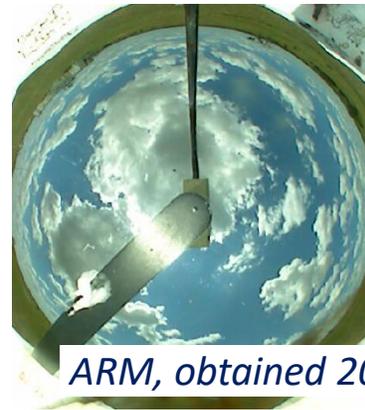


Shallow Cu surface irradiance PDF is bimodal

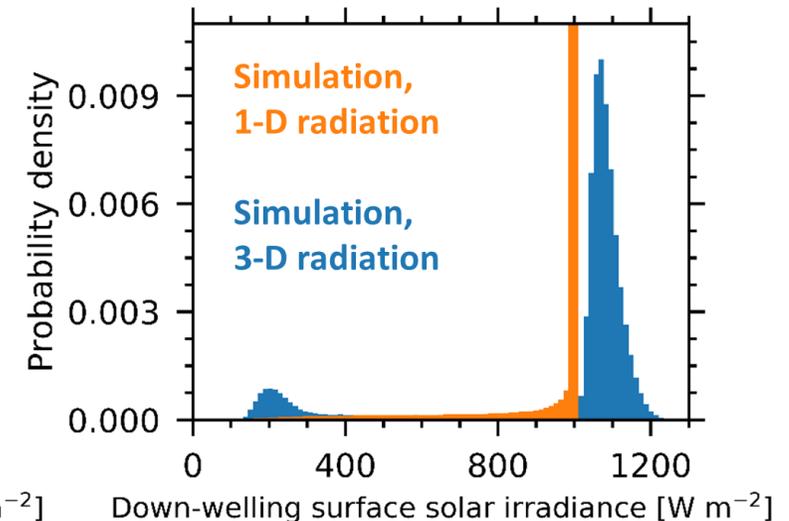
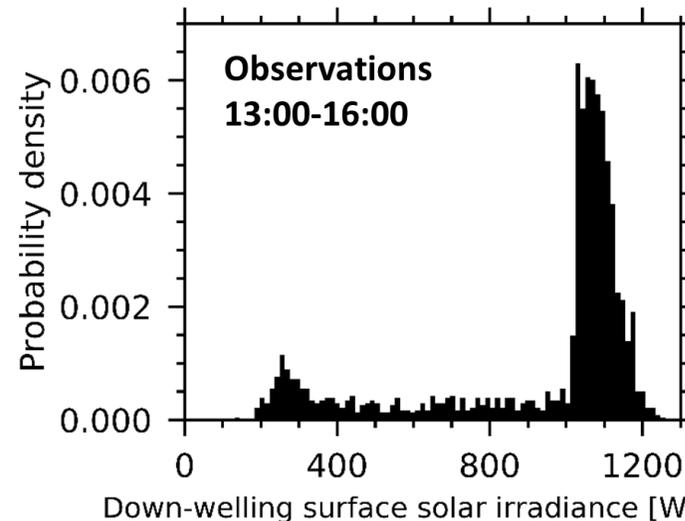
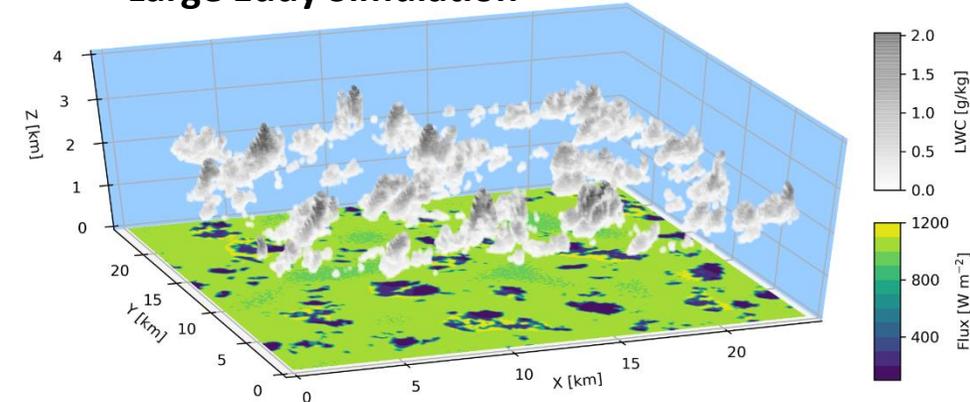
- ARM SGP, June 27th 2015, LASSO
- RADFLUX observations combined across 10 extended facilities
- LES produces realistic cloud field, but surface irradiance PDF shape only captured with 3D radiative transfer
- Consistent across LASSO days

Gristey et al., JAS, 2020;
Glenn et al., JAS, 2020

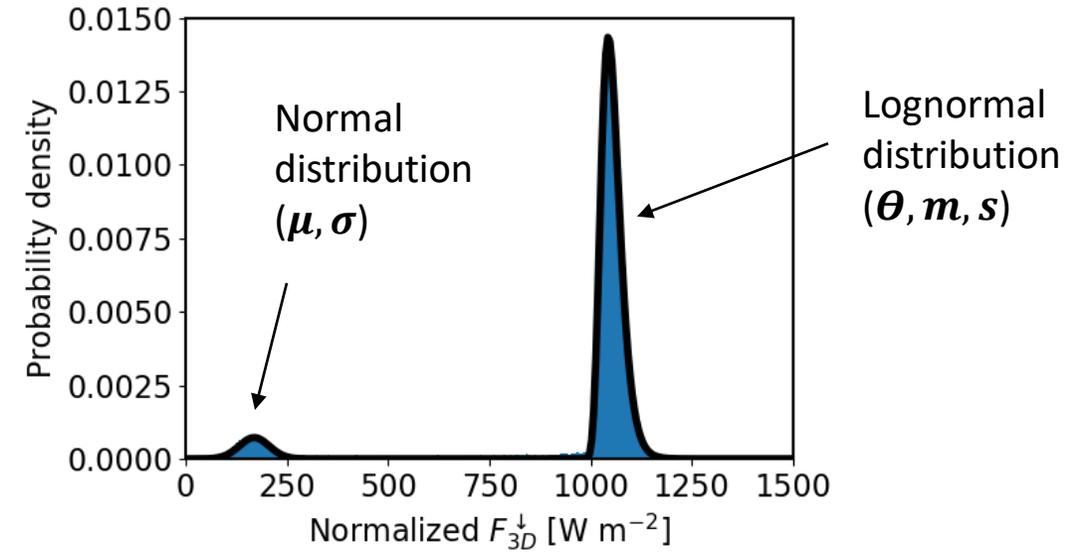
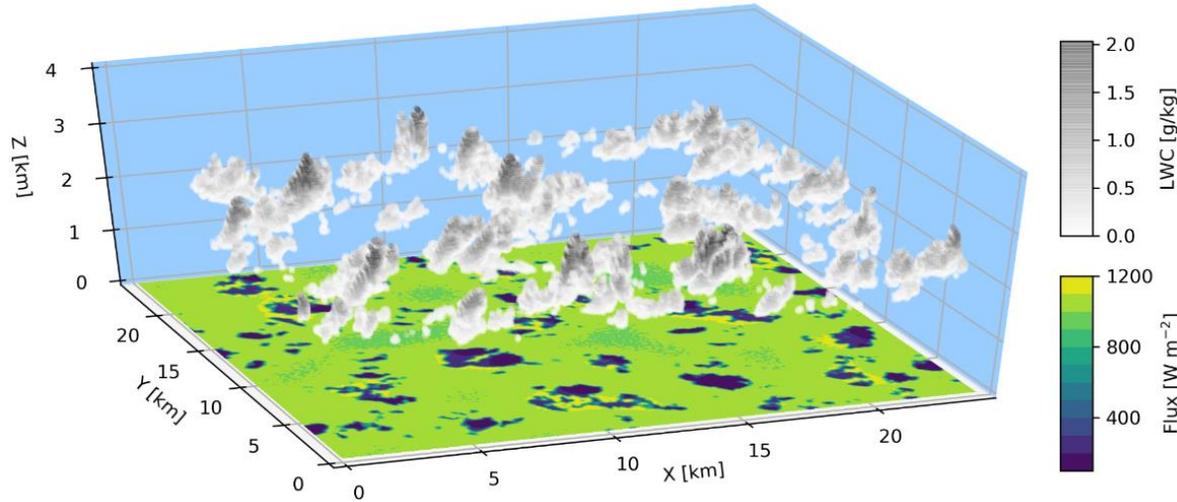
Observed Total Sky Image



Large Eddy Simulation



Mapping directly between clouds and irradiance

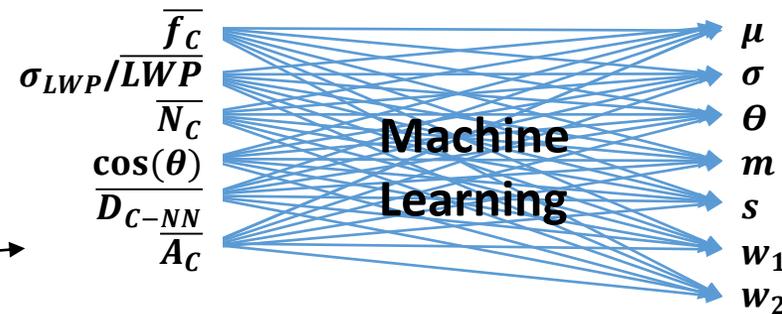


LES cloud field properties

Irradiance PDF fit parameters

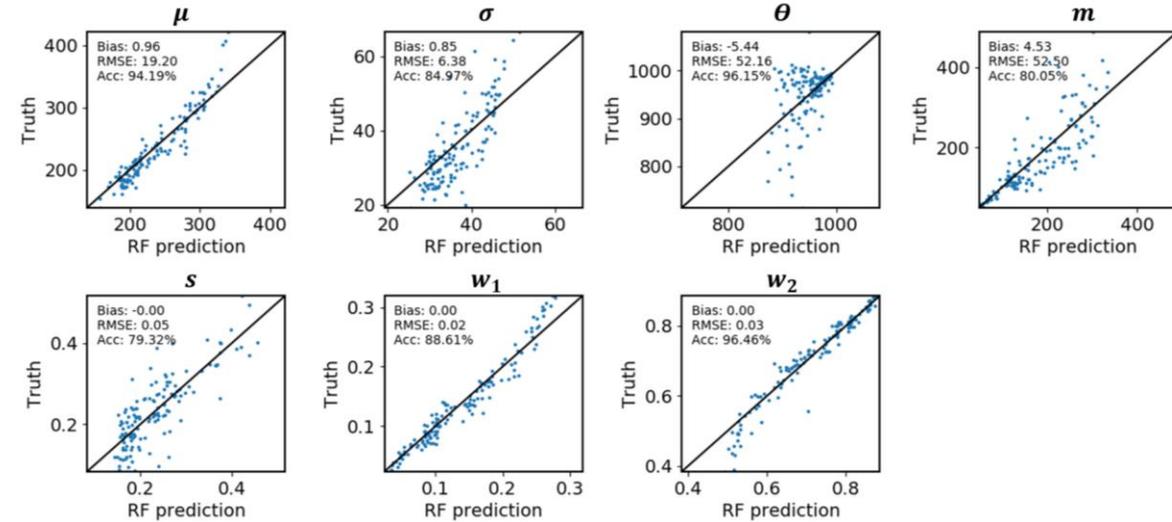
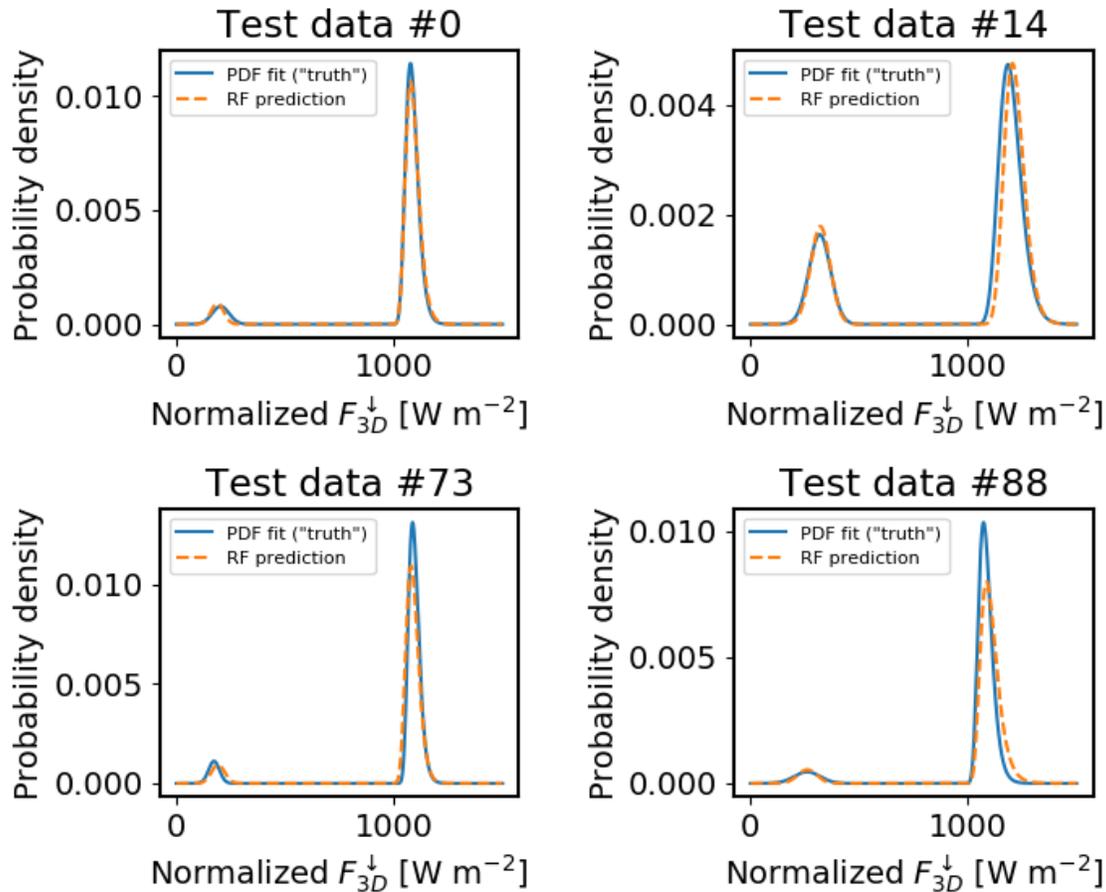
Cloud sizes and distances calculated offline

e.g., Feingold et al., JGR Atmos., 2017



- 3D radiative transfer calculations
 - > 500 snapshots from 30 LES cases
 - train random forest and artificial neural network algorithms

Cloud properties accurately predict 3D irradiance



- Captures variations in shape and size of both modes
 - Drastic improvement w.r.t. 1D calculations
- Potential applications and next steps:
 - LES radiation parameterization
 - NWP 3D bias correction
 - Accessing NWP sub-grid radiation variability
 - Other...