Cloud Characterization Using Sky Imager, Satellite, and Remote Sensing for Solar Forecasting

SOLAR WINTER SCHOOL

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Motivations

- Cloud dynamics significantly contribute to the uncertainty in solar power availability.
- Clouds are typically studied using sky or satellite imaging.
- These methods have limitations in capturing key cloud dynamics and properties (e.g., multi-layer clouds, convective clouds and etc.).
- Integrating imaging with remote sensing instruments enables detailed cloud characterization, supporting solar forecasting applications.

Methodology

- Cloud Imaging: We collect cloud information from above and below using colocated acquisition from ground-based sky imagers and readily available weather satellite data.
- Cloud Motion: We analyze cloud movement using vertical profiles of horizontal and vertical wind components derived from wind radar data.
- Cloud Layers: Multi-level clouds are distinguished via a cloud mask integrating ground-based lidar and radar data using the Cloudnet method (Illingworth et al., 2007).
- Cloud Impact on Solar Radiation: We assess cloud-induced irradiance variations using ground-based measurements of all three solar radiation components.

Next steps

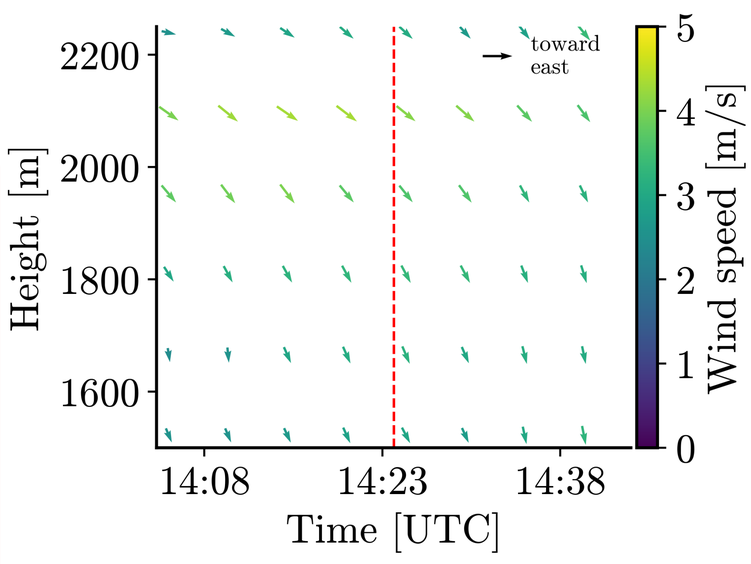
This dataset will support data fusion techniques for solar forecasting, including:

- Cloud property retrieval
- Cloud motion estimation
- Cloud radiative effect modeling

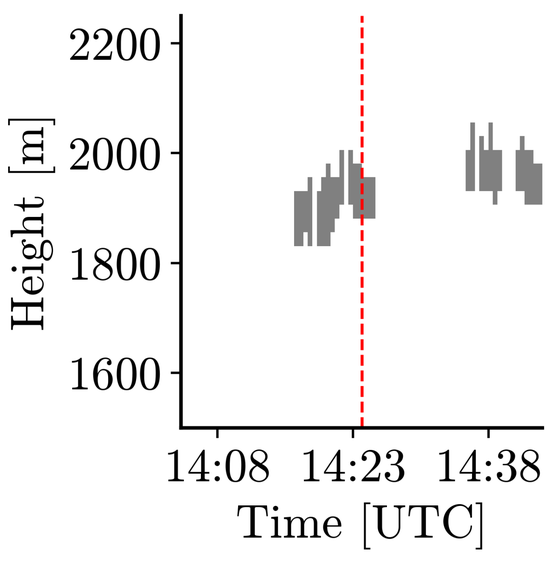
Cloud Imaging

[3]Snapshot at 2022-07-05 14:23:58 (UTC)

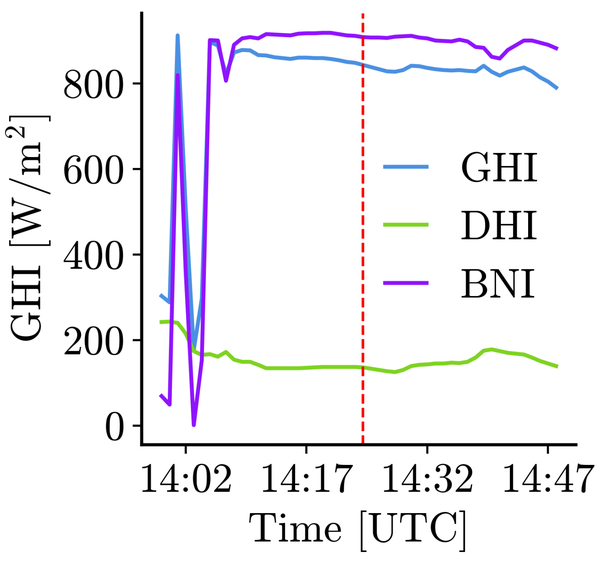
Wind Components



Cloud Layers



Solar Radiation



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