EGU21-7736, updated on 06 Dec 2022
https://doi.org/10.5194/egusphere-egu21-7736
EGU General Assembly 2021

Accuracy assessment of the joint CloudSat-CALIPSO global cloud amount based on the bootstrap confidence intervals

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Vertically-resolved cloud amount is essential for understanding the Earth's radiation budget. Joint CloudSat-CALIPSO, lidar-radar cloud climatology remains the only dataset providing such information globally. However, a specific sampling scheme (pencil-like swath, 16-day revisit) introduces an uncertainty to CloudSat-CALIPSO cloud amounts. In the research we assess those uncertainties in terms of a bootstrap confidence intervals. Five years (2006-2011) of the 2B-GEOPROF-LIDAR (version P2_R05) cloud product was examined, accounting for typical spatial resolutions of a global grids (1.0°, 2.5°, 5.0°, 10.0°), four confidence levels of confidence interval (0.85, 0.90, 0.95, 0.99), and three time scales of mean cloud amount (annual, seasonal, monthly). Results proved that cloud amount accuracy of 1%, or 5%, is not achievable with the dataset, assuming a 5-year mean cloud amount, high (>0.95) confidence level, and fine spatial resolution (1°–2.5°). The 1% requirement was only met by ~6.5% of atmospheric volumes at 1° and 2.5°, while more tolerant criterion (5%) was met by 22.5% volumes at 1°, or 48.9% at 2.5° resolution. In order to have at least 99% of volumes meeting an accuracy criterion, the criterion itself would have to be lowered to ~20% for 1° data, or to ~8% for 2.5° data. Study also quantified the relation between confidence interval width, and spatial resolution, confidence level, number of observations. Cloud regime (mean cloud amount, and standard deviation of cloud amount) was found the most important factor impacting the width of confidence interval. The research has been funded by the National Science Institute of Poland grant no. UMO-2017/25/B/ST10/01787. This research has been supported in part by PL-Grid Infrastructure (a computing resources).