Applying the Heliosat-4 method to three different cloud properties databases for the estimation of the surface downwelling shortwave irradiance

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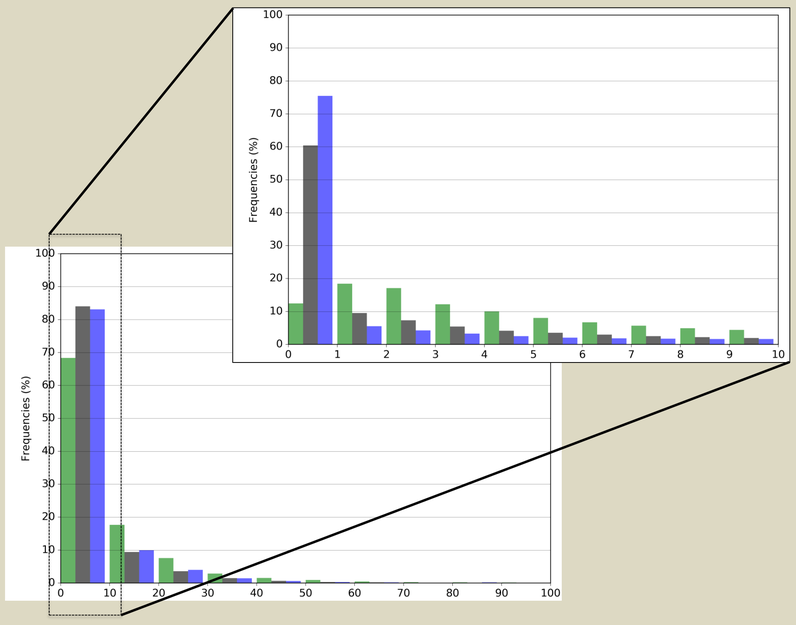
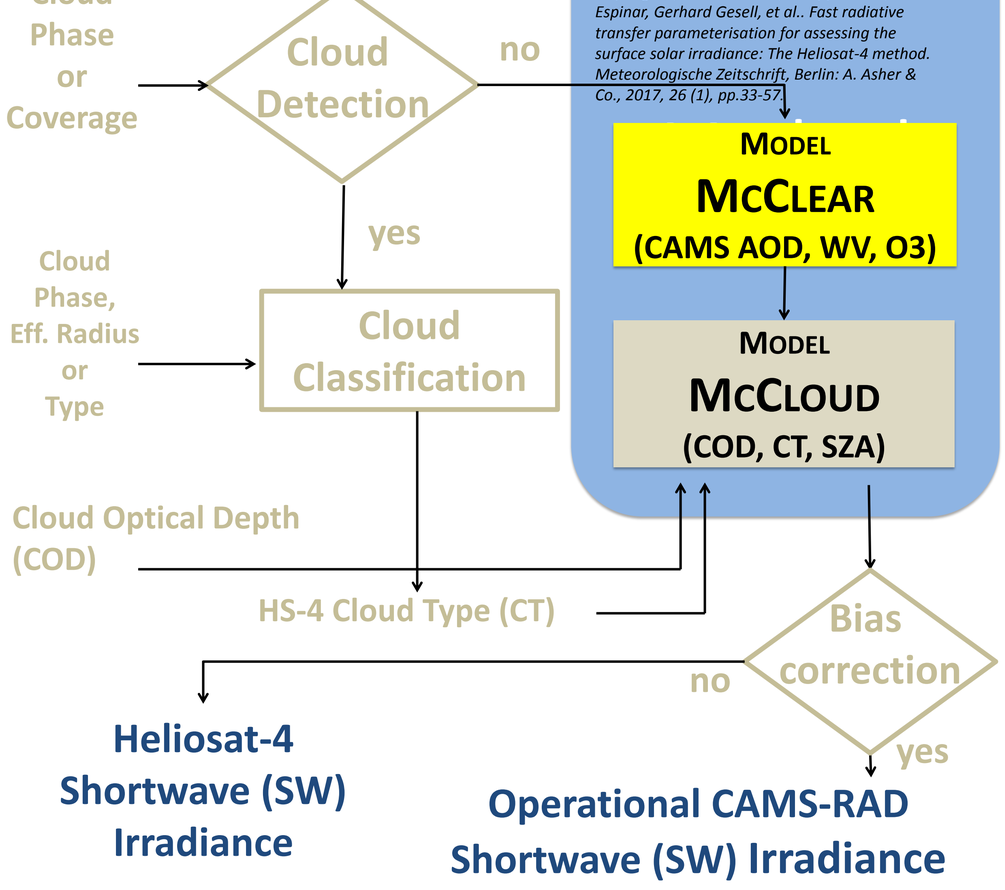
Year 2016: a CAMS-RAD anomaly in the Netherlands investigated with a comparison of different cloud properties databases

SICLONE (NWC SAF) | MSG-CPP (KNMI) | APOLLO (DLR)

Distribution of Cloud Optical Depth (COD)



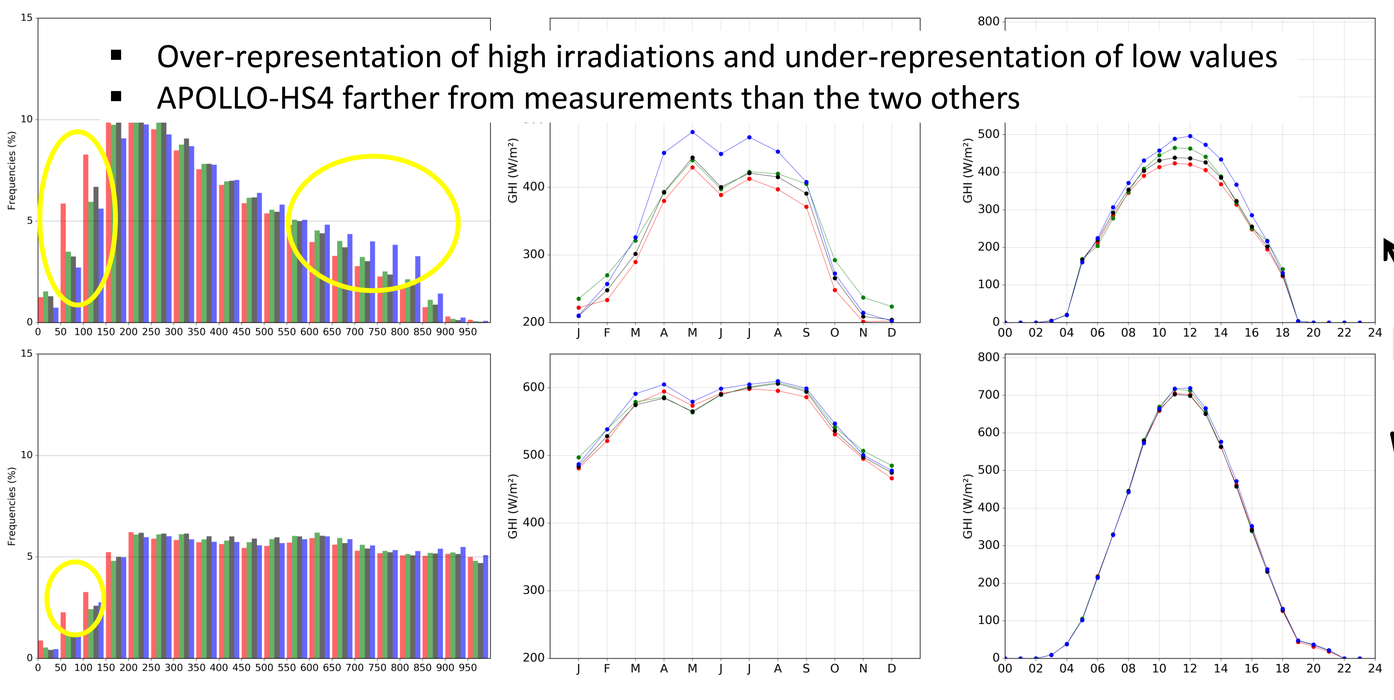
- Marked differences between the different datasets
- APOLLO is relatively non-discriminatory for the low COD mainly considered as null
- SICLONE presents a more uniform distribution of low COD



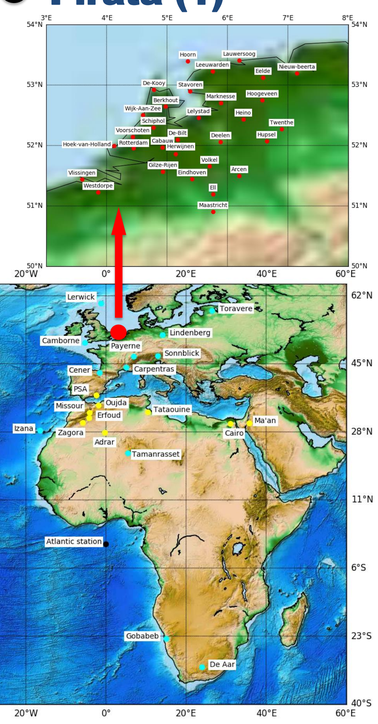
Impact on Heliosat-4 SW irradiance for 56 stations:

STATION measurements | SICLONE HS-4 | KNMI HS-4 | APOLLO HS-4

BSRN (15)
KNMI (31)
EnerMENA (9)
Pirata (1)



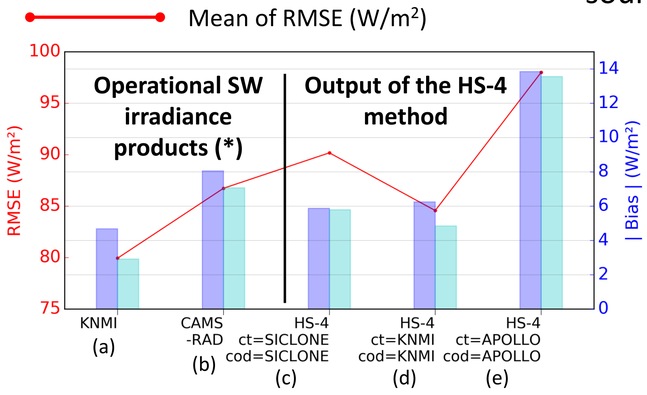
- Over-representation of high irradiations and under-representation of low values
- APOLLO-HS4 farther from measurements than the two others

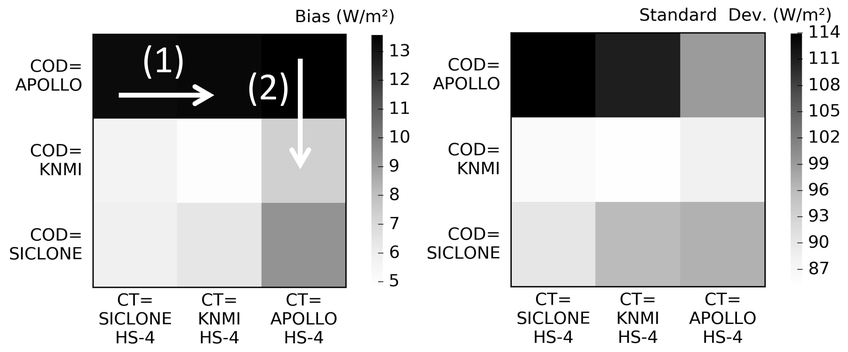


Sensitivity of HS-4 to the cloud properties for the 37 northern stations

Mean of absolute biases (W/m²)
Mean of biases (W/m²)
Mean of RMSE (W/m²)

There is a clear sensitivity of HS-4 output product to the COD and CT from the different sources, and from their temporal evolution (APOLLO bias is unusually higher in 2016).





1) The Cloud Optical Depth is the most sensitive variable
2) SICLONE and KNMI COD improve the bias of HS-4 by 40 % compared to APOLLO. The bias is reduced to that of CAMS-RAD (APOLLO-HS4 + bias correction)

(*) A Model Output Statistics is implemented for KNMI on Dutch stations and CAMS-RAD on BSRN stations.

(a, d) http://msgcpp.knmi.nl/
(b, e) http://www.soda-pro.com/web-services/radiation/cams-radiation-service
(c) http://reuniwatt.com/en/applications/atmospheric-sciences

Conclusion

- Heliosat-4 method is simple to use and to implement with different databases of cloud properties
- There are significant differences among existing cloud properties databases that have a noticeable effect on SW irradiance from Heliosat-4
- This work demonstrated the relevance of inter-comparison of cloud properties databases