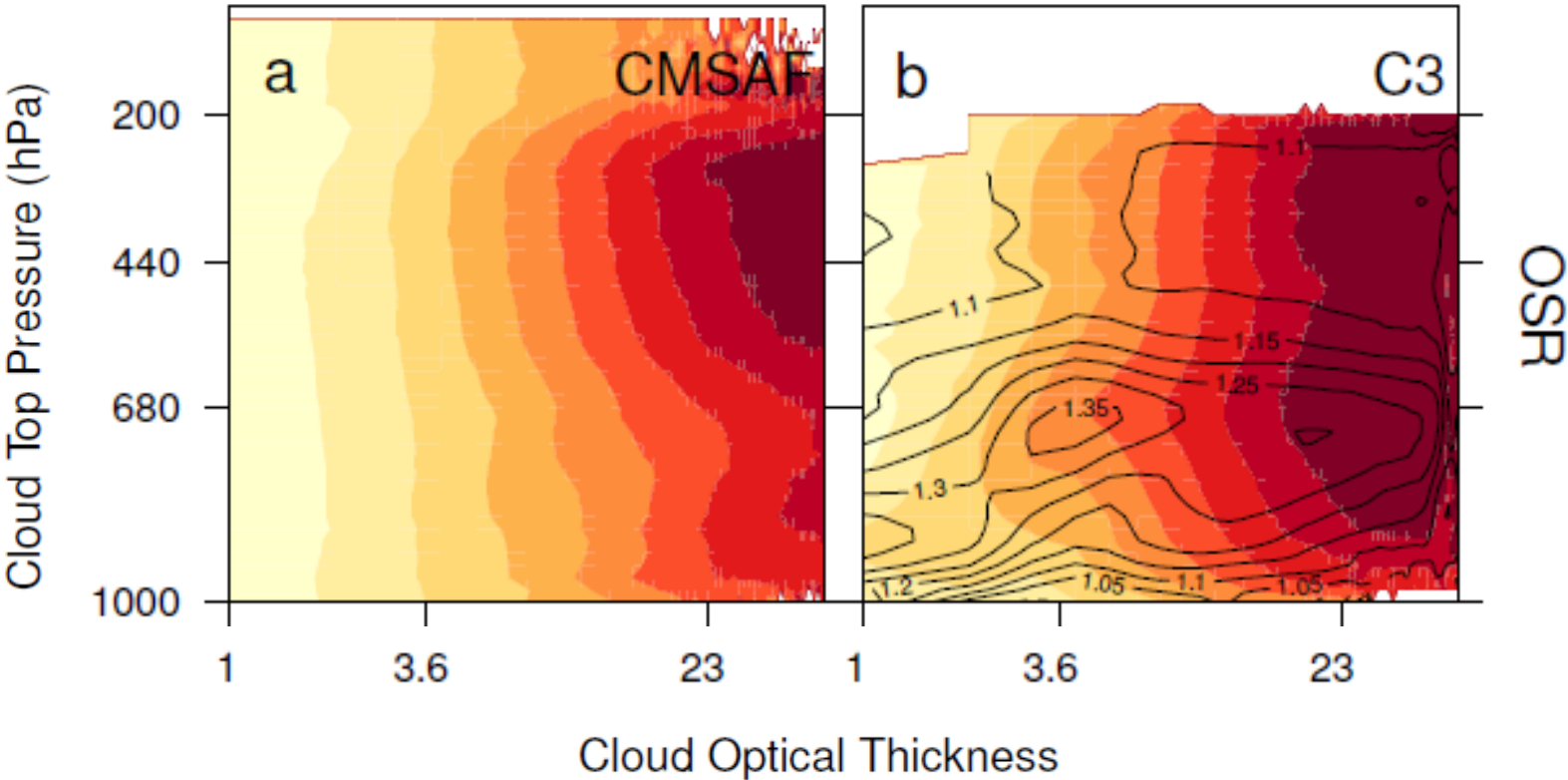- Too little high and intermediate, thick clouds
- Too much low, thin clouds

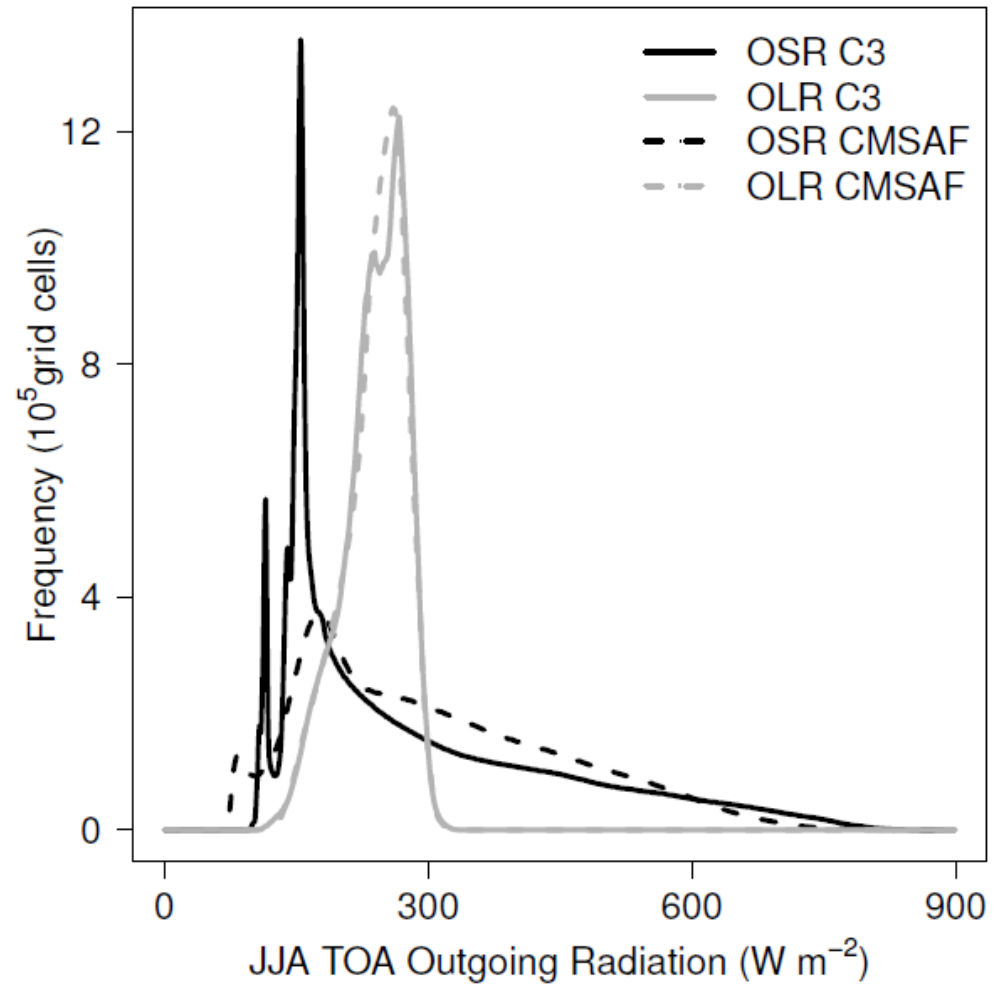General CPM: overestimated high cloud cover in LSM reduced

[Brisson, Van Weverberg, Stengel, van Lipzig et al., 2015]
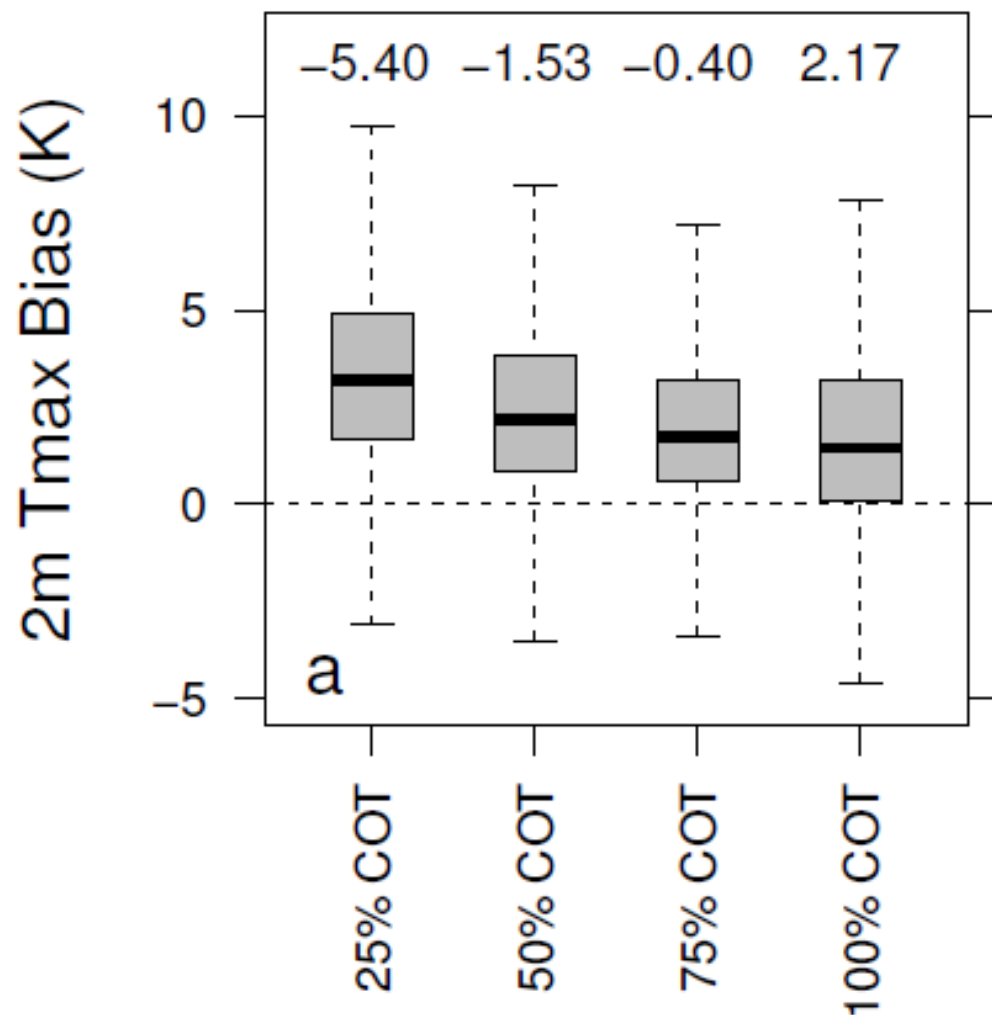- Underestimation of cloud amount is compensated by too much reflectivity of clouds

- TOA OSR 6% underestimated (308 W m^{-2} CMSAF; 291 W m^{-2} COSMO-CLM)

- Overestimation clear-sky conditions partly offset by too reflective clouds when they are present

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[Brisson, Van Weverberg, Stengel, van Lipzig et al., 2015]

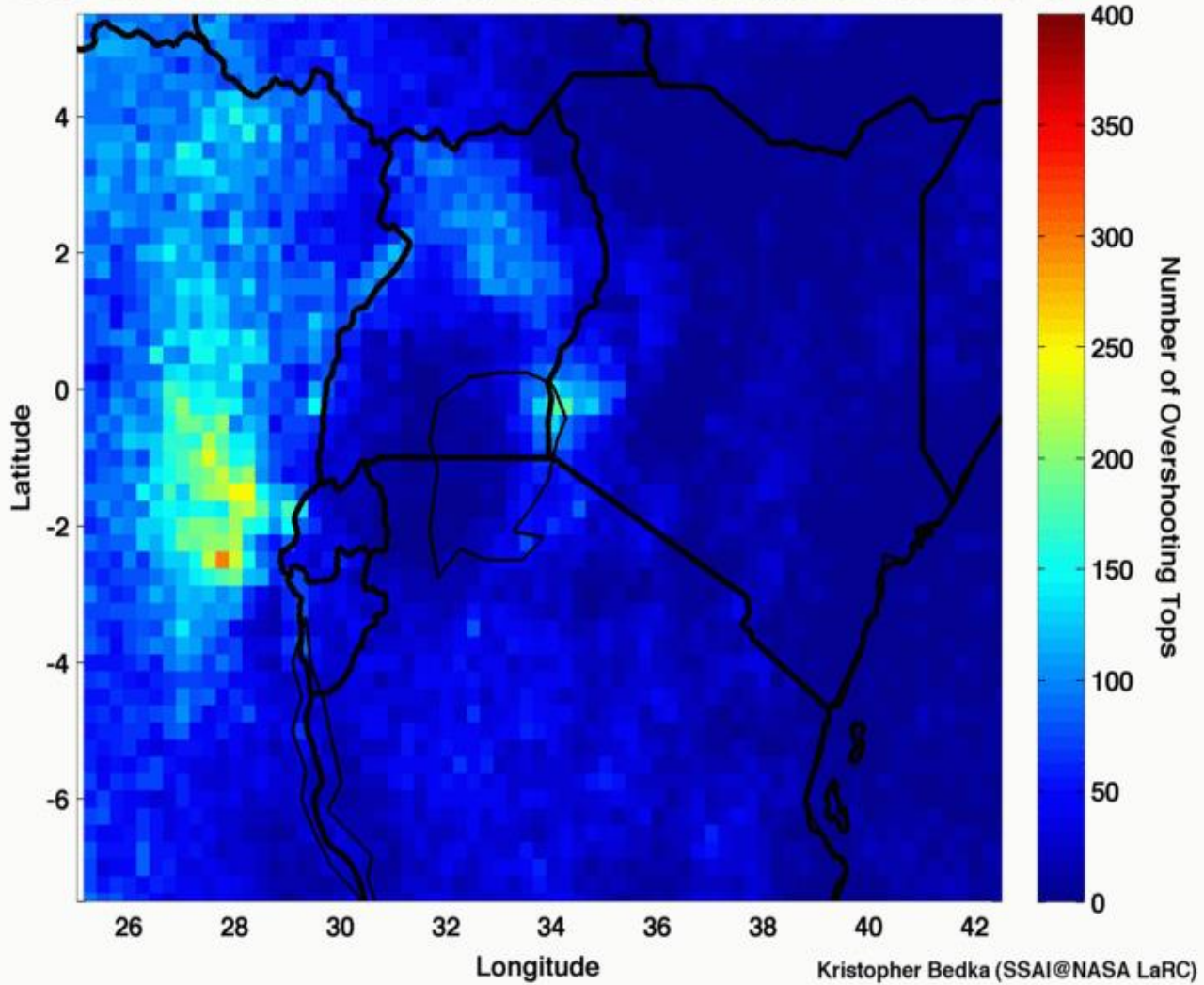- Partly explains the overestimation in JJA Tmax

East Africa

OVERSHOOTING TOP
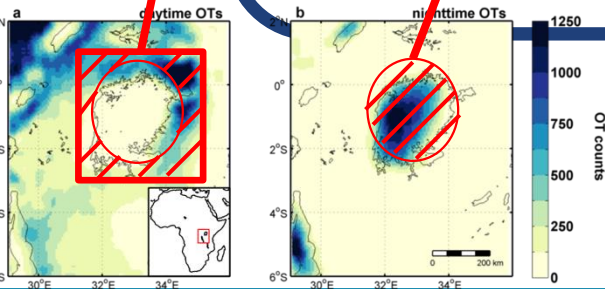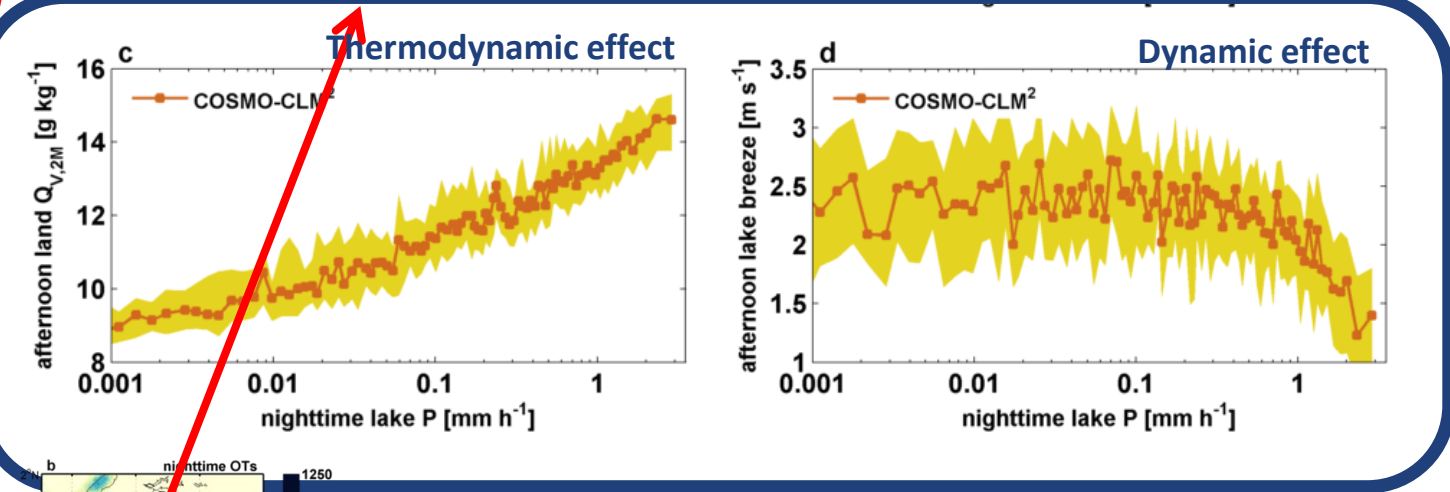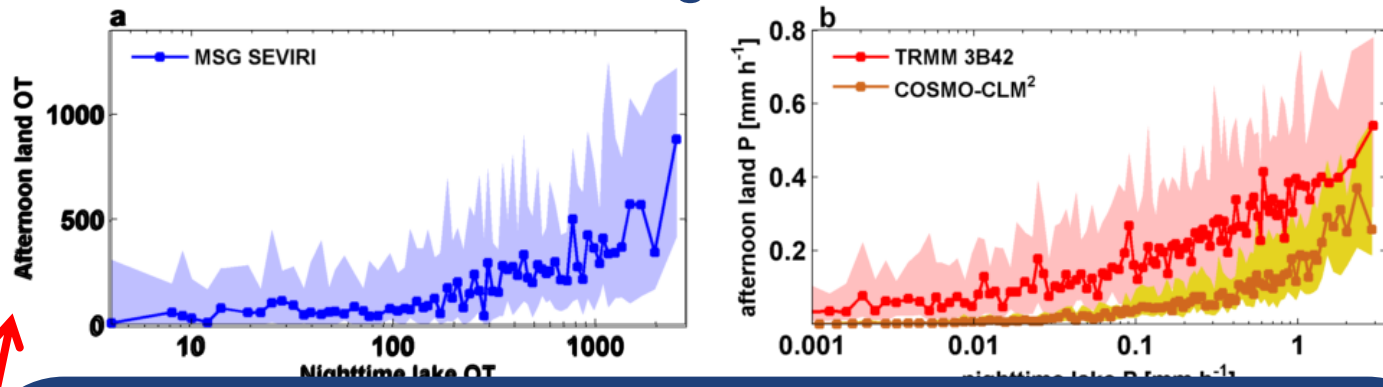
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2005-2009 SEVIRI Overshooting Top Detections, 0.25 deg Grid: 1900-1945 UTC

Kristopher Bedka (SSAI@NASA LaRC)

What drives extreme precipitation over an East African Lake?

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Thiery, Bedka, van Lipzig and three others, 2016, Nature Communications.

Afternoon controls on nighttime thunderstorms
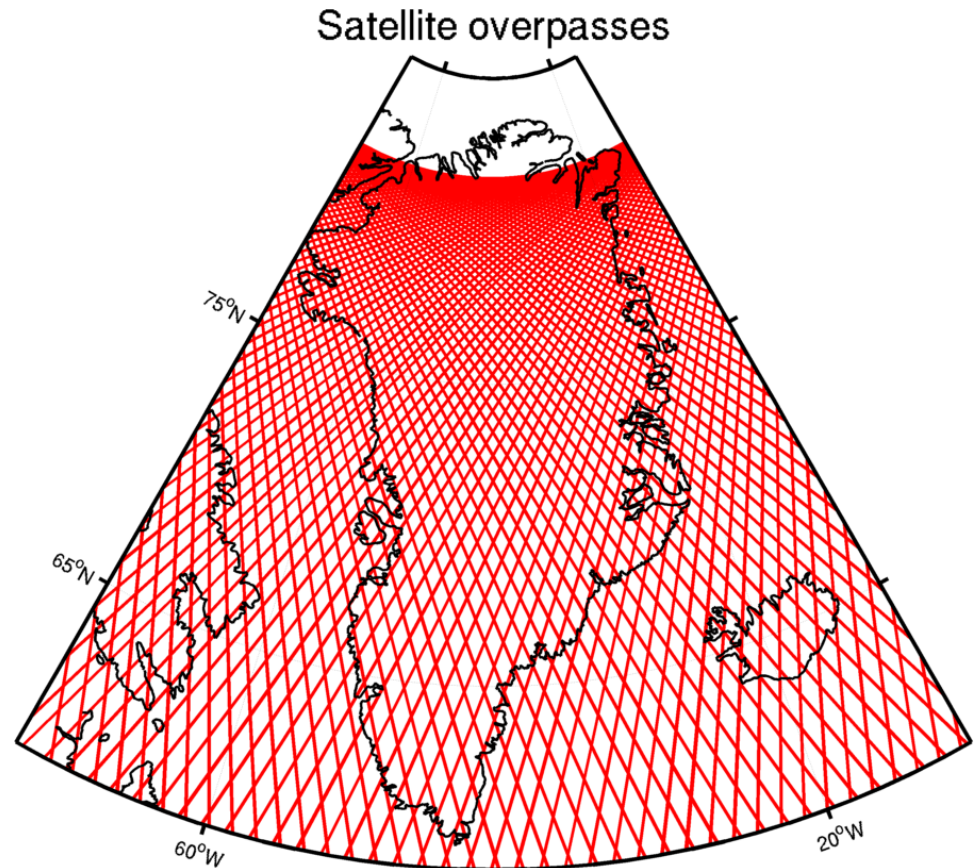
Thermodynamic effect

Dynamic effect

¾ due to dynamic effect

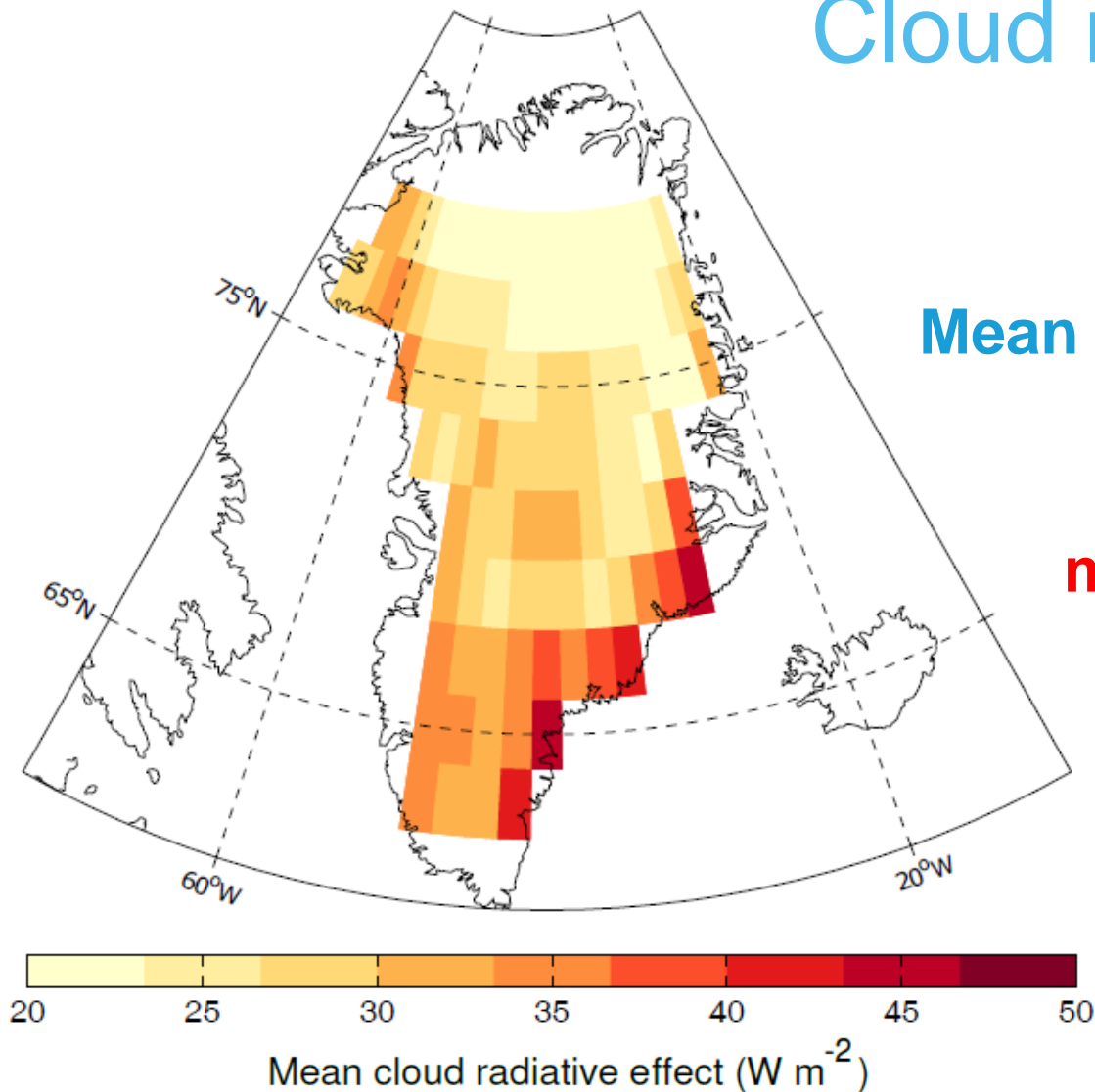How do clouds affect the mass of Greenland?

- 6.3 million obs 2007-2010 CloudSat and CALIPSO supplemented by COT from MODIS
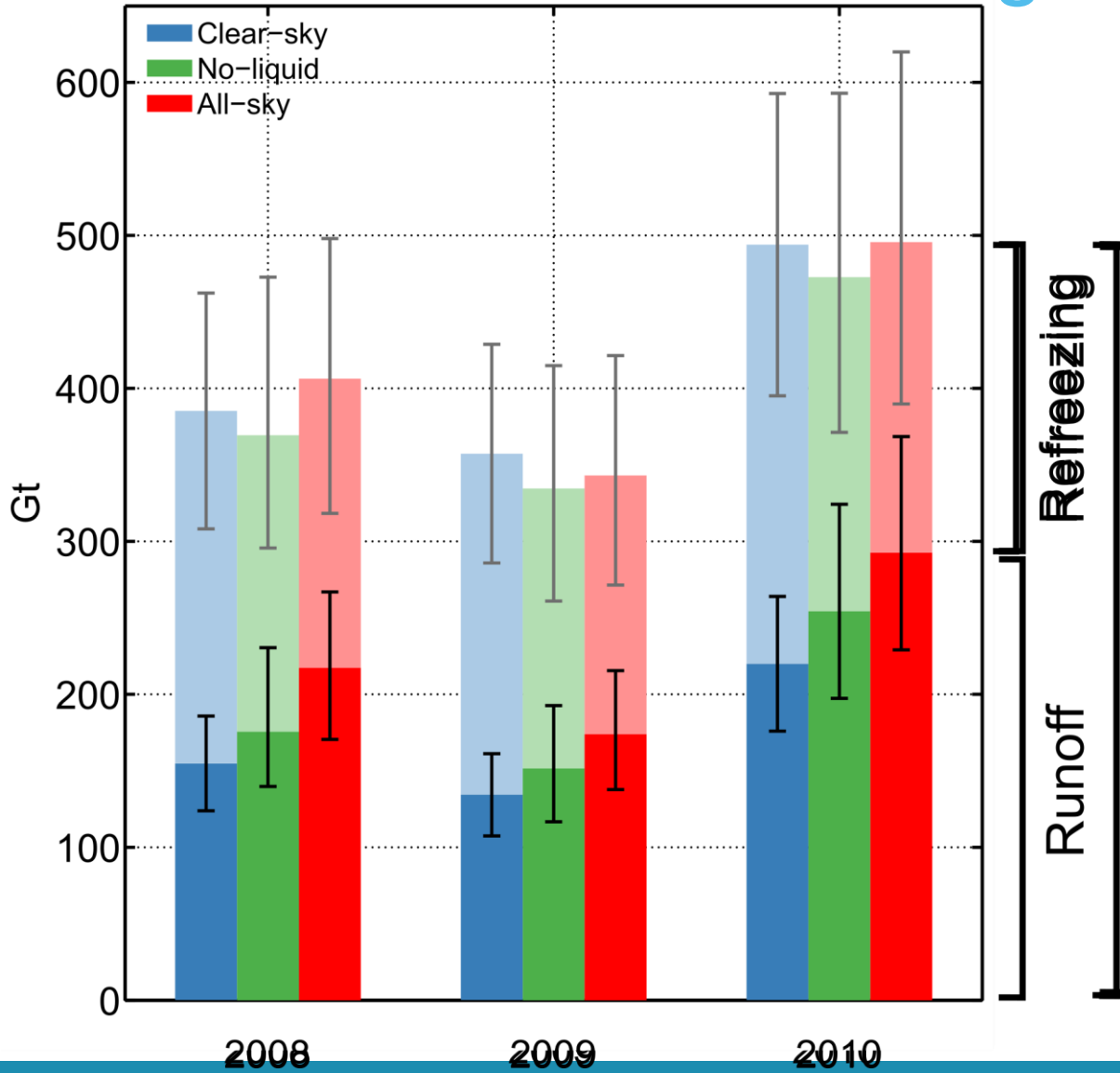- 2B-FLXHR-LIDAR product

Satellite overpasses

Cloud radiative effect

Mean cloud radiative effect (W m^{-2})

Mean CRE = 29.5 ± 5.2 W m^{-2}

What does this mean for the SMB?

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Melt/refreezing/runoff

- **Meltwater** **Similar** **runoff** **amounts of** **enhanced** **melt** **by 56 ±20** **Gt y⁻¹**
- **58% = one-third refreezing in clear sky increase**
- **45% refreezing in all sky**
- **25 Gt due to cloud ice water**
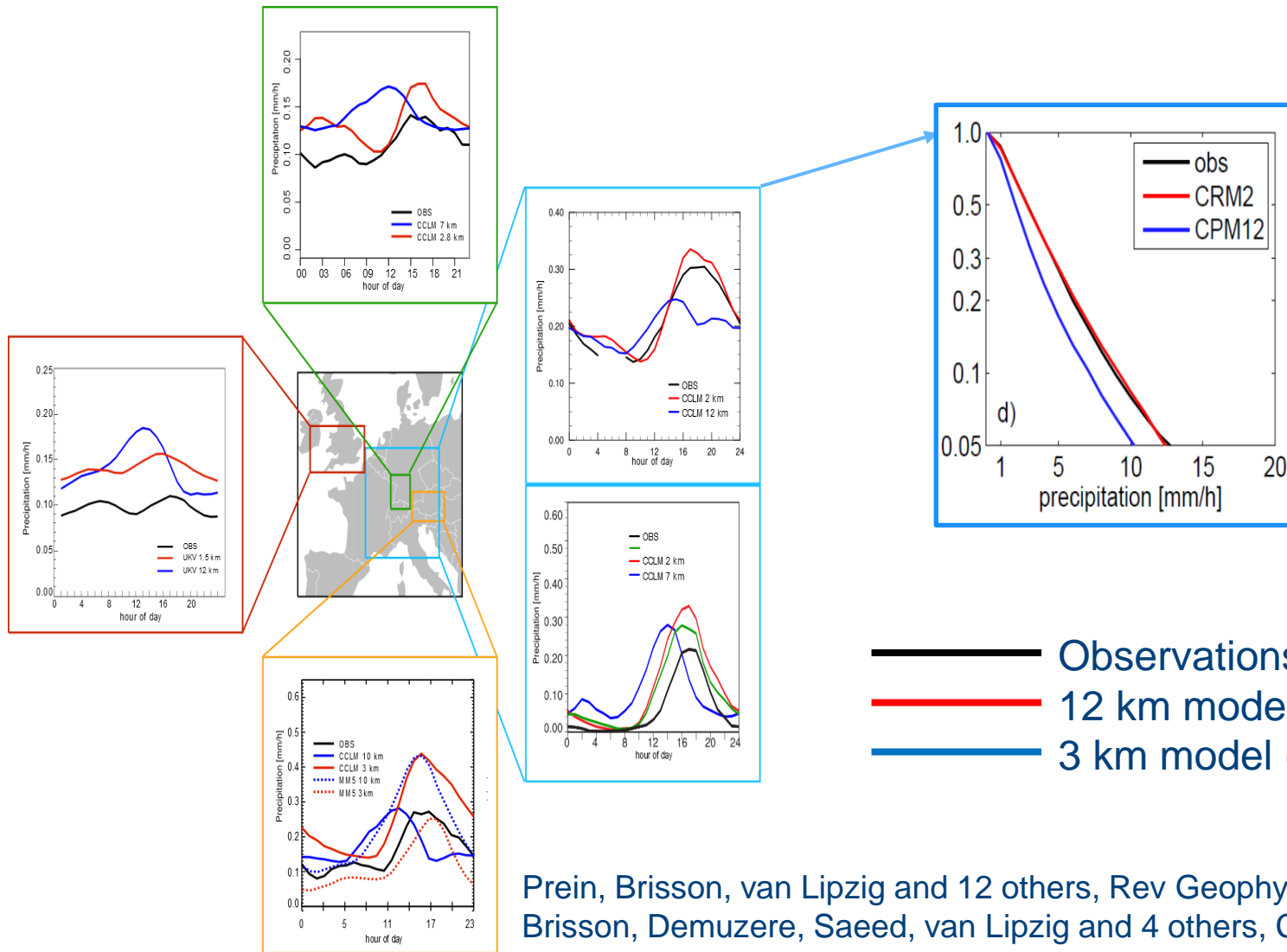- **32 Gt due to cloud liquid water**

Van Tricht et al., 2015, in review

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OVERSHOOTING TOP

Thanks you!

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CPM improves extreme precipitation

Observations
12 km model
3 km model (CPM)

Prein, Brisson, van Lipzig and 12 others, Rev Geophys, 2015
Brisson, Demuzere, Saeed, van Lipzig and 4 others, Clim. Dyn., 2016

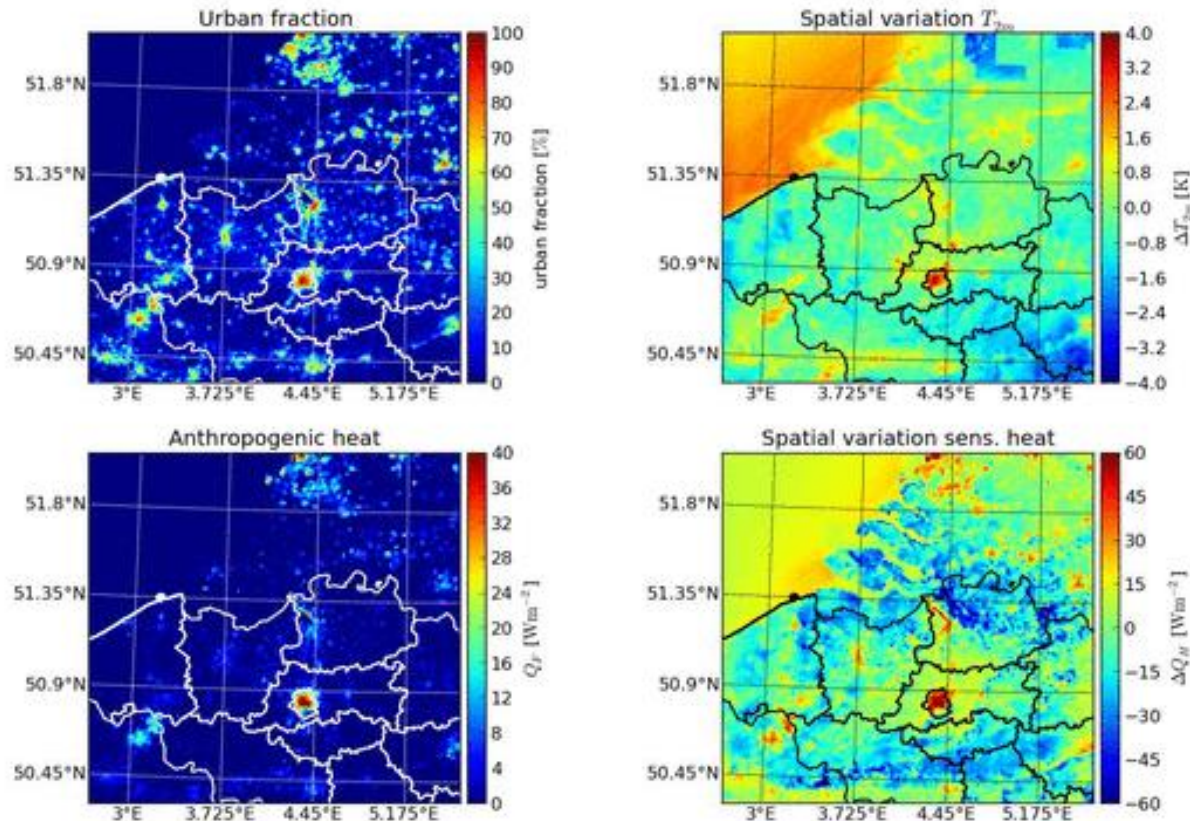KU LEUVEN

LWP/IWP correction
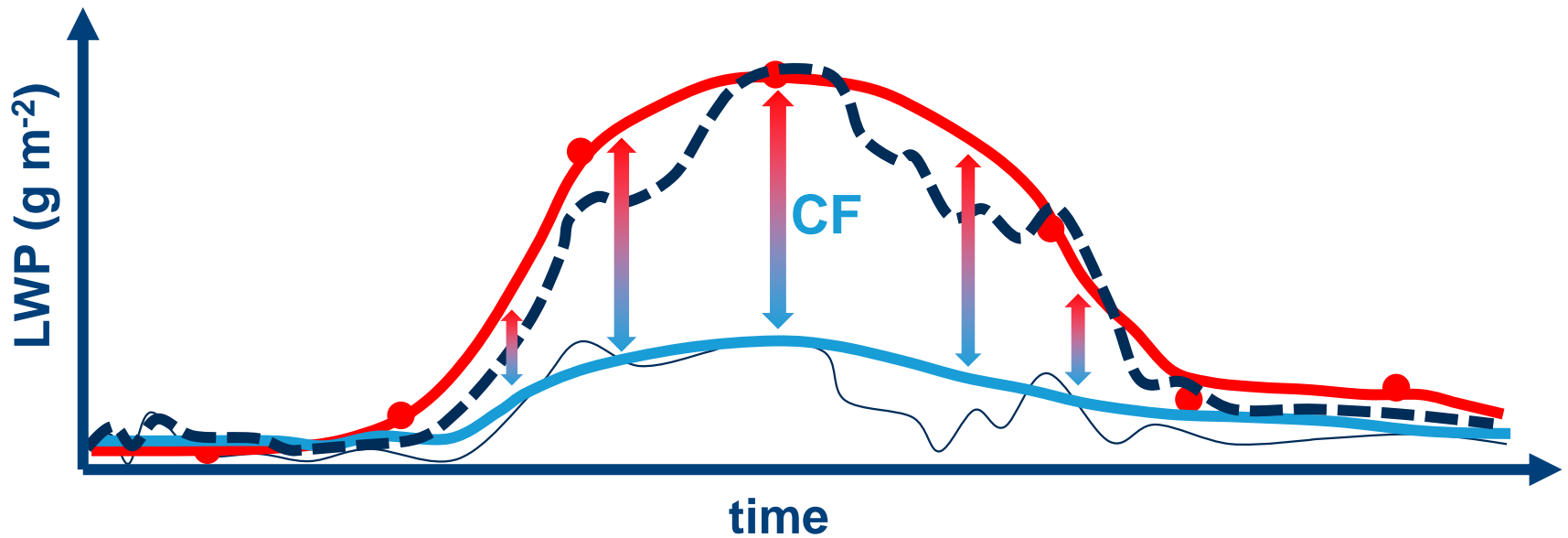
$$LWP_{i,corrected} = LWP_{i,original} + CF \times (1 - exp(-P \times LWP_{i,original}))$$

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Convection Permitting Modelling

CPM improves representation of land use
urbanization, deforestation

Wouters, Demuzere, De Ridder, Van Lipzig, Urban Climate, 2015

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