

Evaluating the spatial and temporal variations of the performance of CAMS Radiation Service and HelioClim-3 databases of surface irradiation in Germany

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Evaluating the spatial variations of the performance of CAMS Radiation Service and HelioClim-3 databases of surface irradiation in Germany

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CAMS-RAD and HelioClim-3 in a nutshell

From MSG: 3 km at nadir, every 15 min, Feb. 2004 onwards

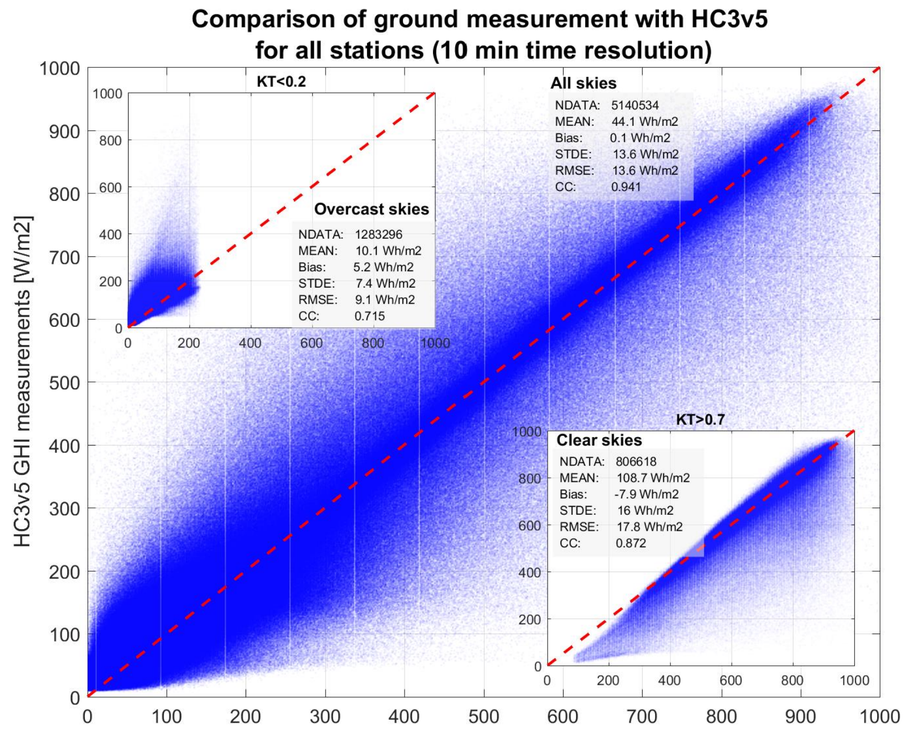
- Both databases contain global horizontal radiation as well as its direct and diffuse components
- Data are updated in real time and available via the SoDa website (www.soda-pro.com)
- CAMS-RAD version 3.2 is based on the physical Heliosat-4 method and use cloud properties from the APOLLO algorithm (DLR)
- HelioClim-3 version 5 (hc3v5) is based on the Heliosat-2 method (cloud index)
- Both methods use the Copernicus McClear service version 3 providing irradiation in cloud-free conditions calculated on the basis of CAMS aerosol data

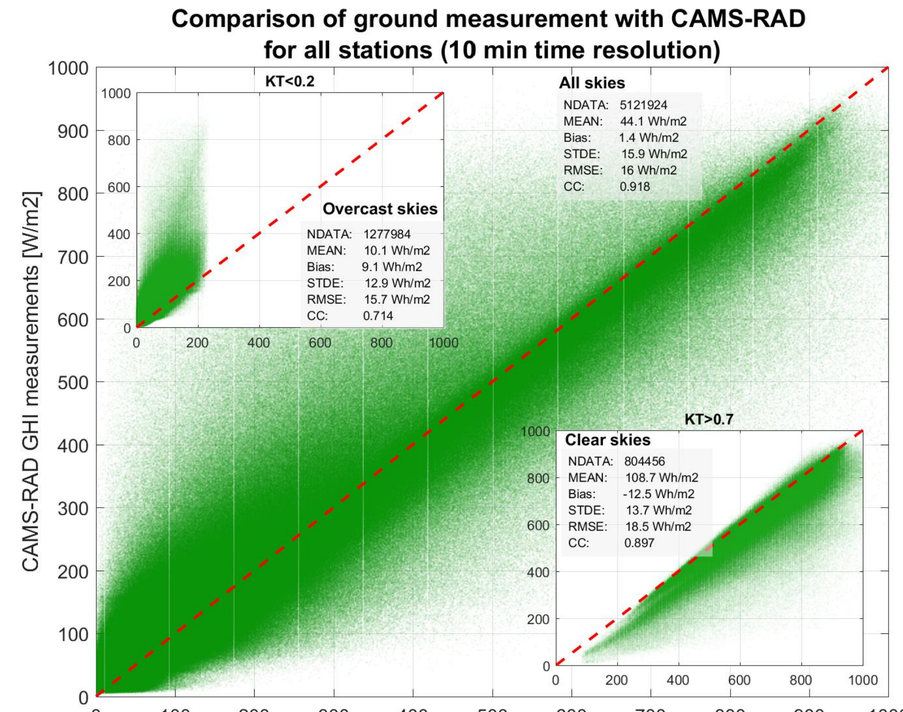
In-situ measurements

- 10 min measurements of global (GHI) and diffuse (DHI) irradiation made by pyranometers (CM11 and CM21) and SCAPP
- 26 stations; period 2010-2018 (9 years)
- Available online from the Deustcher Wetterdienst (DWD) climate data center: (ftp://opendata.dwd.de/climate_environment/CDC/)

Quality Check, Validation - Protocol and Results

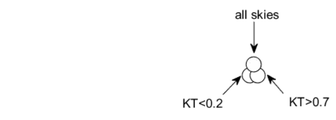
- Discard non-plausible data using quality check procedures from EU-funded FP7 ENDORSE project
- Compute bias, mean of absolute errors, standard deviation of errors, root mean square error, and correlation coefficient
- A conditional validation has been conducted using three classes defined on the basis of the measured clearness index (all data, KT<0.2 for overcast skies and KT>0.7 for clear skies)

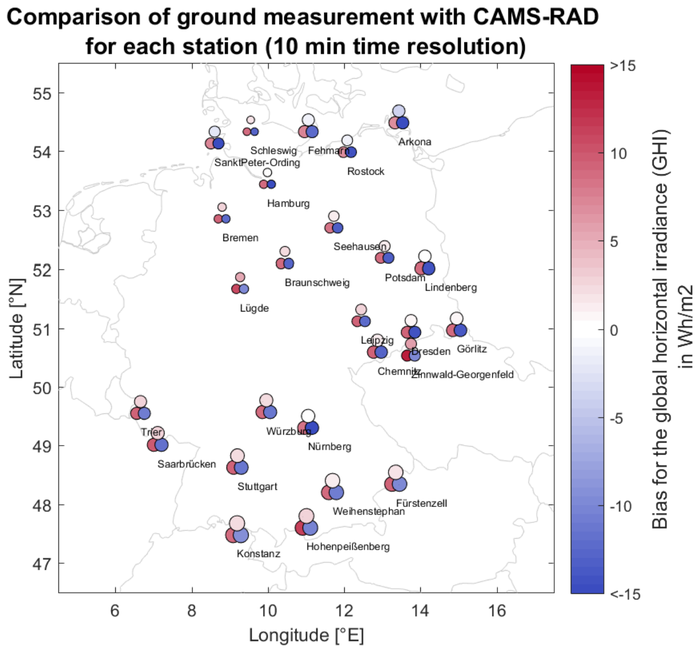


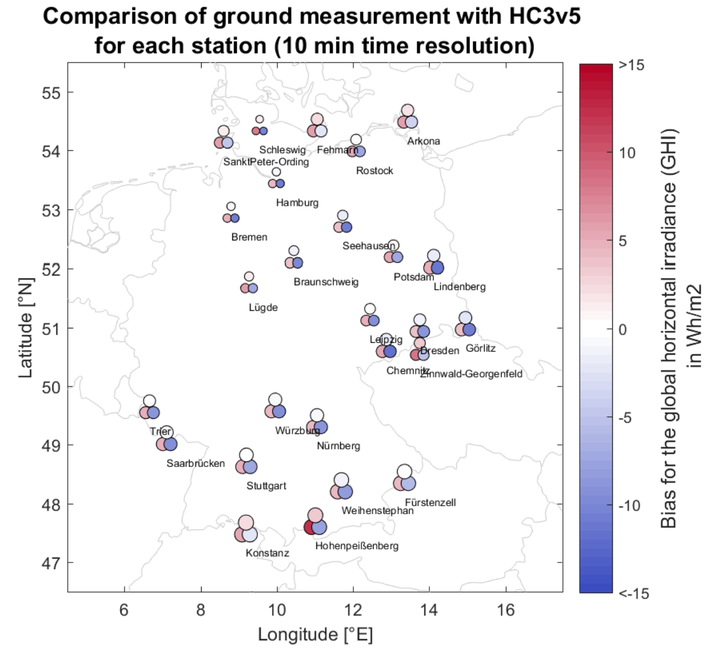


Results and conclusion

- Very good correlation for both CAMS and HC3v5. Both reproduces well the temporal variations of the solar radiation
- Very small bias for all-sky class but positive bias in overcast skies and negative bias in clear skies
- The bias are more pronounced for CAMS-RAD than for HC3v5
- The biases observed for the two considered classes can be partly explained by the validation procedure but other possible causes are to be investigated







CAMS-RAD/HC3v5	All-skies								KT>0.7								KT<0.2							
	Average (Wh/m2)		Bias (Wh/m2)		Stdev (Wh/m2)		CC (-)		Average (Wh/m2)		Bias (Wh/m2)		Stdev (Wh/m2)		CC (-)		Average (Wh/m2)		Bias (Wh/m2)		Stdev (Wh/m2)		CC (-)	
Konstanz	48	48	2	2	16	13	0.932	0.957	115	115	-9	-2	12	12	0.915	0.922	11	11	9	5	13	7	0.693	0.699
Hohenpeißenberg	48	48	3	3	17	15	0.919	0.933	105	105	-10	-8	12	14	0.942	0.922	11	11	11	12	14	11	0.679	0.732
Weihenstephan	47	47	1	-1	16	14	0.926	0.942	111	111	-11	-8	13	17	0.910	0.861	11	11	9	4	12	7	0.707	0.729
Fürstenzell	47	47	2	0	15	13	0.931	0.95	112	112	-10	-6	12	16	0.920	0.883	11	11	9	4	13	7	0.696	0.702
Stuttgart	46	46	2	0	16	14	0.919	0.944	113	113	-11	-7	14	17	0.884	0.853	11	11	9	5	13	7	0.706	0.706
Saarbrücken	45	45	3	-1	17	14	0.912	0.941	112	112	-12	-9	13	17	0.896	0.832	10	10	10	5	14	7	0.706	0.706
Nürnberg	46	46	0	-1	16	14	0.916	0.942	110	110	-15	-9	17	17	0.855	0.864	11	11	8	4	12	7	0.717	0.722
Trier	44	44	3	0	16	15	0.922	0.932	112	112	-11	-9	13	19	0.904	0.804	10	10	9	5	13	7	0.716	0.707
Würzburg	45	45	2	-1	16	15	0.922	0.934	112	112	-11	-9	13	18	0.901	0.820	10	10	9	4	13	7	0.732	0.713
Zinnwald-Georgenfeld	43	43	6	3	19	15	0.875	0.922	103	103	-10	-5	13	15	0.925	0.908	11	11	13	8	17	9	0.7	0.689
Chemnitz	45	45	1	-2	16	15	0.919	0.923	105	105	-13	-12	13	19	0.922	0.853	10	10	9	5	13	7	0.711	0.701
Dresden-Klotzsche	44	44	1	-1	16	14	0.911	0.937	109	109	-14	-9	15	17	0.871	0.851	10	10	9	4	13	7	0.713	0.708
Görlitz	45	45	1	-2	16	14	0.919	0.938	108	108	-14	-11	13	17	0.907	0.862	10	10	9	4	13	7	0.717	0.709
Leipzig	43	43	3	0	15	14	0.923	0.936	111	111	-12	-9	13	17	0.903	0.845	10	10	9	5	12	7	0.73	0.71
Lügde	41	41	5	1	17	14	0.901	0.929	109	109	-10	-7	13	17	0.910	0.851	10	10	11	6	14	7	0.706	0.665
Lindenberg	45	44	0	-2	16	13	0.917	0.942	107	107	-14	-11	13	16	0.895	0.860	10	10	9	5	13	7	0.728	0.767
Braunschweig	42	42	2	-1	16	13	0.914	0.939	109	109	-13	-10	13	18	0.894	0.833	10	10	9	4	13	6	0.726	0.729
Potsdam	43	43	1	1	15	12	0.92	0.948	108	108	-13	-7	13	14	0.893	0.888	10	10	9	5	13	7	0.732	0.758
Seehausen	43	42	1	-2	15	14	0.918	0.932	107	107	-13	-11	13	18	0.901	0.837	10	10	8	4	13	7	0.725	0.736
Bremen	41	41	3	-1	15	14	0.912	0.929	108	108	-12	-11	13	19	0.893	0.809	10	10	9	5	14	7	0.718	0.738
Hamburg	41	41	0	-1	16	13	0.907	0.939	107	107	-17	-11	16	17	0.853	0.859	10	10	9	4	13	6	0.723	0.746
Rostock	43	43	-1	0	14	12	0.934	0.948	107	107	-14	-7	14	14	0.877	0.884	9	9	7	5	11	7	0.733	0.746
Sankt Peter-Ording	43	43	-2	1	14	11	0.935	0.964	106	106	-15	-5	15	9	0.876	0.954	9	9	7	6	10	7	0.76	0.796
Schleswig	40	40	2	1	15	14	0.913	0.93	106	106	-13	-10	13	16	0.900	0.859	9	9	9	8	13	9	0.732	0.763
Fehmarn	44	44	-1	2	14	10	0.938	0.965	107	107	-12	-2	13	8	0.885	0.959	9	9	7	6	10	7	0.739	0.767
Arkona	44	44	-4	2	14	10	0.936	0.968	106	106	-16	-4	15	7	0.863	0.970	9	9	7	6	9	7	0.710	0.787
All stations	**44**	**44**	**1**	**0**	**16**	**14**	**0.918**	**0.941**	**109**	**109**	**-13**	**-8**	**14**	**16**	**0.897**	**0.72**	**10**	**10**	**9**	**5**	**13**	**7**	**0.714**	**0.715**

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