Paper number: essd-2025-425

“AGCPP: All-day Global Cloud Physical Properties dataset with 0.07° resolution retrieved from geostationary satellite imagers covering the period from 2000 to 2022” (Zhao et al.)

This paper describes a new satellite-based global cloud dataset consisting of cloud phase, top height, optical thickness, and effective radius, called “All-day Global Cloud Physical Properties (AGCPP)”, which is designed to overcome limitations in existing cloud data products by providing continuous, global coverage of essential cloud properties from 2000 to 2022, with high spatial and temporal resolution. This was achieved by using a deep learning model, CloudAtUNet, which was trained on MODIS and applied to gridded geostationary satellite data (GridSat-B1). The work included evaluation results against MODIS and CALIOP products. The paper presents an ML-based approach to generate consistent global cloud products utilizing existing satellite data, which would potentially provide benefits for climate change research, particularly by enabling long-term, all-day analysis.

Additional details and results would be desirable to strengthen the physical interpretation of the model training, particularly given the use of only two IR channels. In particular, for nighttime evaluation, further discussion of cloud optical properties such as cloud optical thickness and effective radius would enhance the scientific robustness of the work for publication.

The authors present yearly trends of the AGCPP products in Figure 13. To better highlight the strengths of this dataset, it would be beneficial to include an additional comparison with existing global cloud datasets. While comparison with ISCCP or SatCORPS may not be feasible due to the lack of overlapping periods, a comparison with CLARA-A3 or current ABI/AHI products for specific regions could provide valuable context and validation.

Major comments

MODIS L2 cloud products have been used in the initial CloudAtUNet model training, which would be anticipated to produce degraded cloud optical properties at night due to lack of visible information. Although the authors designed AGCPP generating day and night cloud products utilizing both GridSat and ERA-5 and show consistent trends against MODIS and CALIOP (CLP and COT), it does not provide clear explanations about using two IR bands only and estimation of nighttime evaluation results, especially for comparisons with CALIOP data (such as cloud optical thickness and effective radius). More discussions

about how to match with MODIS and CALIOP products and physical explanations about nighttime comparisons (1-2 additional figures) would be needed.

Minor comments / typos

Section 2.2.1 and 2.2.2 have several overlaps, which could be better reorganized.

Section 5 Data availability could be placed after Section 6.

Line 57: “Wang et al. 2024 -> Better references such as Bessho et al. 2016

Line 84-86: Complete the sentence “For example, calibrating raw sensor signals to radiant …”

Line 99: “in the fact that AGCPP is the first global dataset with a spatial resolution of 0.07° and a temporal resolution of 3 h.” -> The statement would be better revised with additional specifications regarding what distinguishes this dataset. It may be clarified whether the emphasis lies on its comparatively high spatial and temporal resolutions relative to existing global cloud datasets such as ISCCP, NASA’s SatCORPS, and CLARA-A3, for instance, if the authors intended. Also, specifying that it is a “satellite-based” global cloud dataset would provide important context of the description.

Table 1: "specifications of" will be better than "Comparison results". Please spell out the acronyms of the datasets.

Line 111-112: Revise the sentence. Maybe evaluation would be “evaluate”?

Line 161: “MOD/MYD” -> I can guess those are from collection 6, but specify the data collection version with a proper reference here first.

Line 180-181: Correct the incomplete sentence.

Table 3: Correct the first row.

Line 260 and Table 2: Gridsat -> GridSat

Line 299-304: Please add more details on how the initial cloud detection has been treated, which are also different between MODIS and CALIOP.

Line 411: Missing words. Complete the sentence “Although deep learning models well trained…”.

Line 516-517: Correct the sentence “Since MODIS is insufficient to cover the entire globe at a 3 h time resolution, especially in the equatorial regions…”

Figure 13: Correct the caption. CTH has been repeated.

Line 567: Add satellite-based or satellite in “global cloud physical …”