Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

EURADCLIM: The European climatological high-resolution gauge-adjusted radar precipitation dataset

INT.T5 29 August 2022

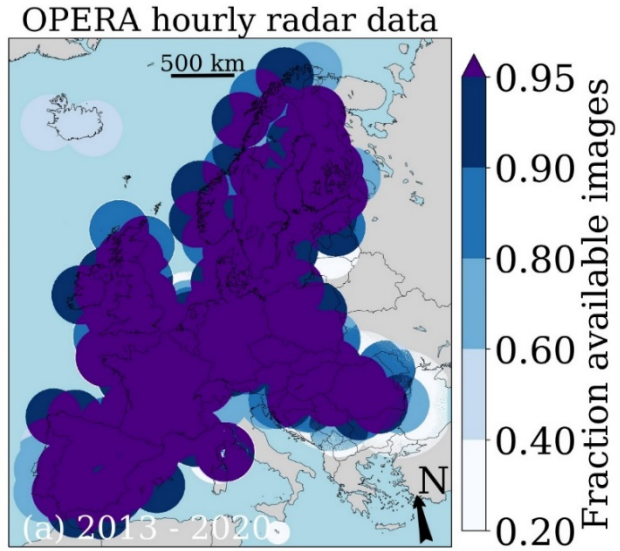
Locarno, Switzerland

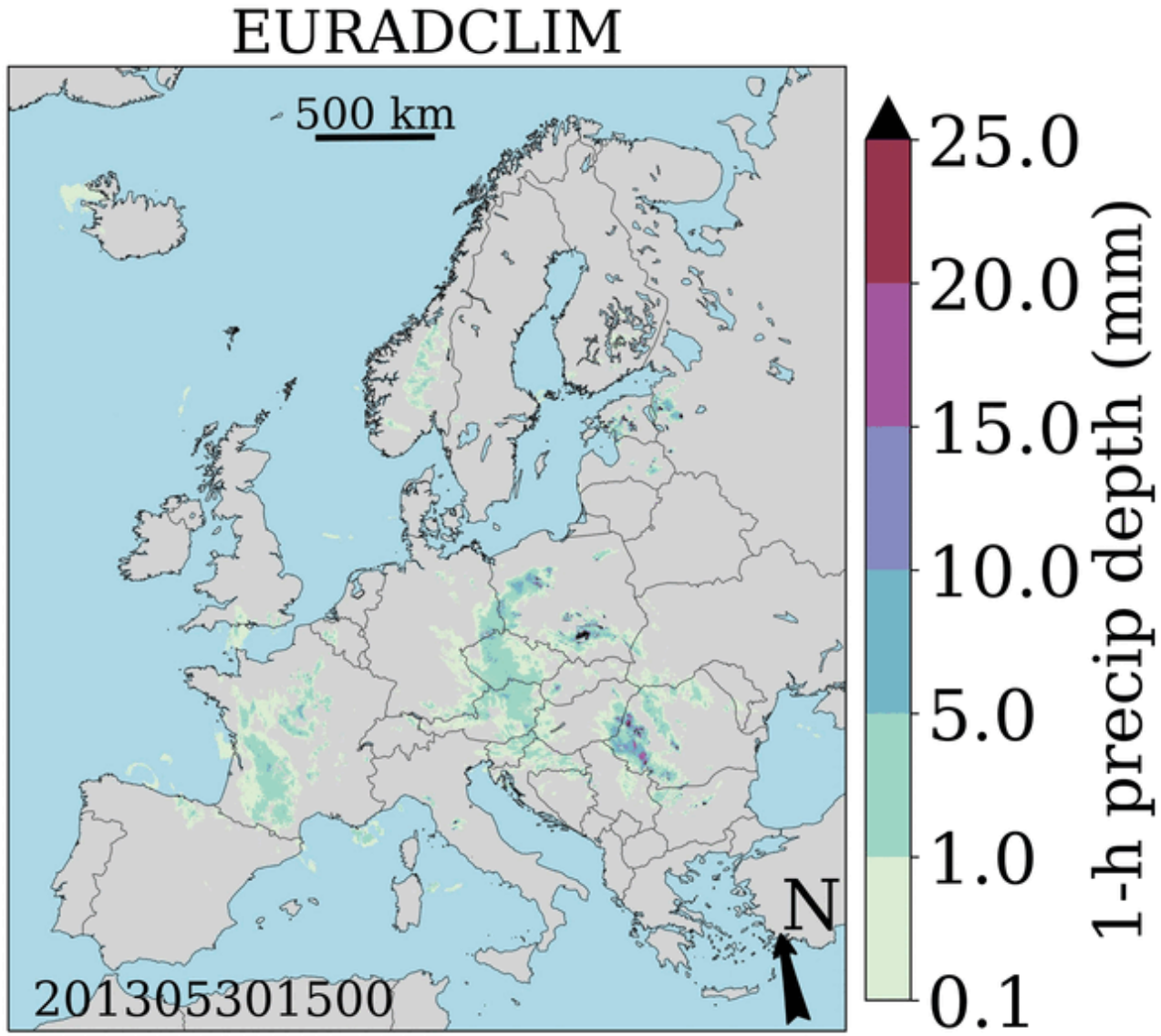
2022 ERAD

Aart Overeem, Hidde Leijnse, Else van den Besselaar, Gerard van der Schrier, Emiel van der Plas, Jan Fokke Meirink, Hylke de Vries, Geert Lenderink, Lotte de Vos (KNMI)

What is EURADCLIM?

- Internally (KNMI) funded project of the Multiannual Strategic Research Program (MSO).
- A climatological gauge-adjusted radar precipitation dataset of 1-h & 24-h accumulations every clock-hour, covering Europe at a 2 km grid from 2013-2020.



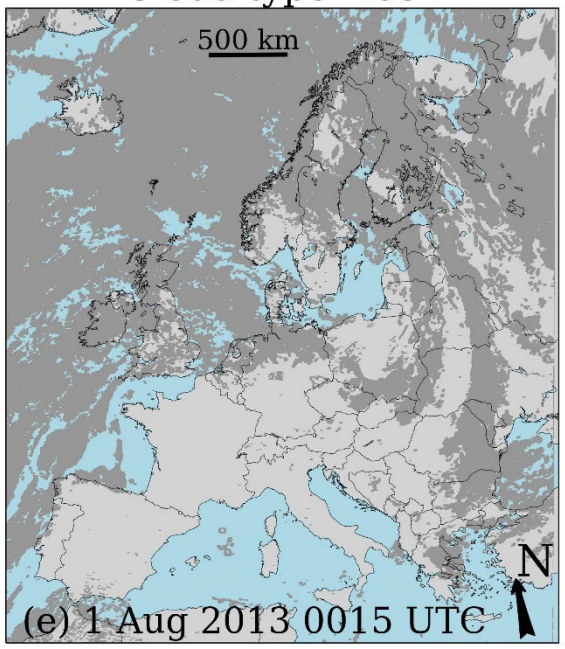


Data obtained via international collaboration

- The European Meteorological Network (EUMETNET) Operational Program on the Exchange of weather RAdar Information (OPERA) radar archive of 15-min instantaneous surface rain rates @4 km^2. We thank the NMHS who provided radar data to OPERA.
- Satellite cloud type mask from the CLAAS-2 product based on data from the geostationary Meteosat Second Generation satellites operated by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). Thanks to Dr. Martin Stengel (DWD, Deutscher Wetterdienst) for providing the product.

EUMETNET

Cloud type mask

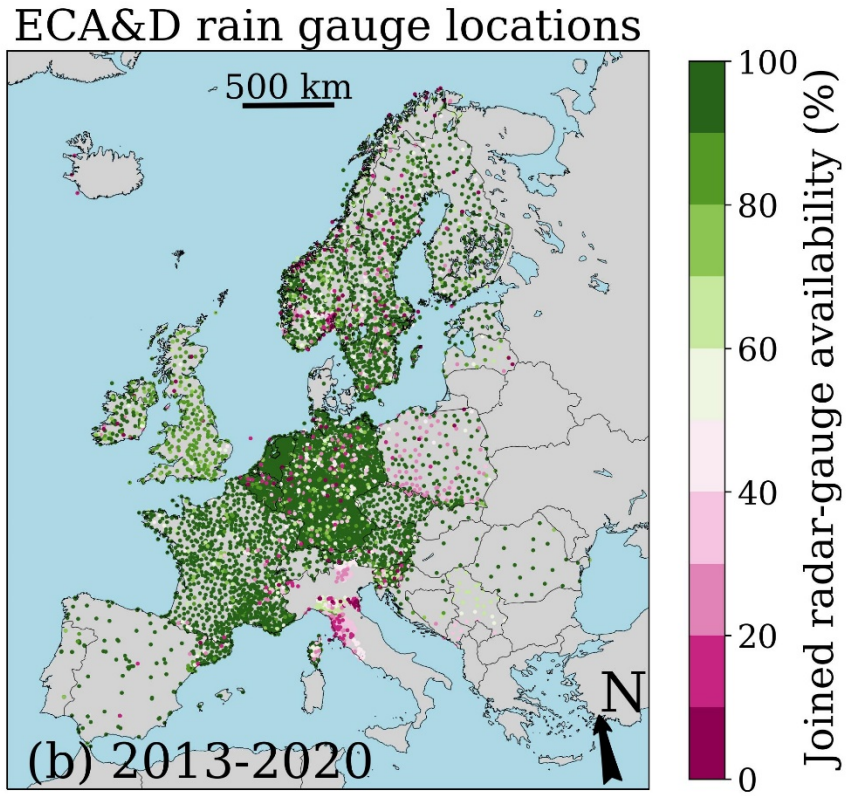


Data obtained via international collaboration

- European Climate Assessment & Dataset (ECA&D) daily rain gauge accumulations from potentially 7700 stations. We thank the data providers in the ECA&D project (https://www.ecad.eu).

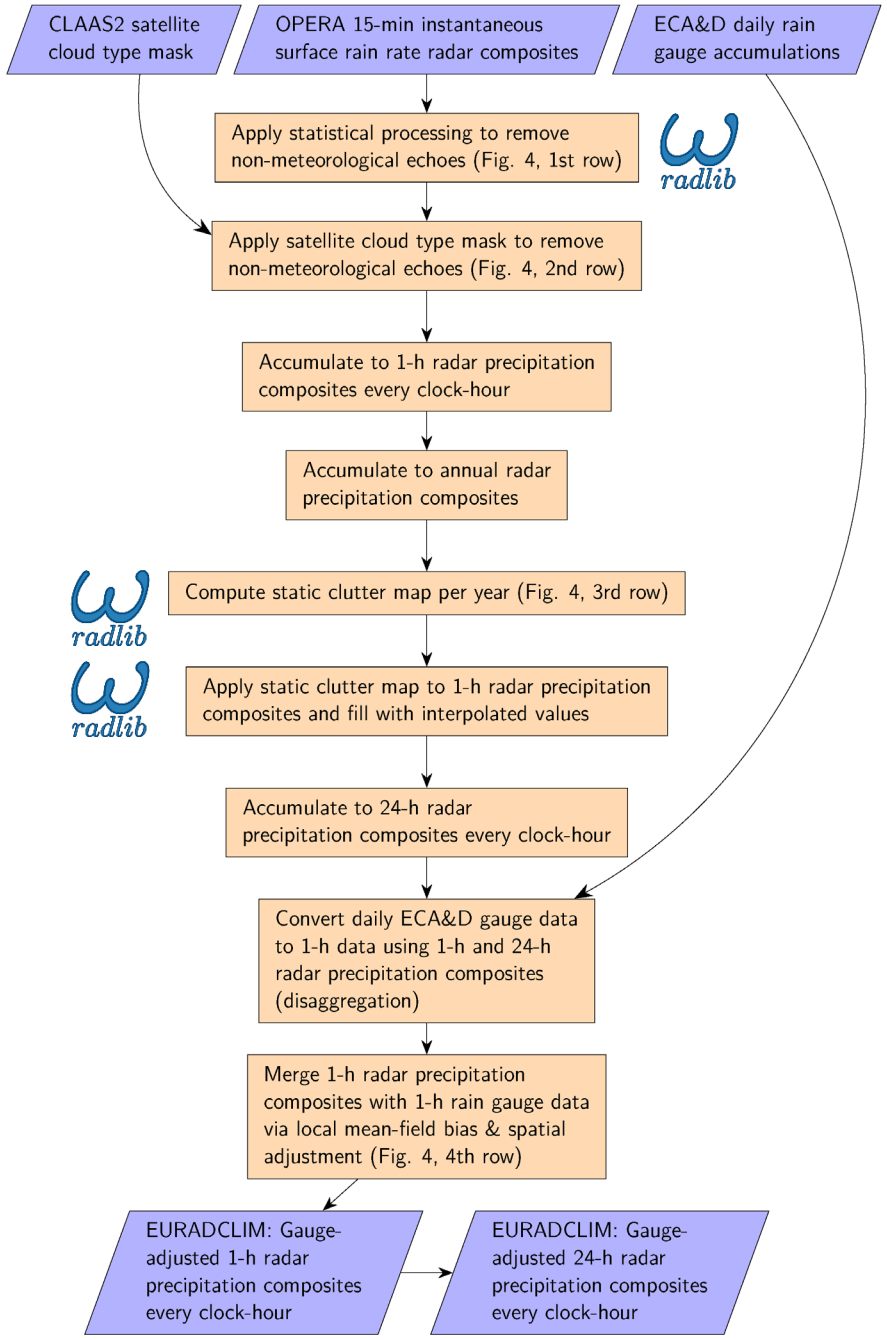
ECA&D

European Climate Assessment & Dataset

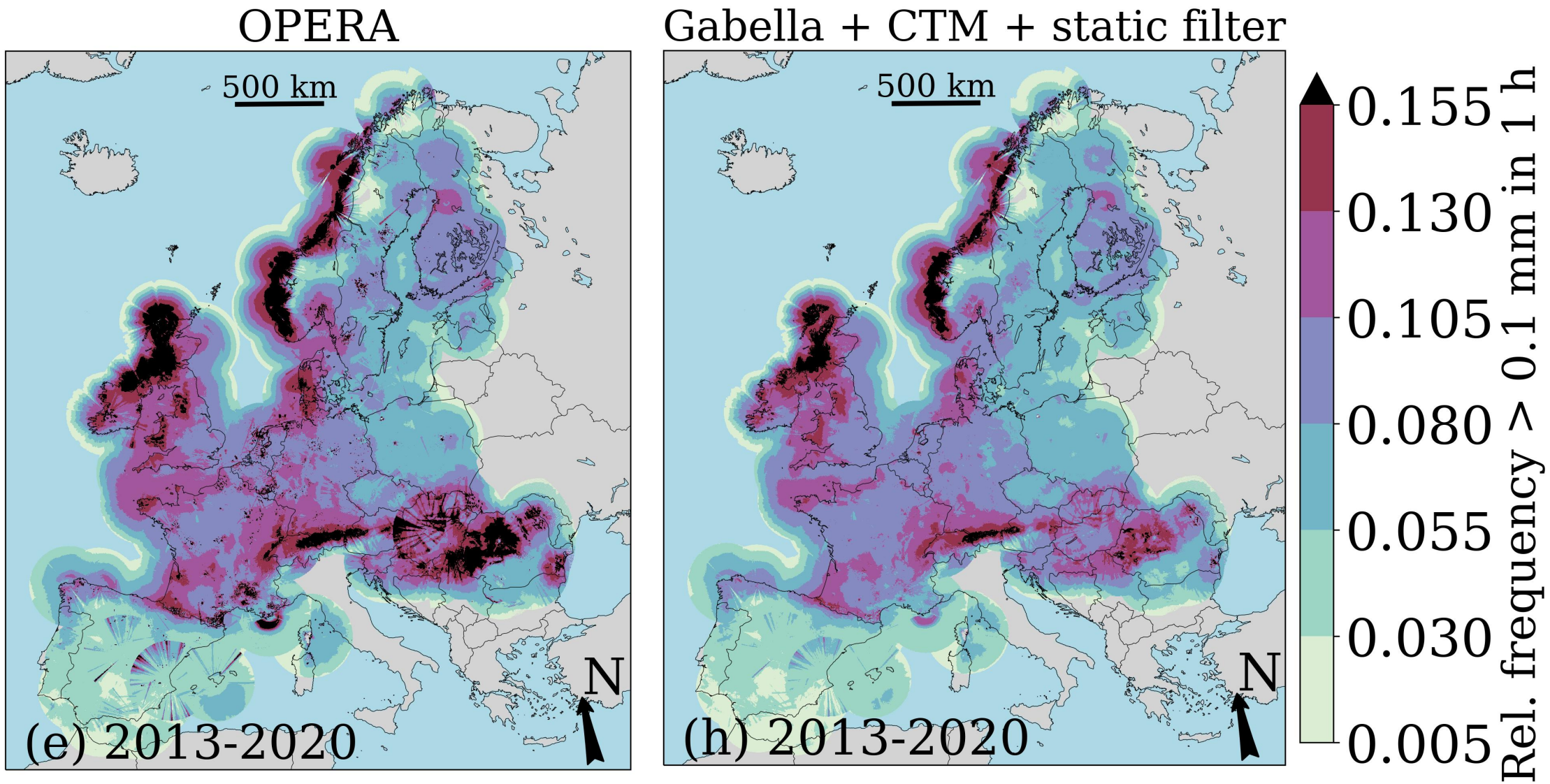


EURADCLIM processing

- Additional removal of clutter (2 statistical methods from open-source library wradlib & satellite cloud type mask). = Gabella + CTM + static filter
- Next, merging with ECA&D (NMHS) rain gauge data from potentially 7700 stations. = EURADCLIM
- Merging algorithm is based on Barnes' Objective Analysis. Local mean-field bias adjustment followed by a local spatial adjustment.

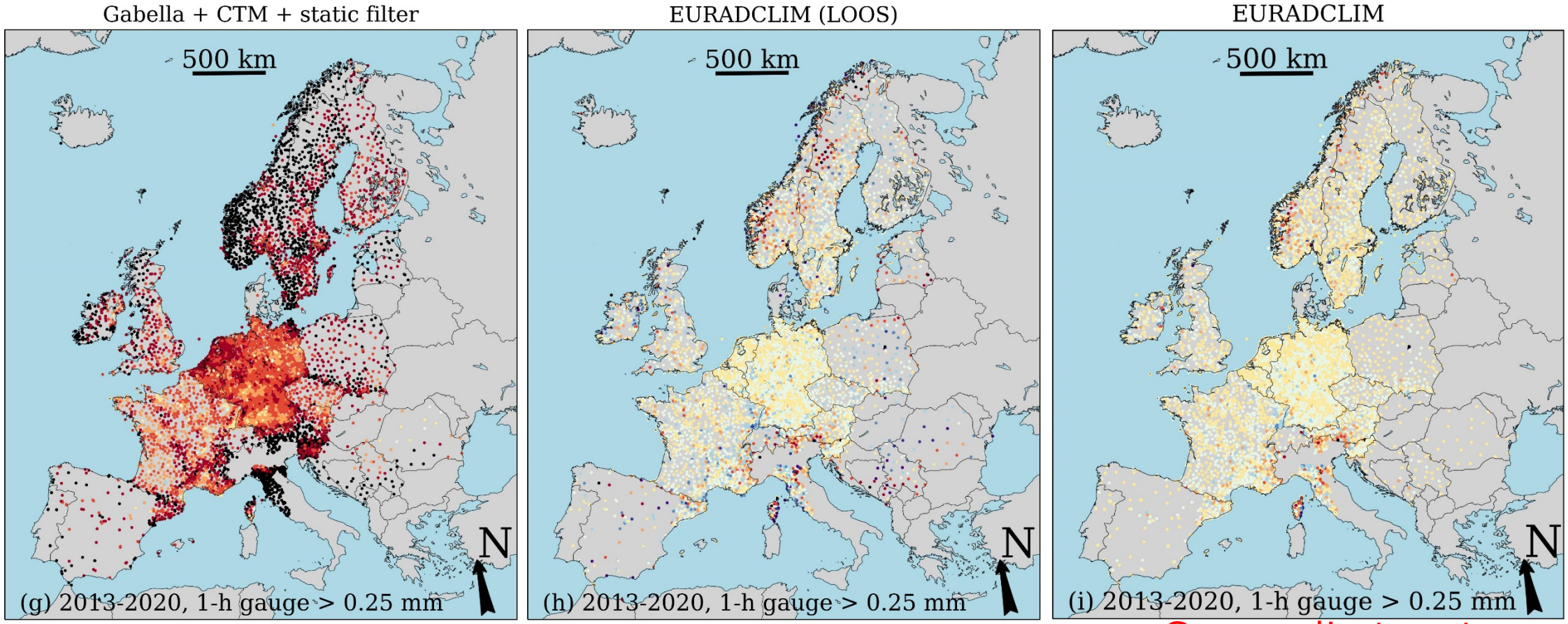


Clutter removal



- Many non-meteorological echoes in OPERA radar data (overestimation), which are often removed or suppressed when 3 clutter removal algorithms are applied.

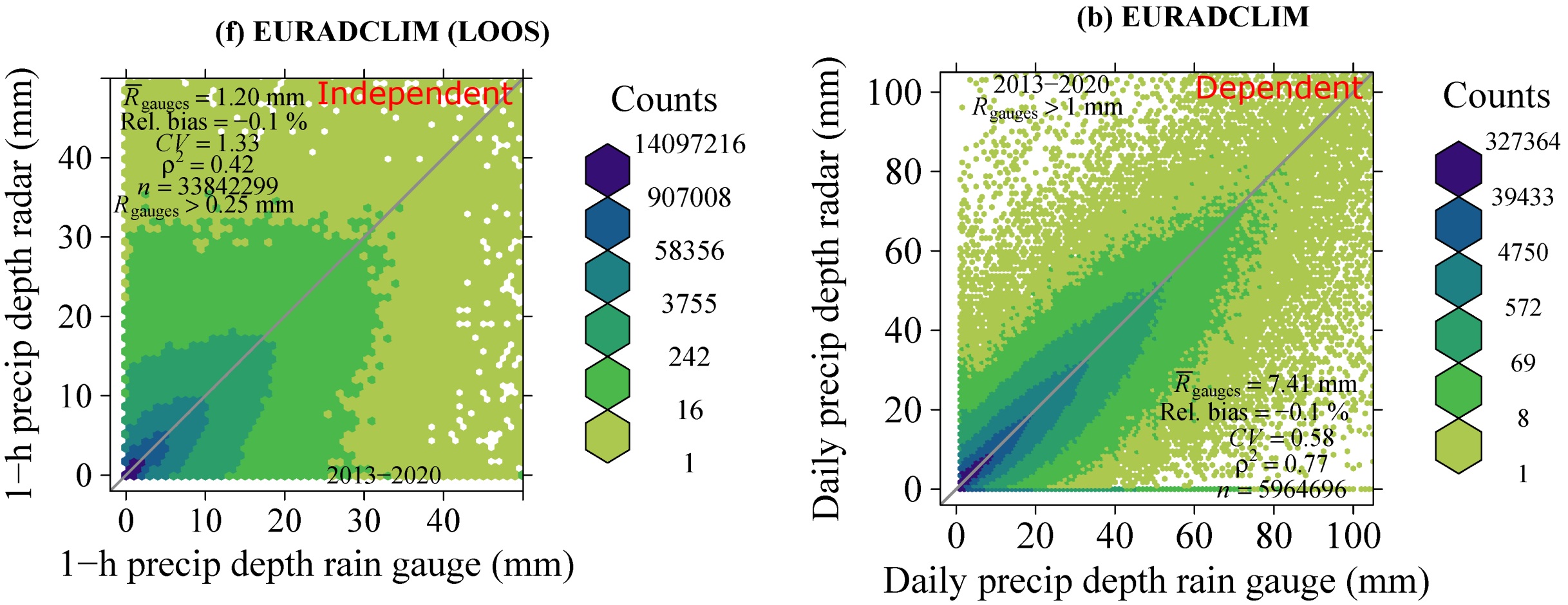
Verification against disaggregated ECA&D 1-h rain gauge accumulations



No gauge adjustment | Gauge adjustment | Gauge adjustment

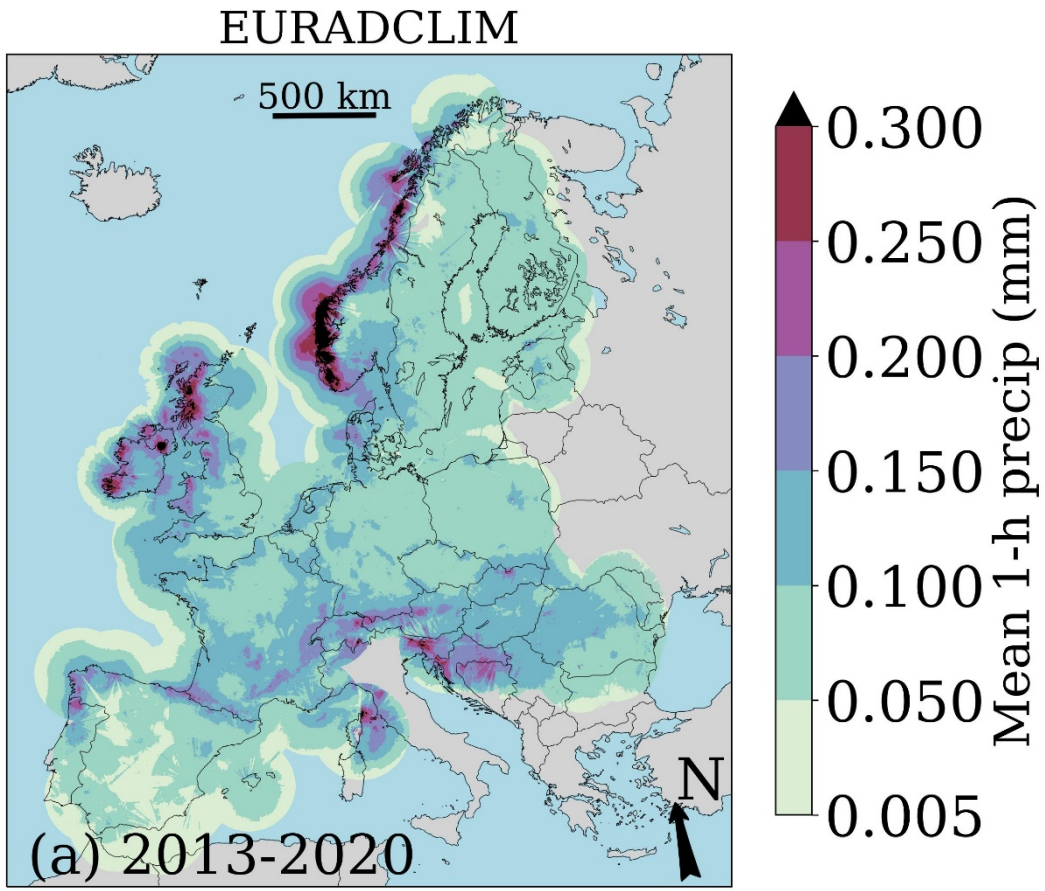
- Underestimation is much reduced by merging with rain gauge accumulations.

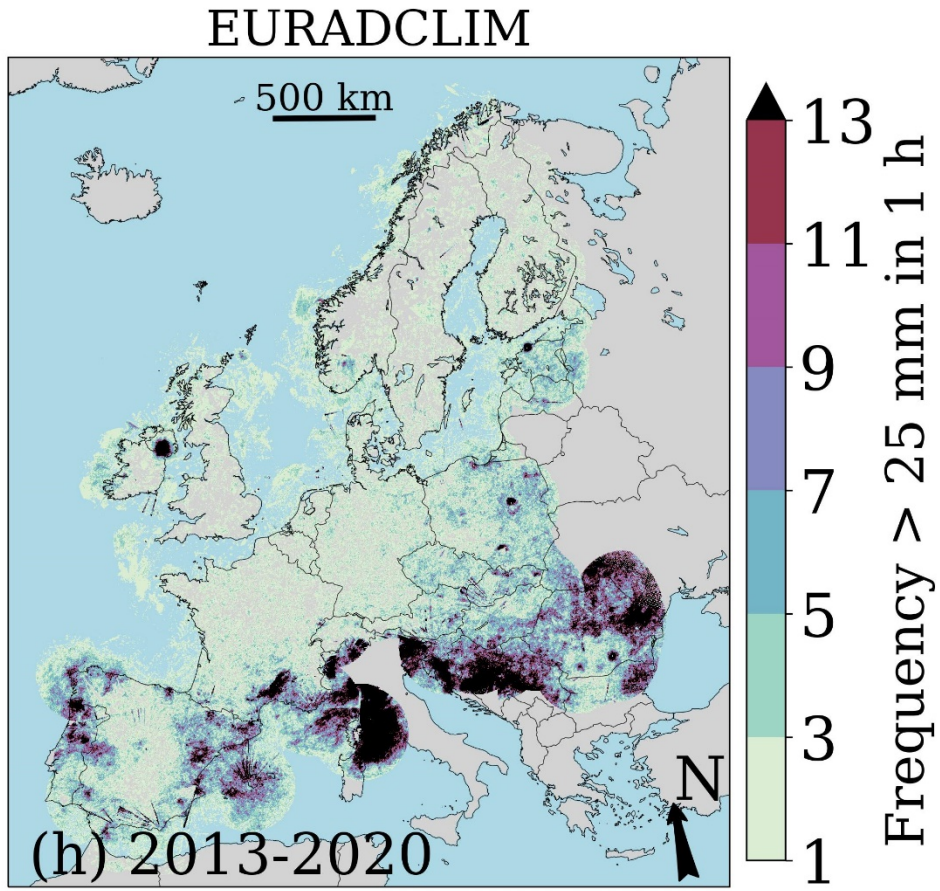
Verification against ECA&D rain gauge accumulations



- Verification against hourly rain gauge data (disaggregated from daily rain gauge data; left), and original daily rain gauge data (right).

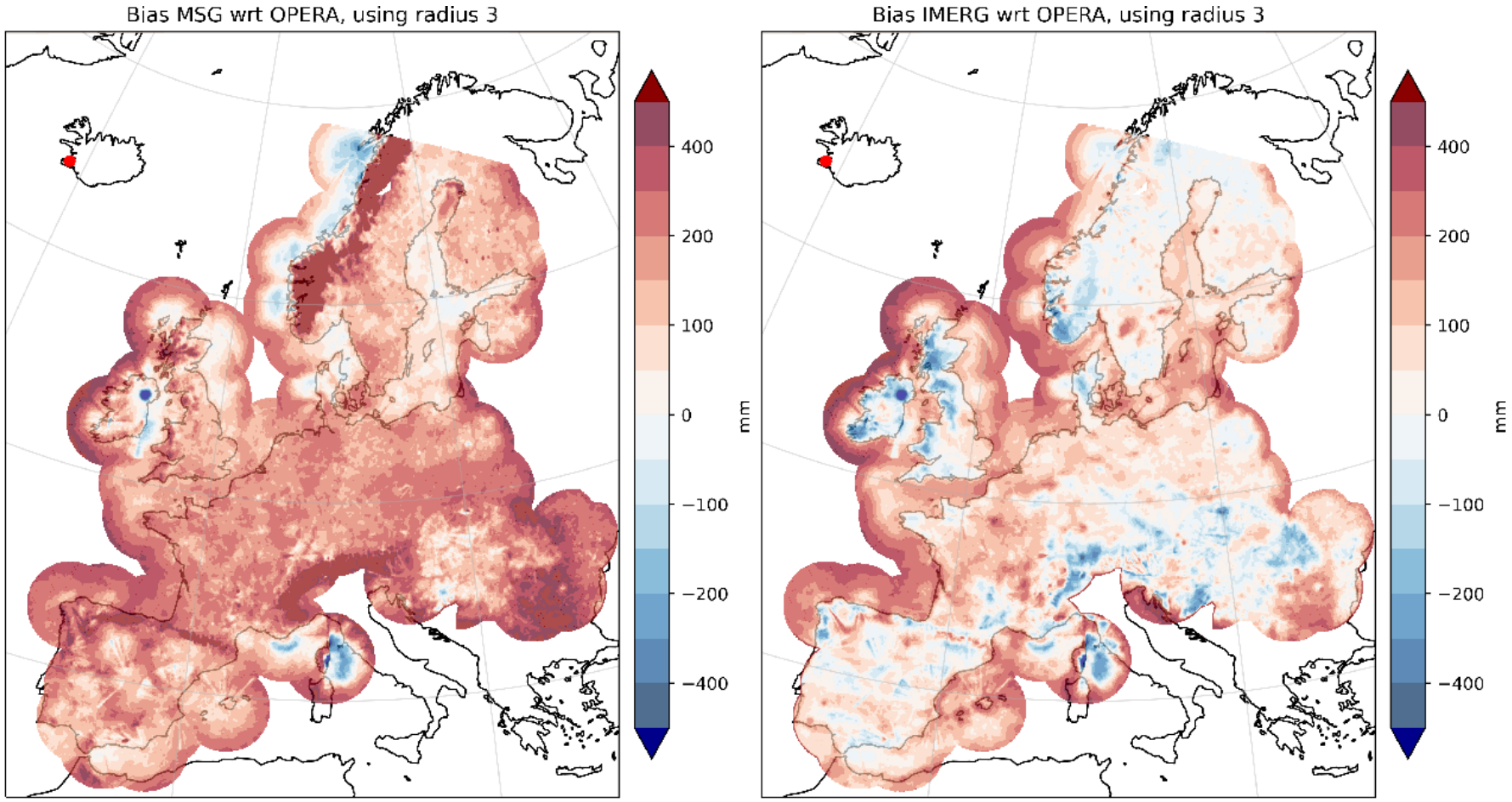
Illustration of EURADCLIM precip climatology





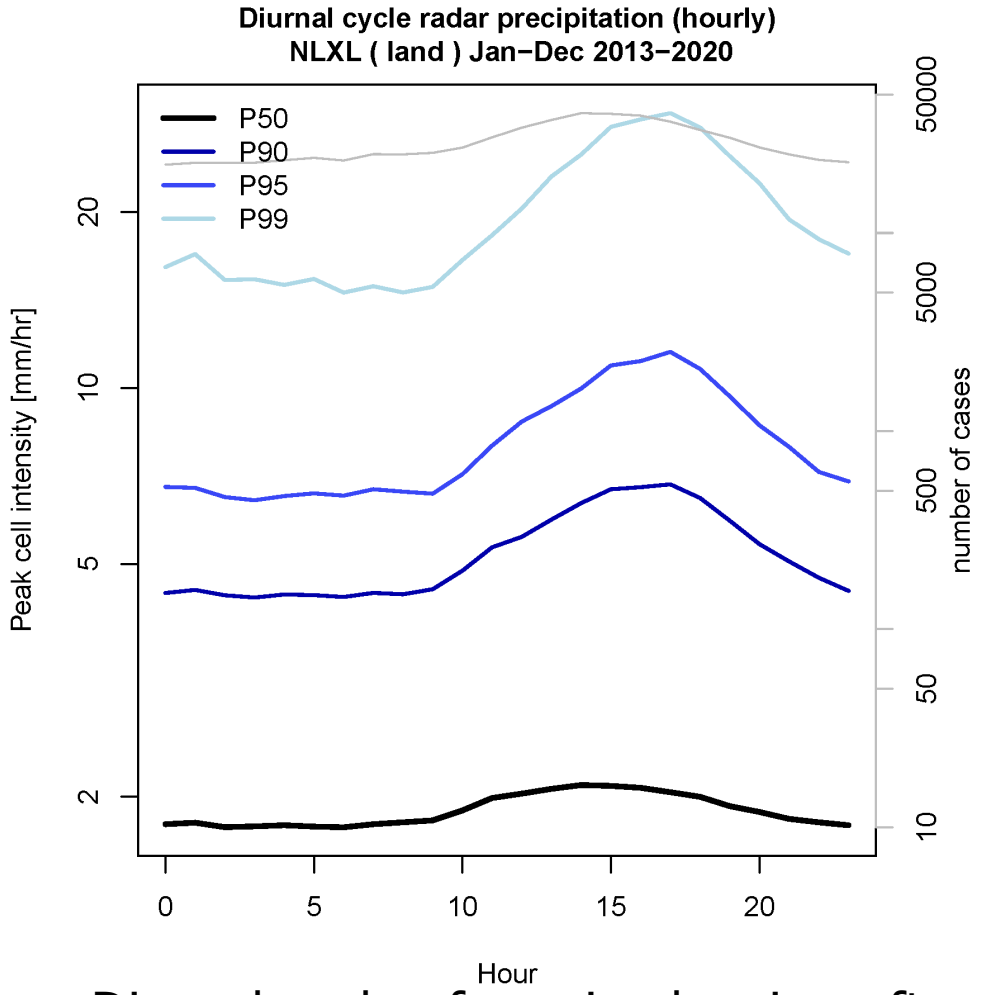
- 8-year mean 1-h precipitation accumulation.
- Remaining artefacts in EURADCLIM, especially for larger 1-h precipitation accumulations.

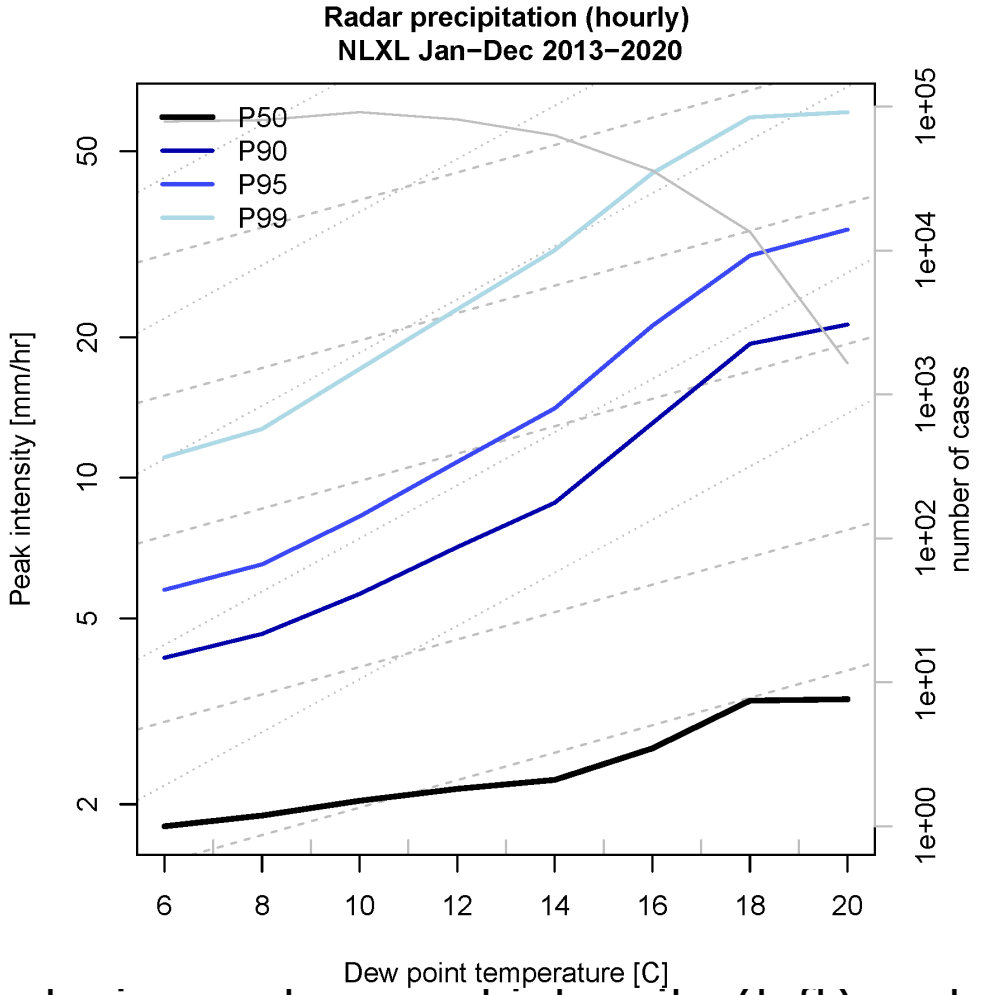
Use case of EURADCLIM: validation of satellite precip



- Validation of two satellite precipitation products against EURADCLIM over 2013-2019 during daylight hours: MSG Cloud Physical Properties (left), IMERG Late Run from the Global Precipitation Measurement Mission (right). Mostly overestimation by satellites.

Use case of EURADCLIM: extreme precip characteristics

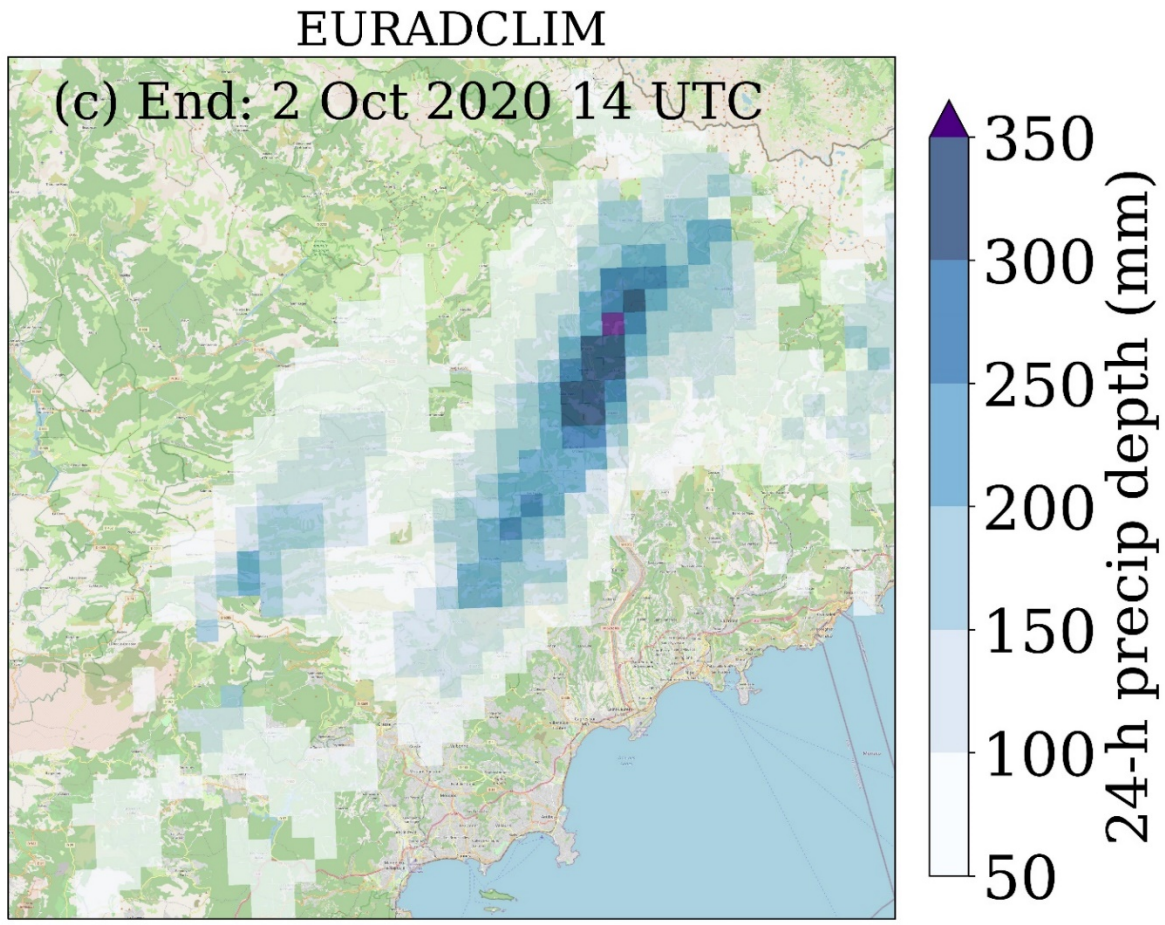




- Diurnal cycle of precip showing afternoon peaks in numbers and intensity (left) and scaling of cell peak intensity with daily mean dew point temperature derived from E-OBS 0.25º, both over a large domain around the Netherlands. Only showers are considered with at least 5 contiguous grid cells and with a min. intensity of 1 mm/h.

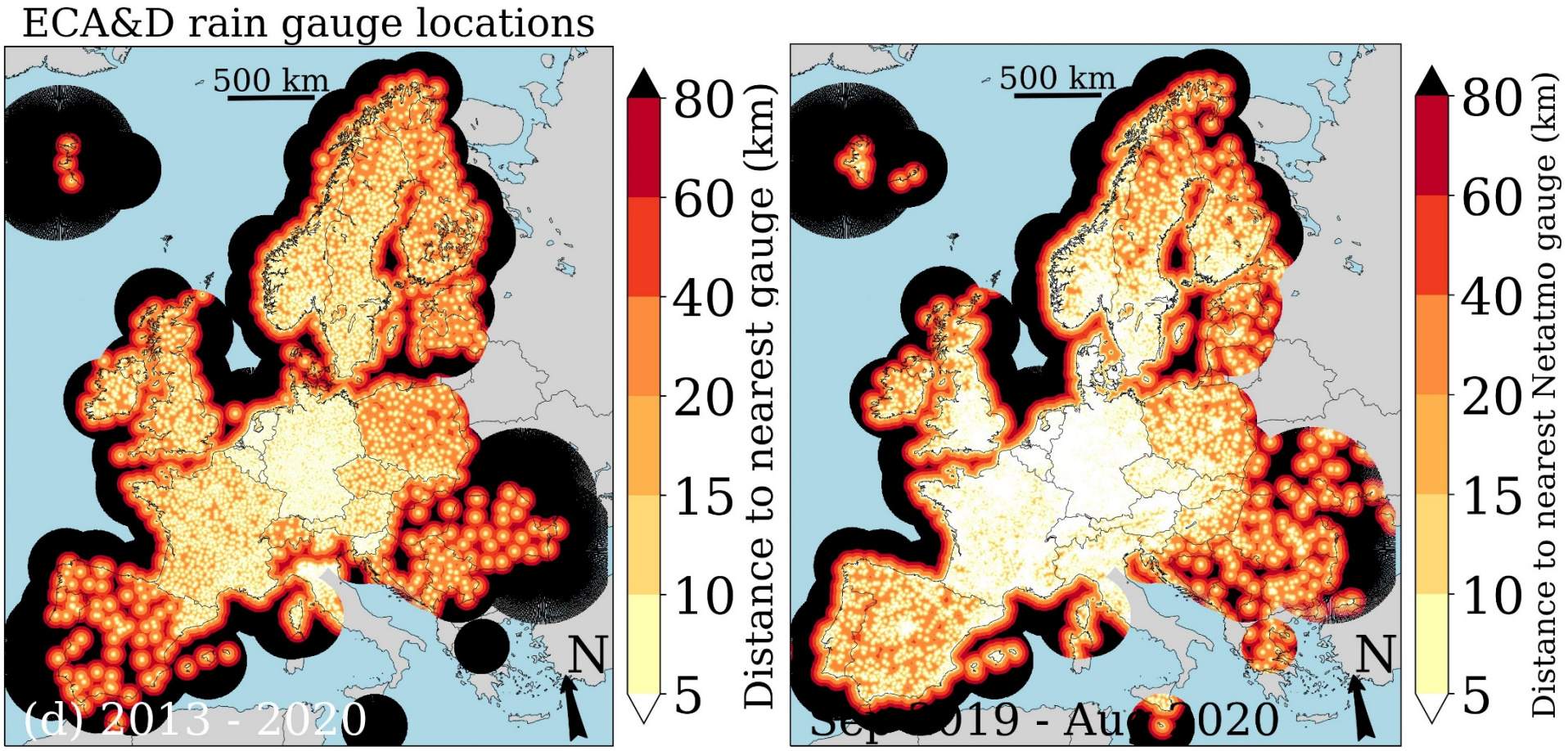
Conclusions

- EURADCLIM fills a gap in pan-European climatological precipitation datasets due to its high spatiotemporal resolution.
- Is not expected to outperform national climatological radar datasets, but these are often not available or do not exist.
- Publicly available at KNMI's Data Platform: https://doi.org/10.21944/7ypj-wn68 & https://doi.org/10.21944/1a54-gg96
- Associated ESSD manuscript is available: https://doi.org/10.5194/essd-2022-334
- One update per year with more rain gauge data included in EURADCLIM over whole period + extension of EURADCLIM with 1 year.



But what about crowdsourcing?

Personal weather stations are often located in areas without NMHS stations (urban areas).

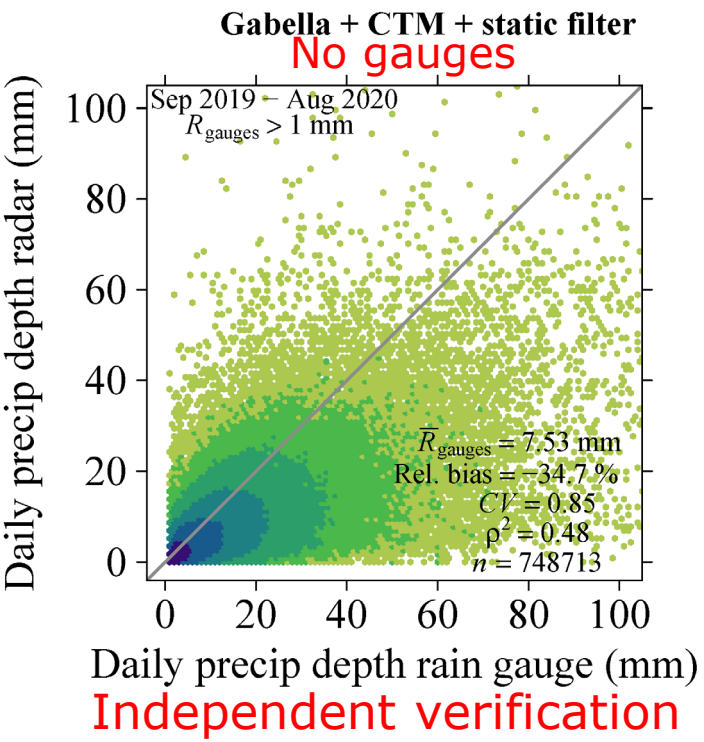


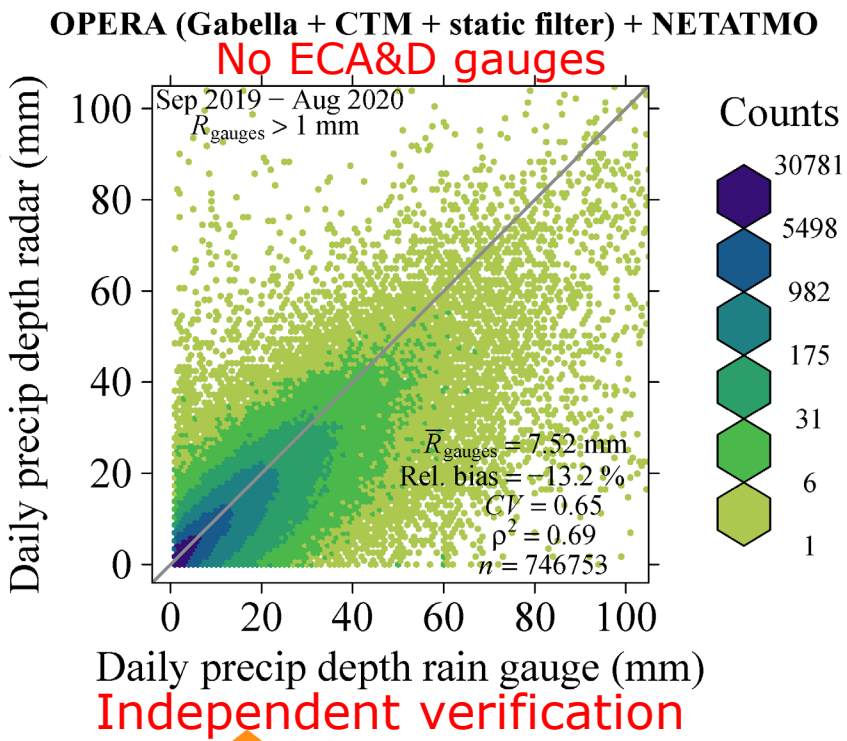
Netatmo

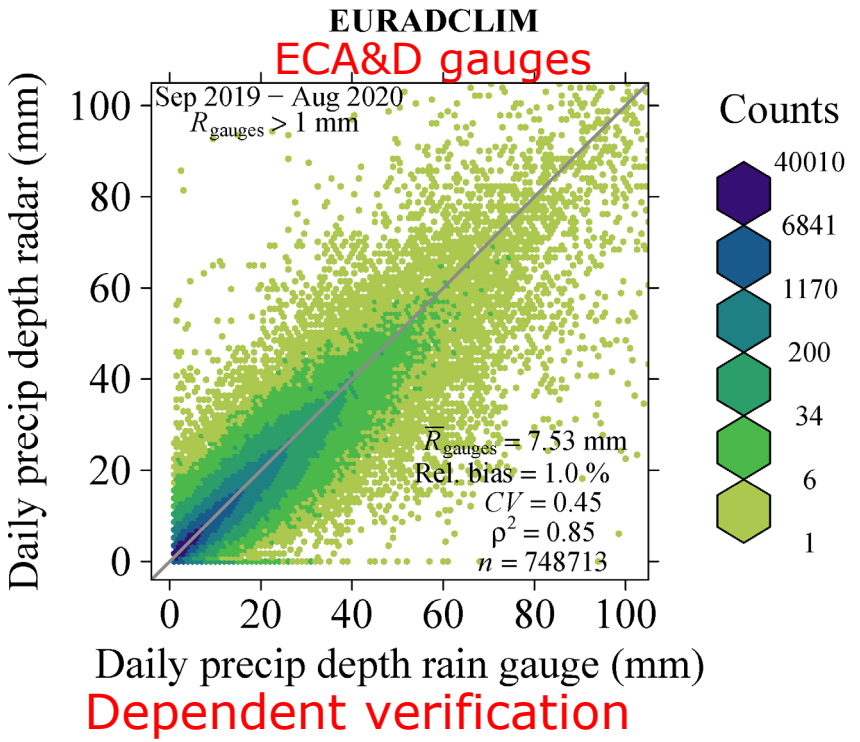
(https://www.netatmo.com/weather)

- Density of network from 1 brand of IoT rain gauges is ~10 × ECA&D gauge density.
- These crowdsourced data could be available in real time and merged with OPERA radar data.

Verification against ECA&D gauges



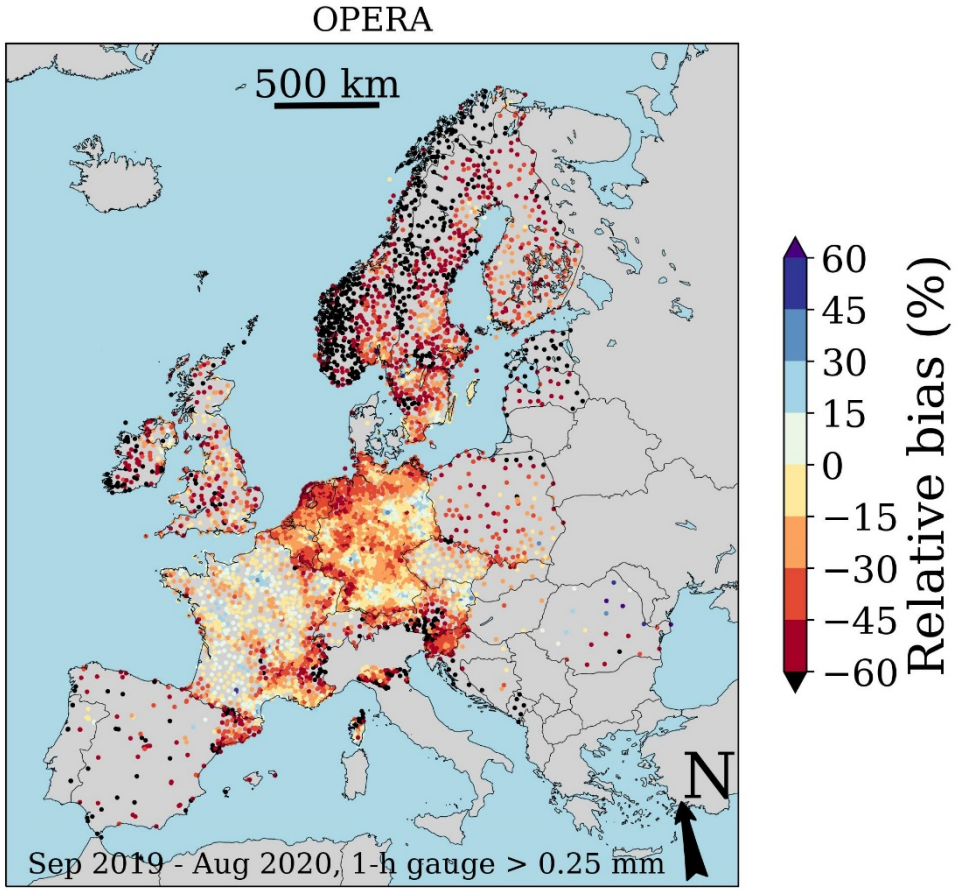


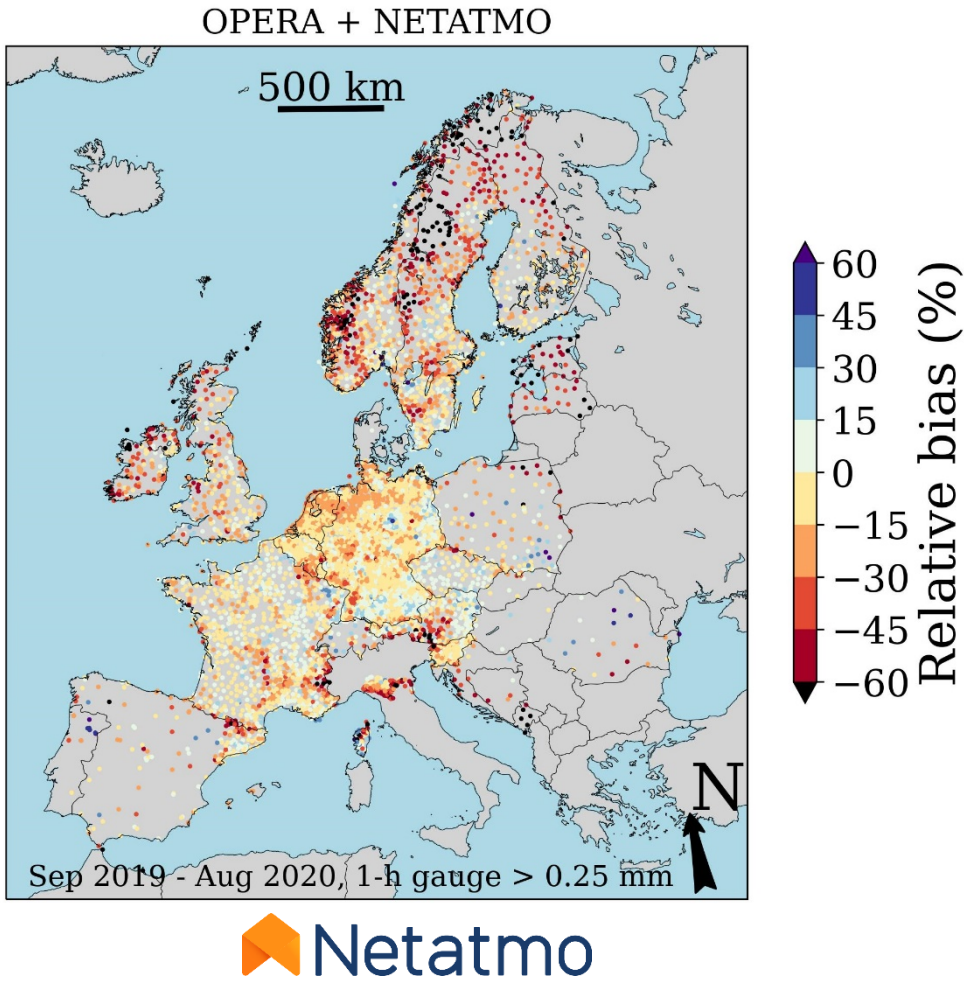


Netatmo

- Apply part of QC by De Vos et al. (GRL2019) to Netatmo data.
- Merge 1-year of Netatmo & OPERA 1-h accumulations over Europe
- Quality of real-time merged OPERA-Netatmo dataset would lie somewhere between that of OPERA and EURADCLIM.
- Thanks to Netatmo and citizens buying and operating these stations.

Verification against ECA&D gauges





Netatmo