Elevation Brings Perspective: A Dual-View Approach to Cloud Reconstruction

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Introduction

All-sky imagers (ASIs) help model clouds to reduce solar power uncertainty.

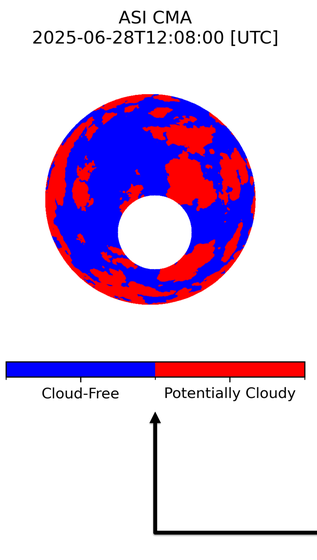
Yet, current approaches rely solely on ASIs, leaving the potential of integrating satellite top-down imaging unexplored.

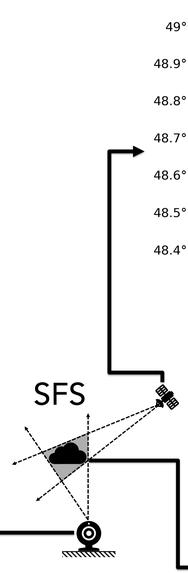
Methods

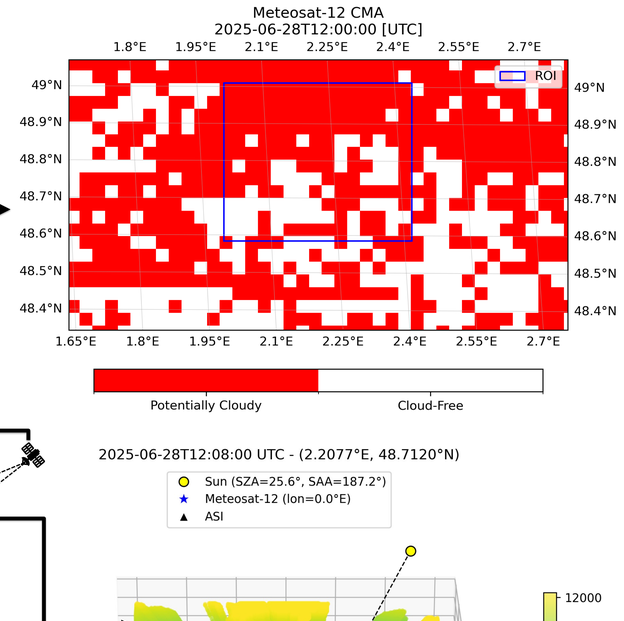
The reconstruction uses Shape-from-Silhouette (SFS), requiring:

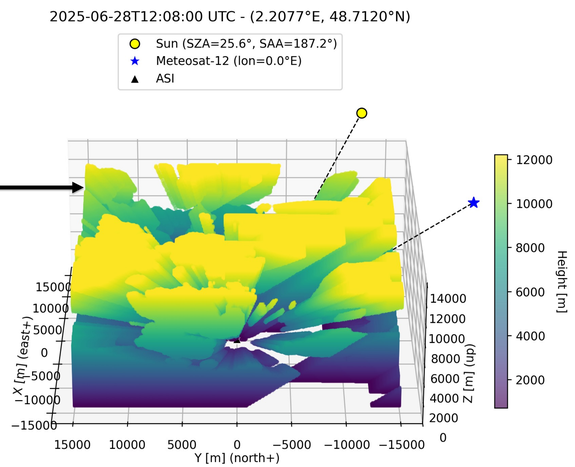
- Calibrated cameras (ASI and geostationary satellite)
- Cloud masks (CMA)
- Temporal–spatial alignment between views

Results









SFS Cloud Reconstruction Accuracy

- Total grid voxels: 10,509,716
- ASI only: 5,658,912 (53.84%)
- SAT only: 6,729,079 (64.03%)
- ASI ∩ SAT: 3,479,487 (33.11%) *(see figure)*
  - Gain (vs. ASI only): -2,179,425 (-38.51%)

Conclusions

Readily available satellite data improve the geometric characterization of clouds, enabling better shadow localization and reducing solar power uncertainty.

However, the limited number of viewpoints (two in this case) and their configuration make the method unsuitable under overcast conditions. Ongoing work aims to integrate Cloud Top Height (CTH) from satellite data to better constrain the visual hull.

Related Work

L. R. Thorne et al. 1997. Data and image fusion for geometrical cloud characterization. *Technical Report*.

L. Vallance. 2018. Synergie des mesures pyranométriques et des images hémisphériques in-situ avec des images satellites météorologiques pour la prévision photovoltaïque. *Diss.*

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Further information

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