ARM Cloud Radar Simulator for GCMs

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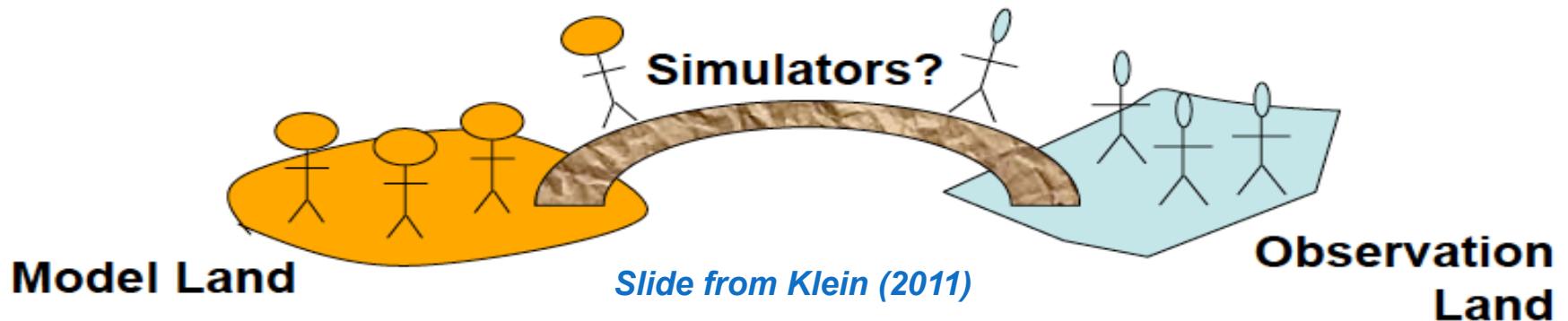
Simulators?

Model Land
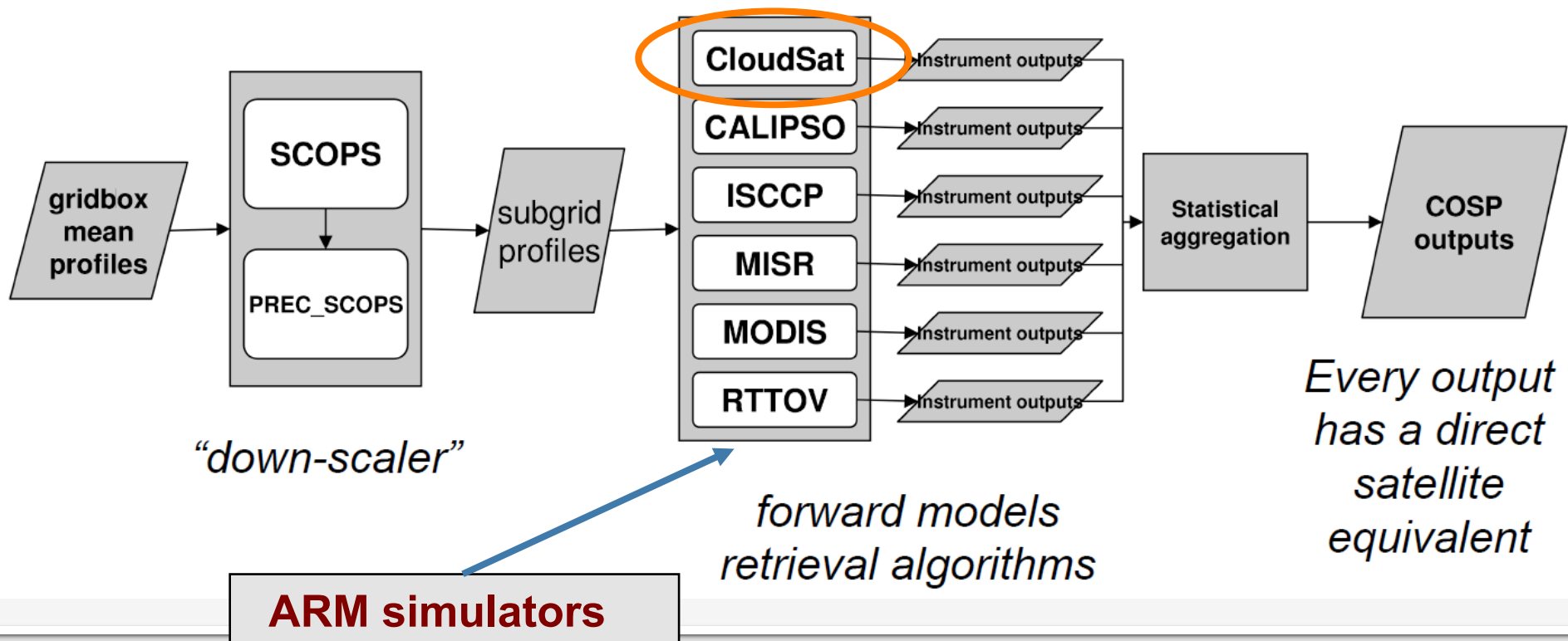
Observation Land

Slide from Klein (2011)

Ideas on the ARM Radar Simulator

- Take the advantage of COSP**, the CFMIP Observation Simulator Package**, by inverting the COSP CloudSat simulator for view from the ground and run at a different wavelength for the ARM ground-based remote sensors

- Make it as part of **COSP** for a broad use by the climate modeling community
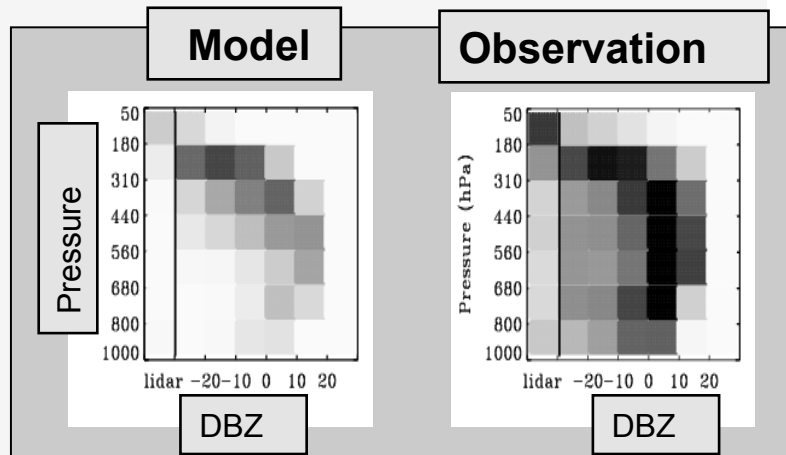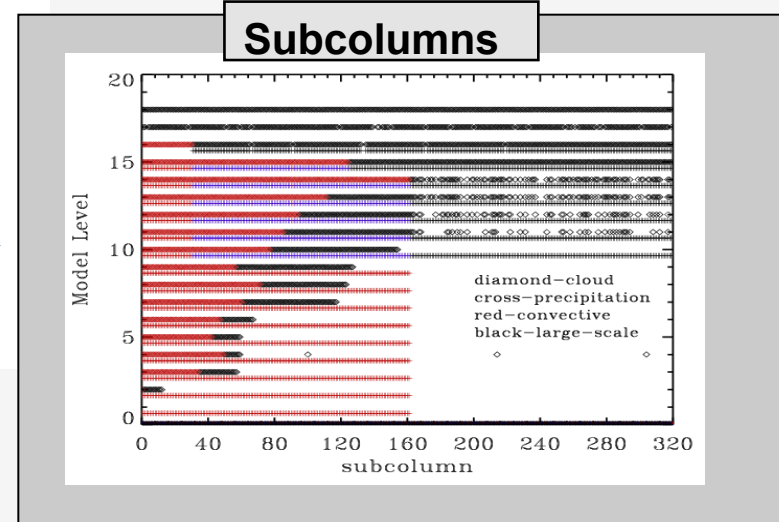
How Does the ARM Radar Simulator Work?

GCM output

Cloud Cover | Mixing ratio | Pr Fluxes
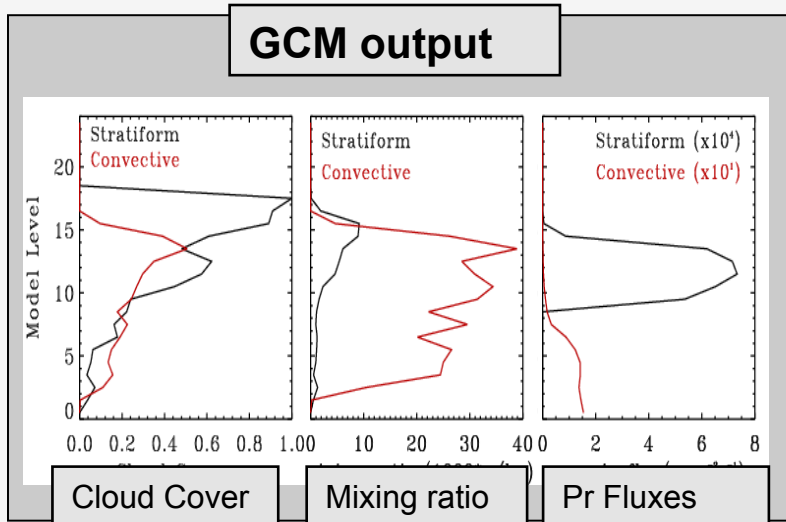
COSP "down-scaler" to generate subcolumn distribution

SCOPS + PREC_SCOPS

Subcolumns

diamond−cloud
cross−precipitation
red−convective
black−large−scale

Radar simulator to convert model variables into pseudo-instrument obs

Model ARM Radars

Effective reflectivity factor   dBZe

Statistical processing (a statistical module) to produce joint histogram

Model   **Observation**

DBZ   DBZ
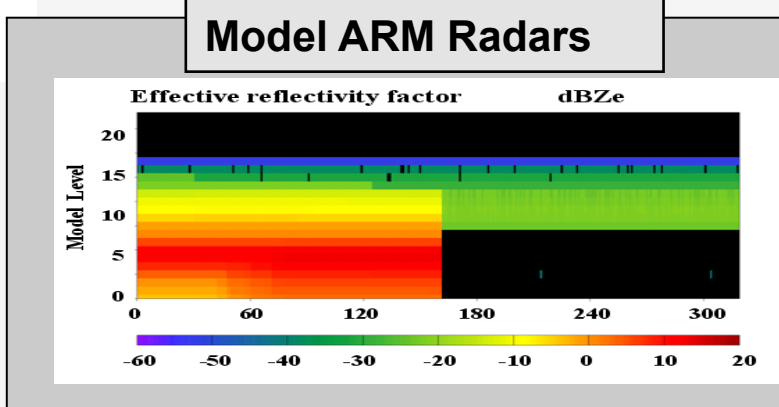
CFAD - The Contoured Frequency by Altitude Diagram (the reflectivity-height histogram)

Current Status and Future Plan

- The ARM cloud radar simulator has been created based on the COSP CloudSat radar simulator and tested with ACME
- Additional ARM instrument limitations such as the minimum and maximum detectable signals are considered in the ARM simulator
- Multi-year ARM GCM-oriented cloud radar data (CFAD) at ARM permanent sites and AMF sites are being created.
  - 2006 -2010 at SGP (done) (working on other sites)
  - Will extend to the most recent years once *the KAZR-ARSCL data are available*
- Working with COSP PMC and ARM for code release
  - Documentation, user guide, and distribution
- Refine and improve the ARM radar simulator
  - Add the non-attenuated, Rayleigh-scattering only, radar reflectivity CFAD to the simulator output and refine the code structure to make it more flexible for future modification
- Develop ideas to create an ARM lidar simulator

Retrievals vs. Simulator

- Retrievals: comparing retrieved geophysical parameters (LWC/IWC) can easily link model problems to particular physical processes, but uncertainty from the instrument limitations

- Simulator: bypass some difficulties to compare with retrieved parameters, but difficult to interpreting results in terms of physical processes because the comparison variables are not trivially related to any single geophysical quantity

Slide from Klein (2011) (modified by Xie)