



Supplemental Material

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LIST OF FIGURES

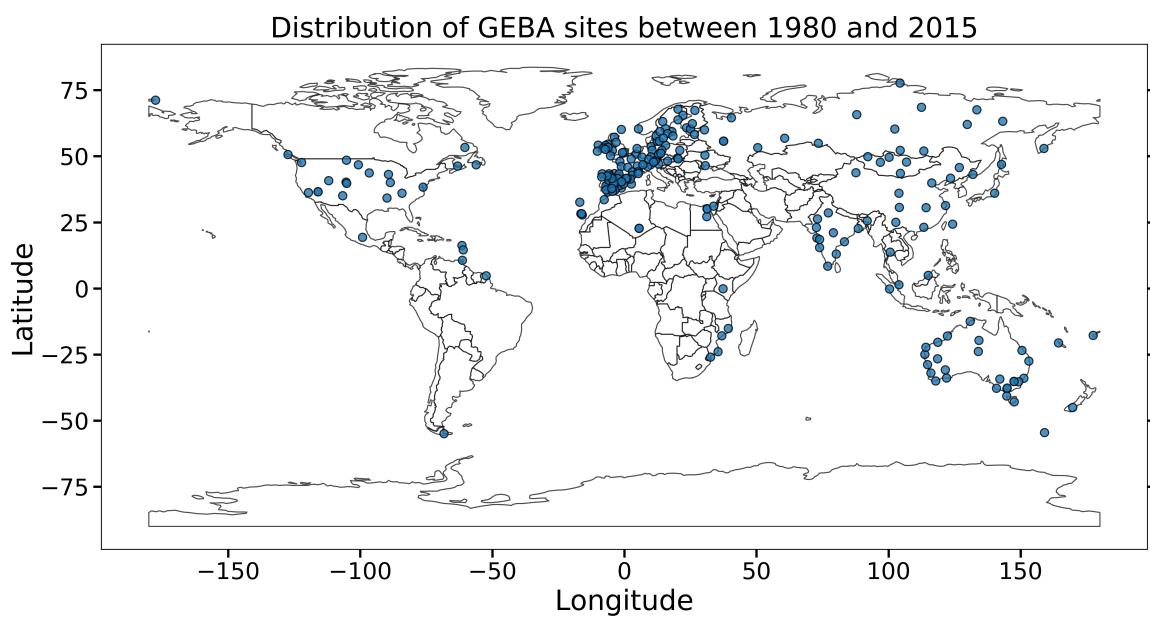
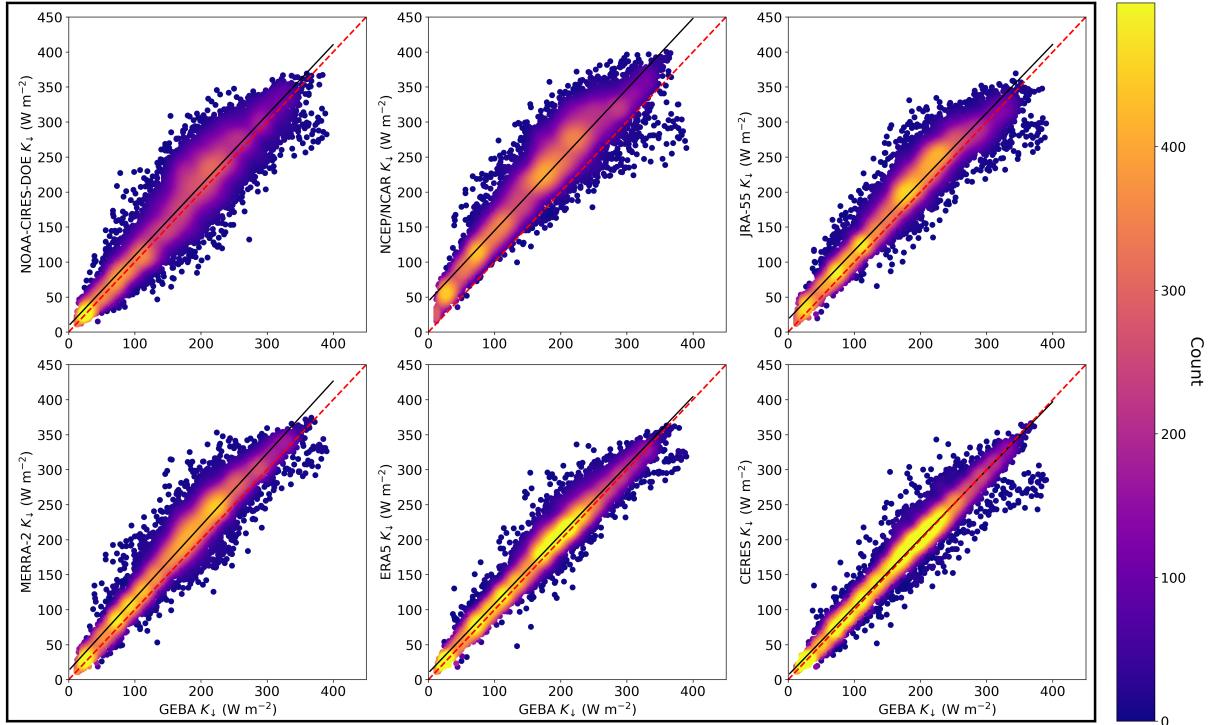


Fig. S1. Geographic distribution of all the GEBA sites used in this study. The sites used for Common Period I (2001-2015) are shown in Fig. S3.



3 Fig. S2. Evaluations of monthly mean incoming shortwave radiation (K_{\downarrow}) at the surface of gridded reanalysis
 4 and CERES products using all common GEBA observations for Common Period I (2001-2015). The red dashed
 5 lines represent the 1:1 relationship. Color indicates data density. Statistical summaries of the evaluations are in
 6 Table 2 of the main text.

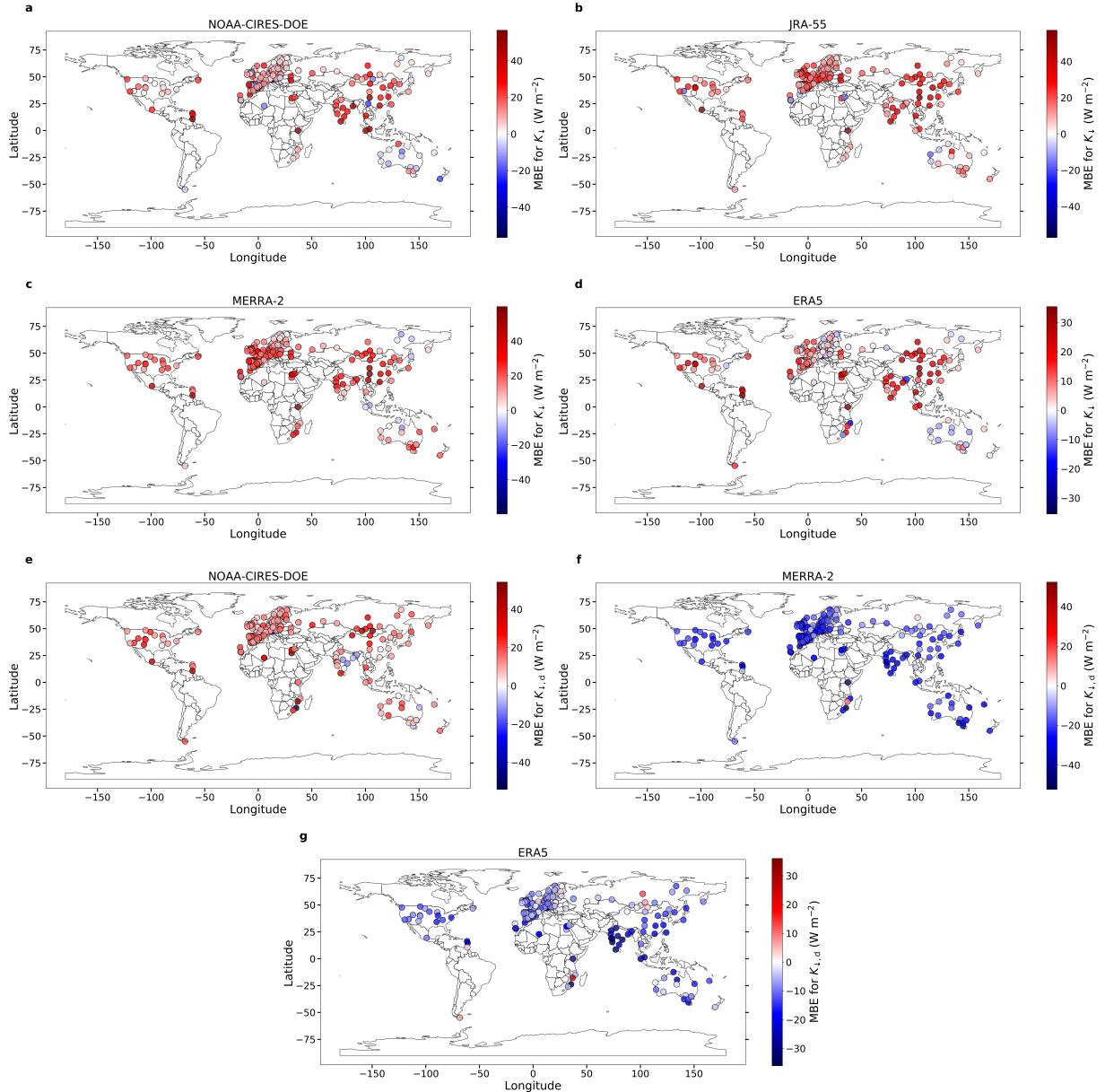
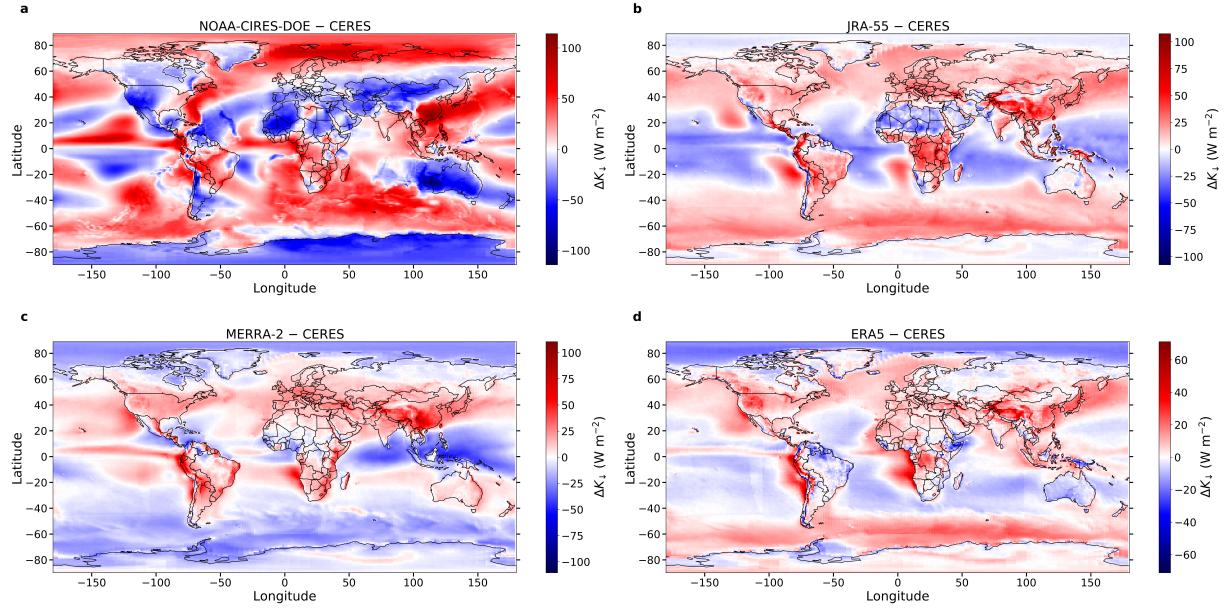
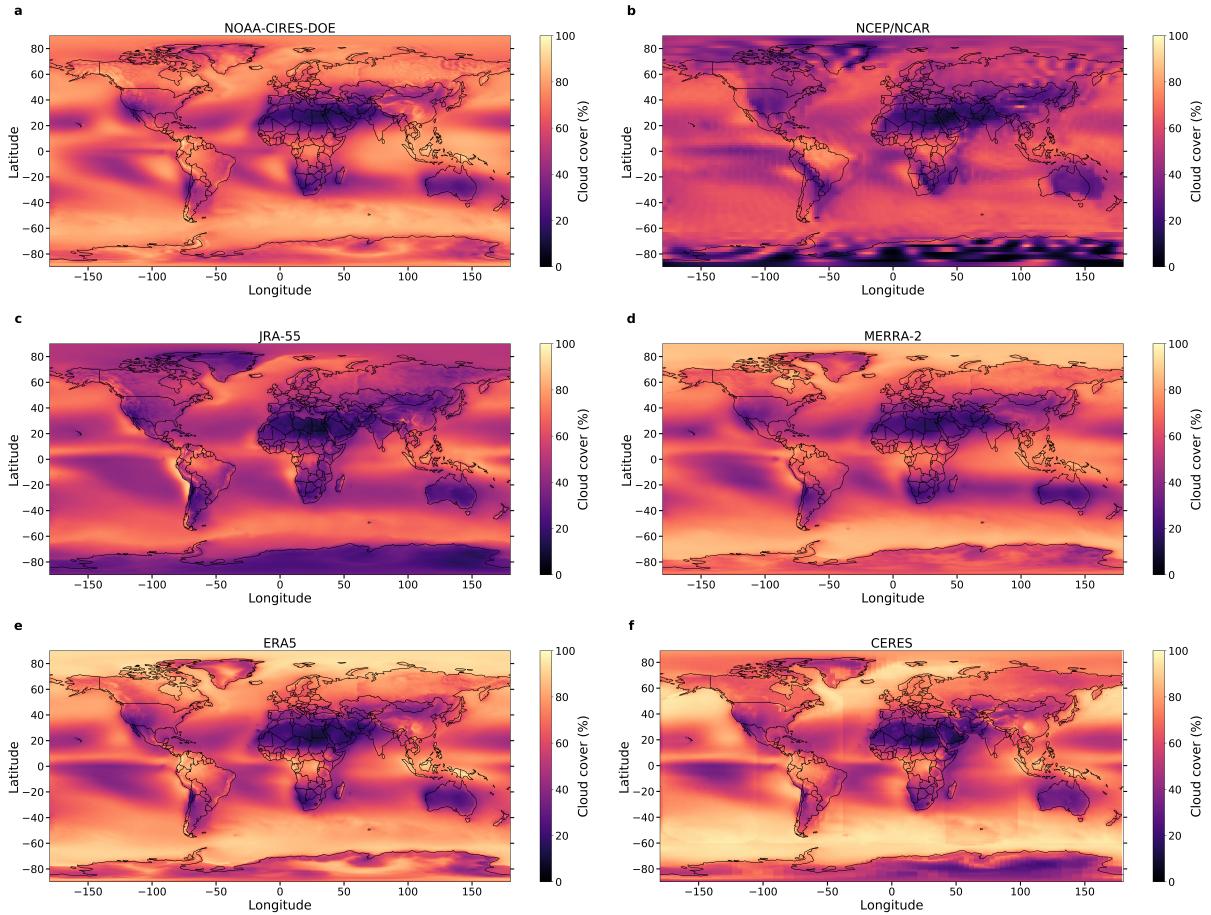


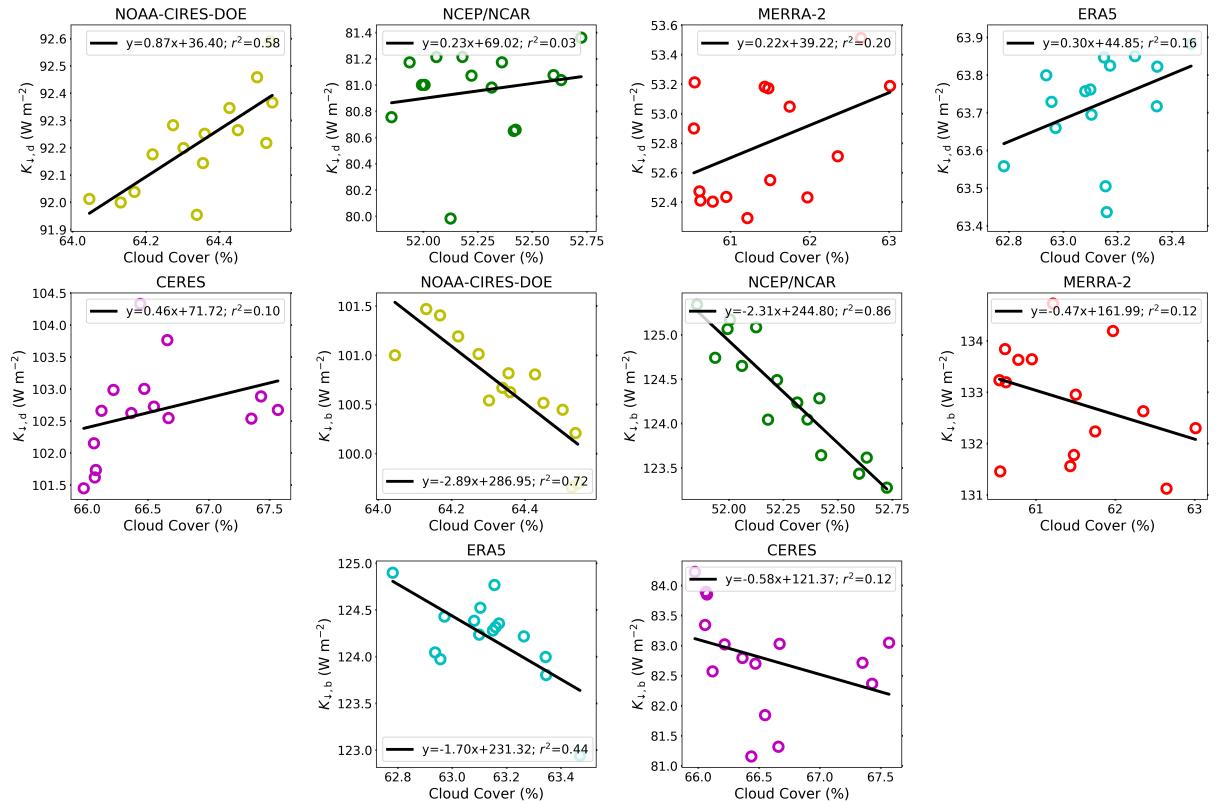
Fig. S3. Site-level mean bias error (MBE) in incoming shortwave radiation (K_{\downarrow}) at the surface for **a** NOAA-CIRES-DOE, **b** JRA-55, **c** MERRA-2, and **d** ERA5 gridded data compared to common GEBA observations for Common Period I (2001-2015). Sub-figures **e**, **f**, and **g** show the corresponding MBE in incoming diffuse radiation ($K_{\downarrow,b}$) at the surface for NOAA-CIRES-DOE, MERRA-2, and ERA5, respectively.



11 Fig. S4. Grid-wise difference in incoming shortwave radiation (K_{\downarrow}) at surface between CERES data and **a**
 12 NOAA-CIRES, **b** JRA-55, **c** MERRA-2, and **d** ERA5, respectively for Common Period I (2001-2015).



13 Fig. S5. Spatial distribution of cloud cover in **a** NOAA-CIRES, **b** NCEP/NCAR, **c** JRA-55, **d** MERRA-2, **e**
14 ERA5, and **f** CERES for Common Period I (2001-2015).



15 Fig. S6. Associations between annual average percentage cloud cover and surface radiation fields (incident
 16 diffuse radiation $K_{\downarrow,d}$ and direct beam radiation $K_{\downarrow,b}$) for Common Period I (2001-2015) for each of the gridded
 17 products. The lines of best fit and their equations are shown.