Surface SW flux over the Tibet Plateau from ISCCP-D1 data

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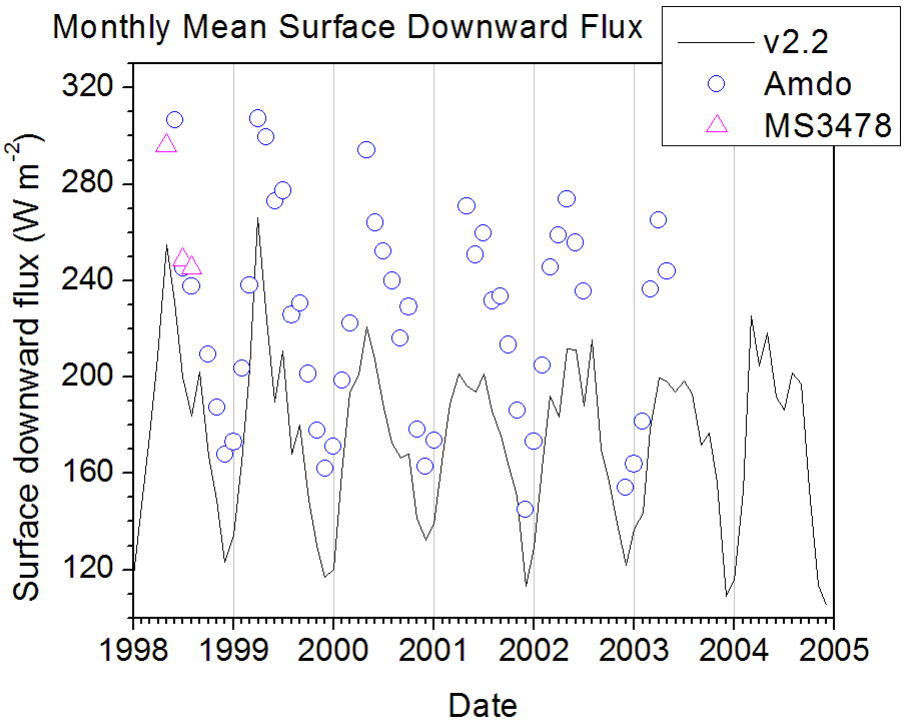
SW Surface Flux in GAME

- Surface shortwave (SW) radiative fluxes derived from satellites and observed at the ground were compared for the GEWEX Asian Monsoon Experiment (GAME) (Masuda, IRS 2004):
  - The UMD algorithm (V2.2) significantly under estimates the SW flux over the Tibet Plateau.
  - Not unexpected since v2.2 is for sea level.
- Estimated SW fluxes with the newer version v3.0.



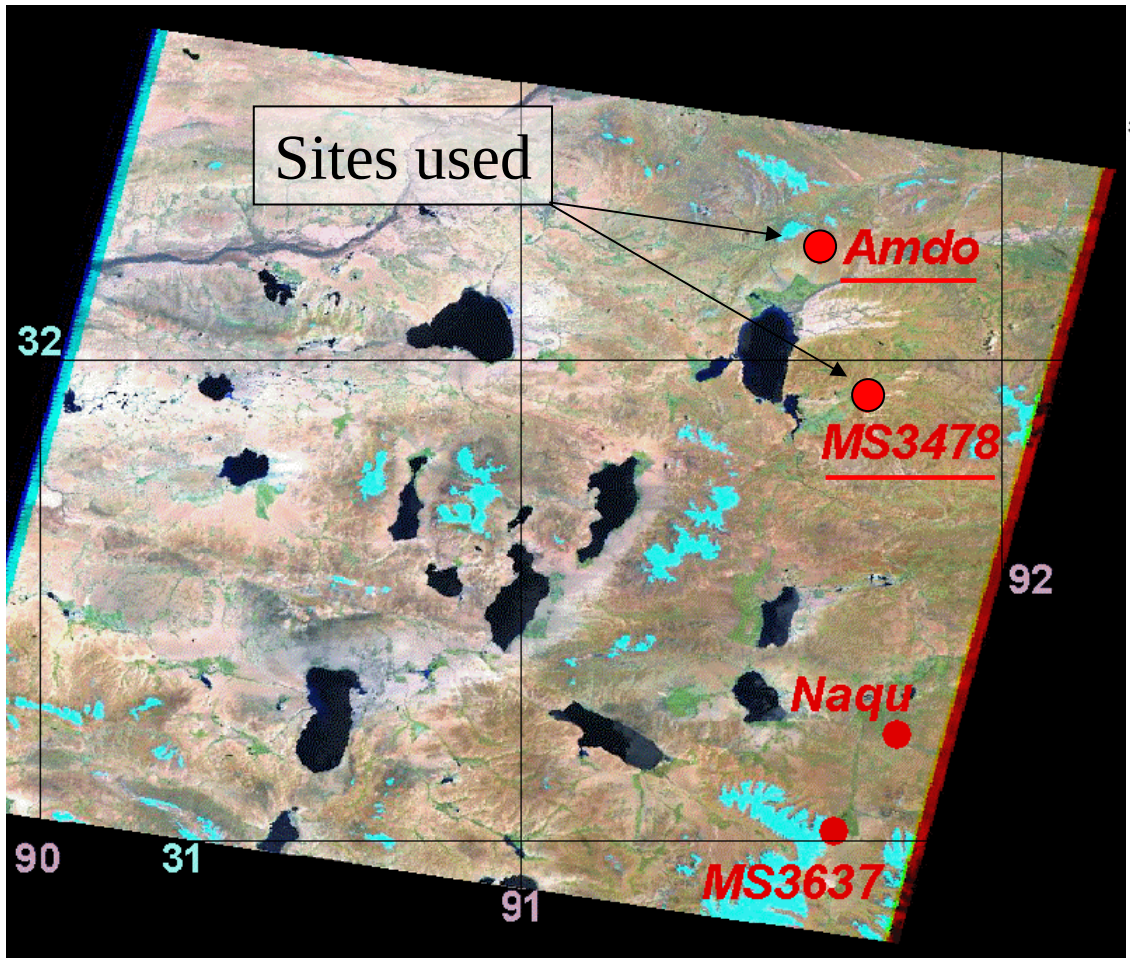
v2.2 vs. v3.0

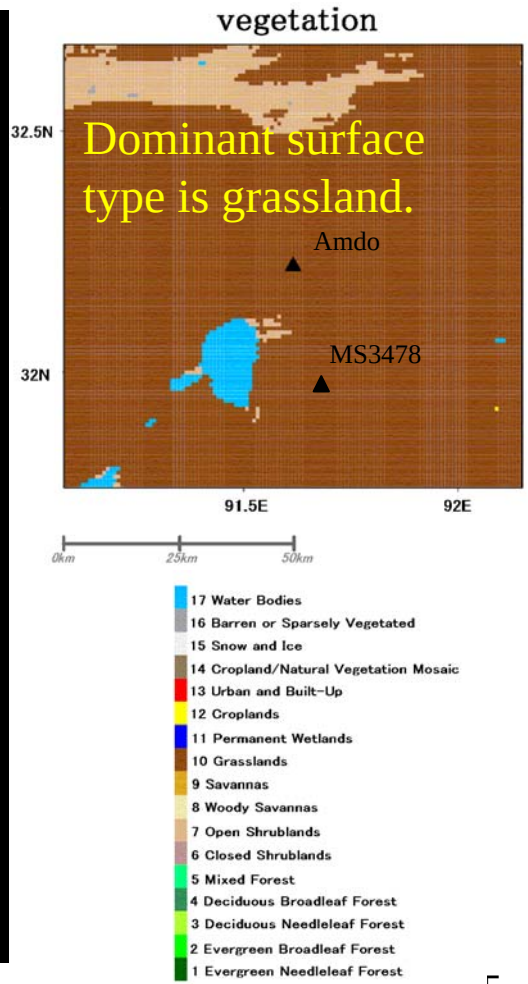
	V2.2	V3.0
Aerosol and cloud optical depth retrieval	from TOA broadband albedo	same as in v2.2
Radiative transfer (RT)	in look-up table (LUT)	full RT module used
Surface height	fixed at sea level	varying; from observation
Cloud top altitude	fixed at 5.5 km	varying; from observation
Aerosol optical depth used for surface albedo retrieval	ocean, land, desert from SRA, independent of season	geographically varying monthly climatology from chemical transport model

Surface Data

- Data are from the GEWEX Asian Monsoon Experiment (GAME) Asian Automatic weather station Network (AAN) collection.
  - Principal Investigator: *M. Sugita* (Univ. of Tsukuba, Japan)
- Two stations are used:
  - **Amdo**, Xizang, China (primary station in this study)
    - Lat: 32º 14.468' N, Lon: 91º 37.507' E, Elevation: 4,700 m.
    - PI: *Hirohiko Ishikawa*, Disaster Prevention Research Institute, Kyoto University, Japan. SW instrument: EKO MS-801 pyranometer.
  - **MS3478**_NPAM , Tibet, China
    - Lat: 31º 55.586' N, Lon: 91º 42.945' E, Elevation: 5,063 m.
    - PI: *Osamu Tsukamoto*, Department of Earth Sciences, Faculty of Science, Okayama University, Japan. SW instrument: Kipp & Zonen pyranometer (CM21).

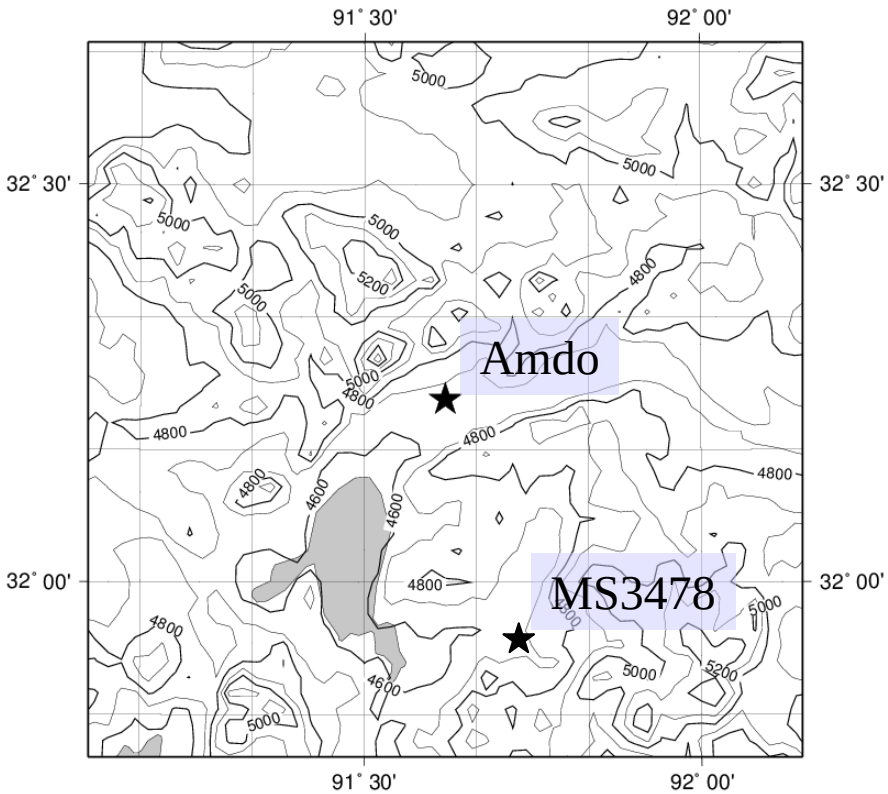
Station Sites

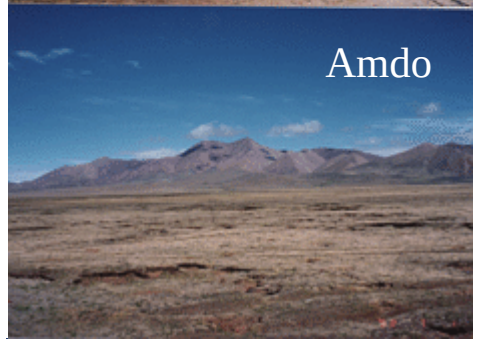




Station sites (cont.)

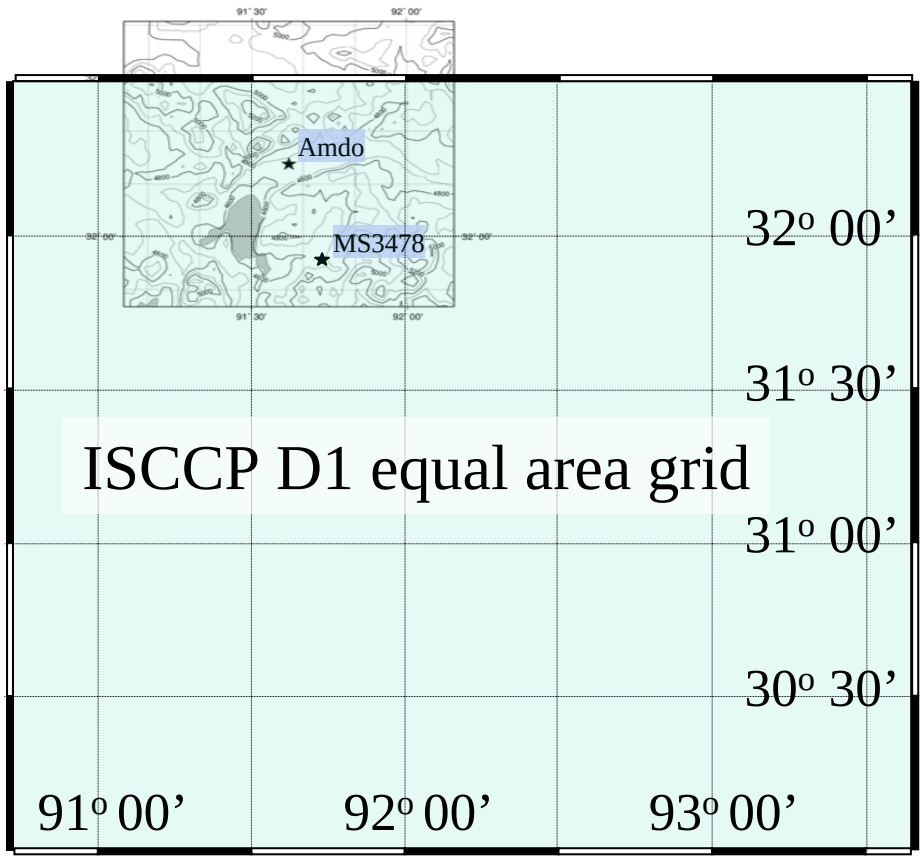
Surface elevation map





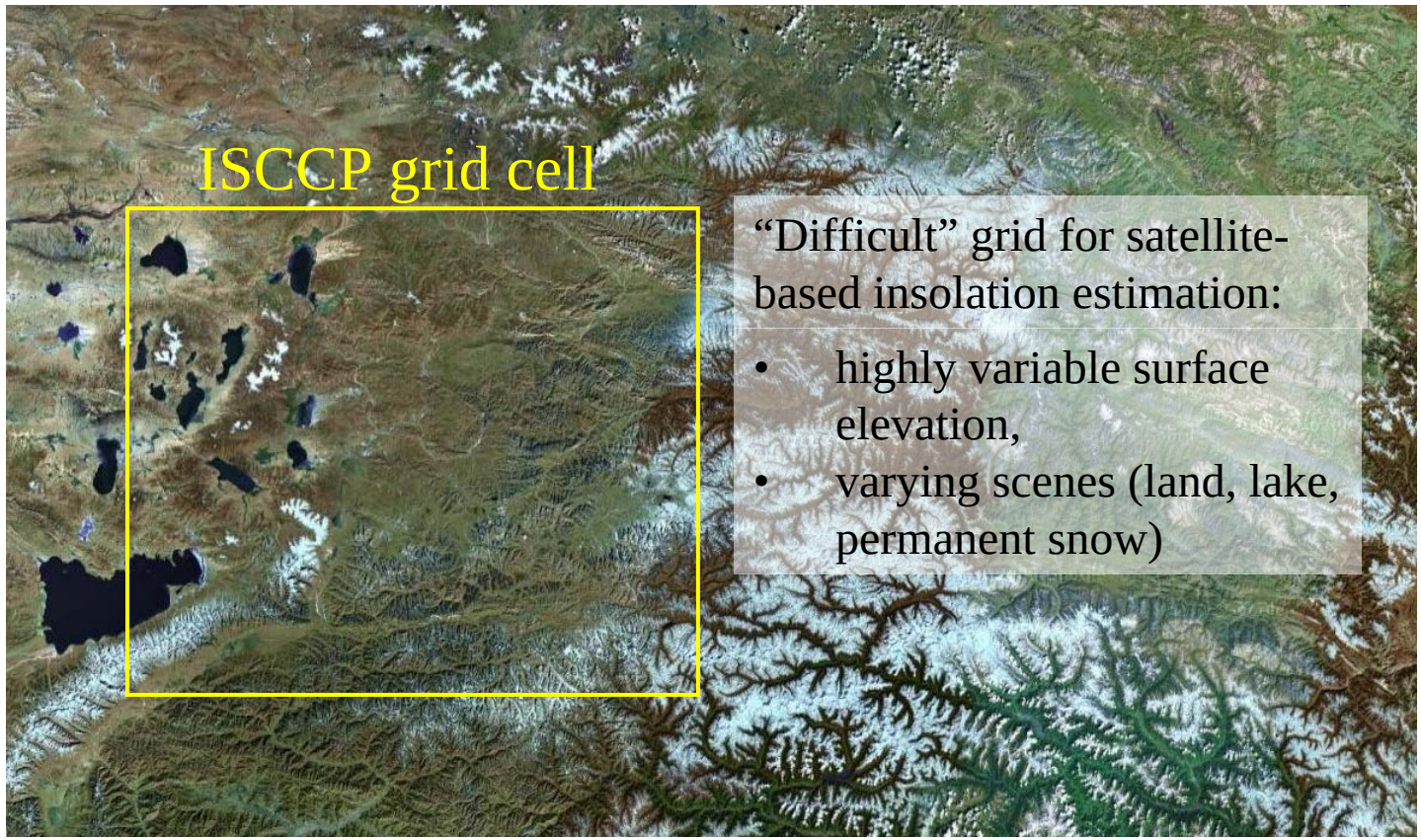
- Surface elevation varies from 4,600 m to 5,200 m.
- Sites are situated on a flat terrain.

Station sites (cont.)



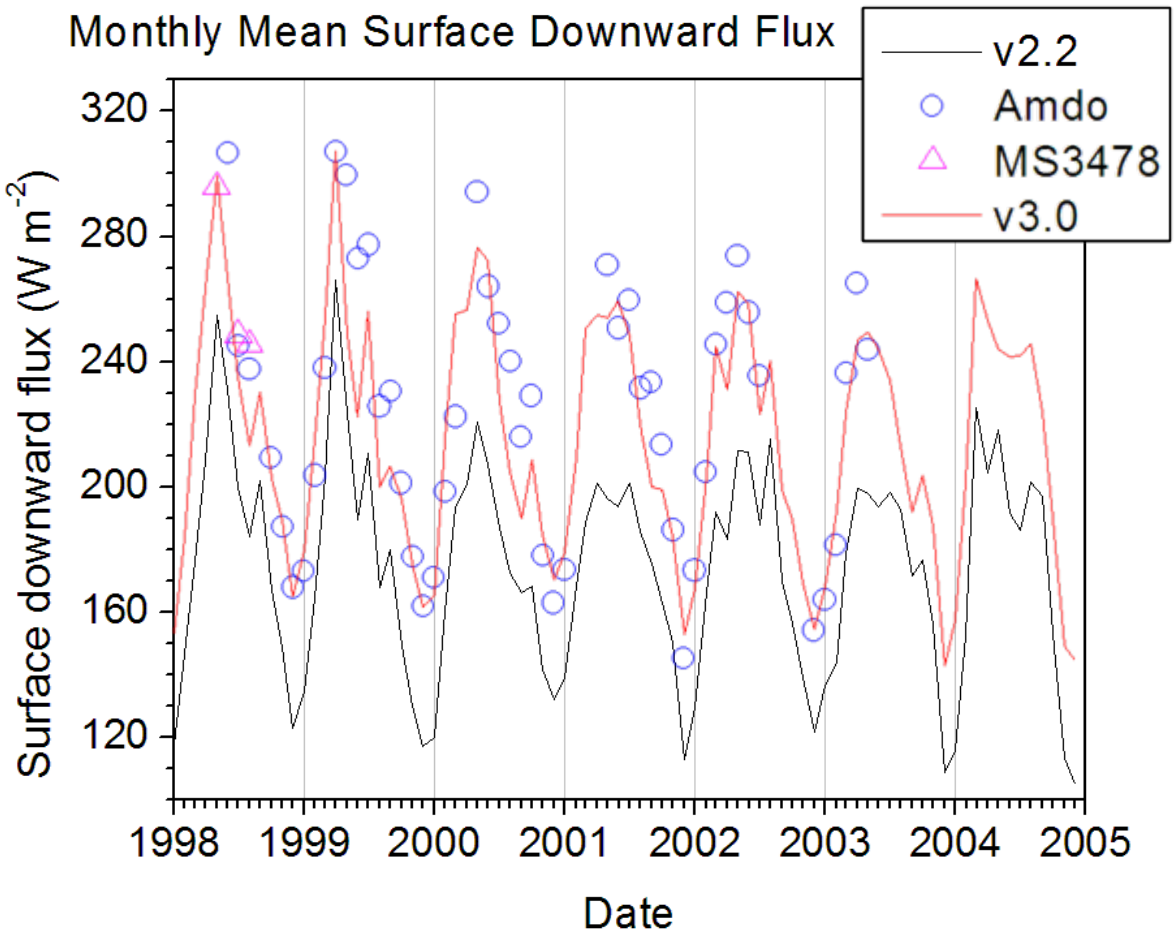
- The stations and the ISCCP grid represent vastly different spatial scales.
- Cannot expect identical values of SW surface flux data from station and ISCCP grid.

Approximate ISCCP grid



http://maps.google.com/

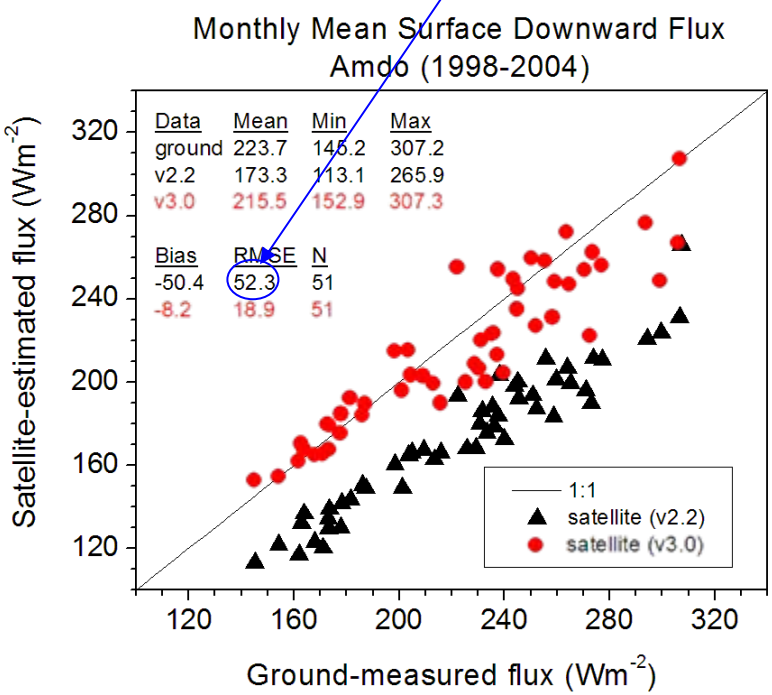
SW flux from v3.0

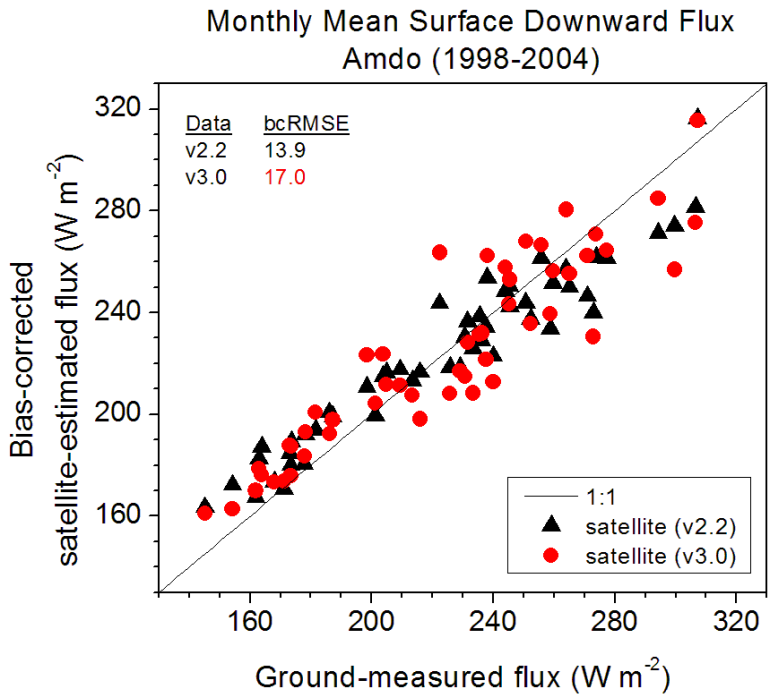


- v3.0 estimates are significantly better than those in v2.2.
- Comparison of the two station data indicate a (at least) 5-10 Wm^{-2} spatial variability.

Bias and RMS

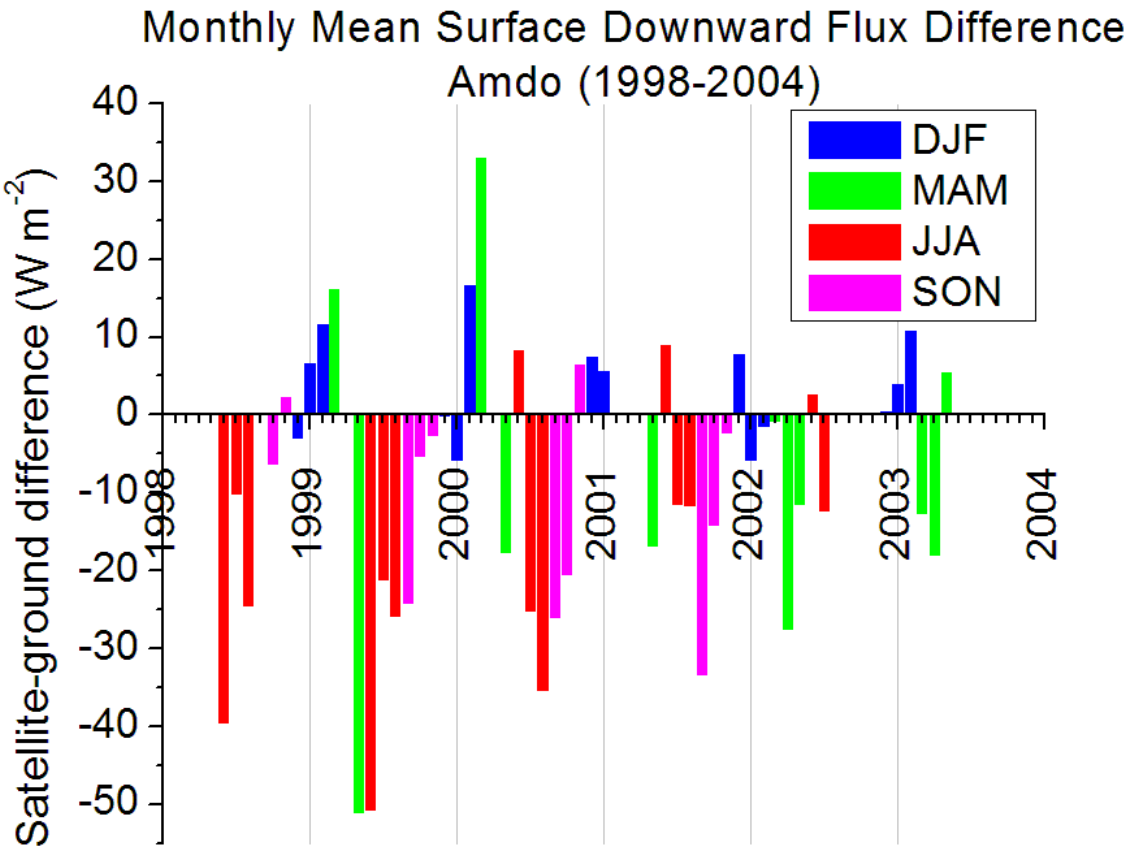
RMSE includes the (large) bias!





The bias improved but scatter is somewhat larger in v3.0!

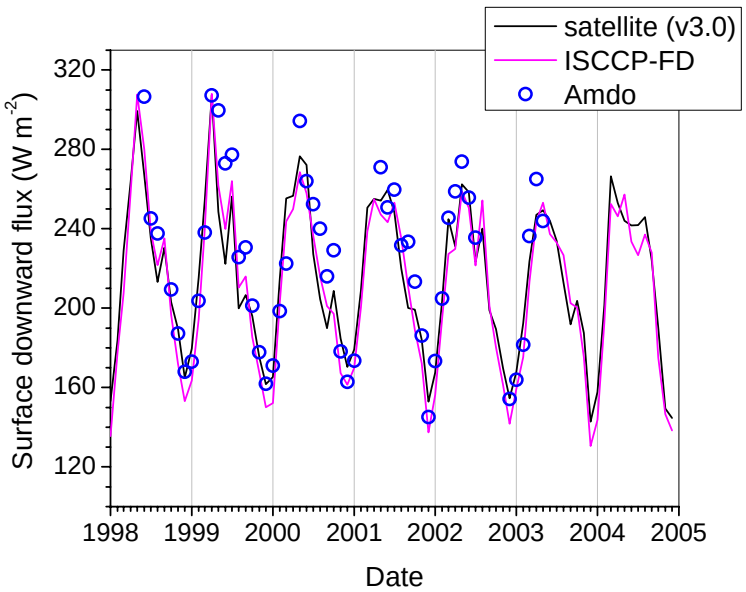
v3.0 bias vs. season



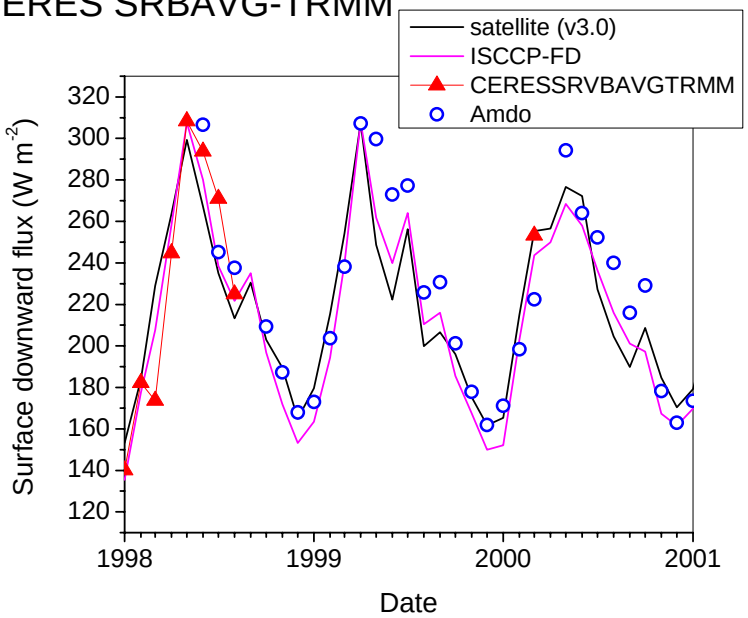
Except for some winter & spring months the surface flux is still underestimated relative to the measurement at the Amdo site.

Comparison with other satellite-derived data

ISCCP-FD



CERES SRBAVG-TRMM

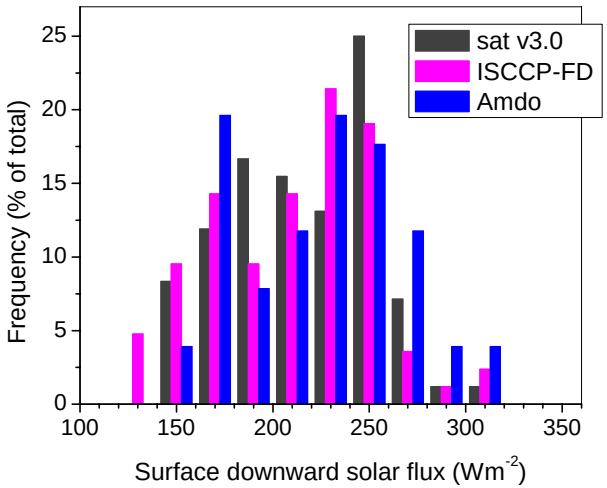


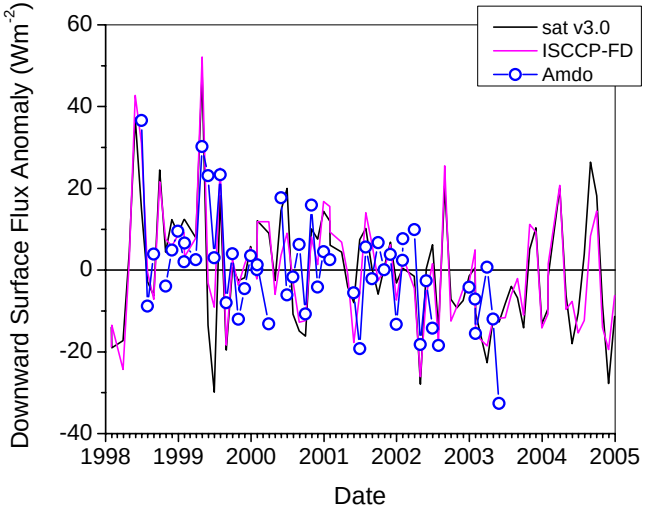
Data	Mean	SD	Min	Max
Amdo	224	43	145	307
V3.0	215	37	153	307
ISCCP-FD	211	41	137	308

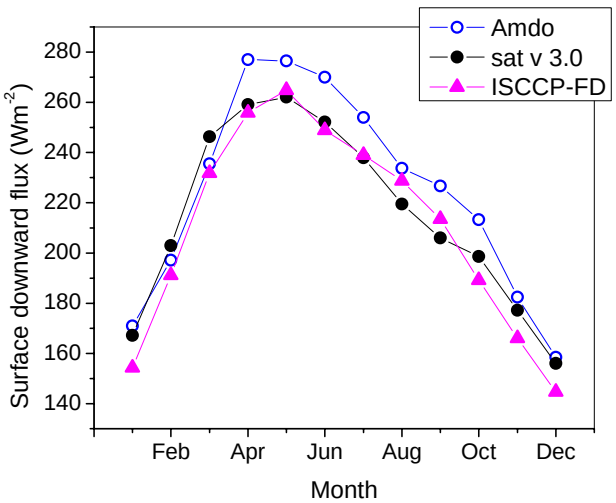
The grid-cell averages of satellite estimates are similar and both are smaller than the ground average.

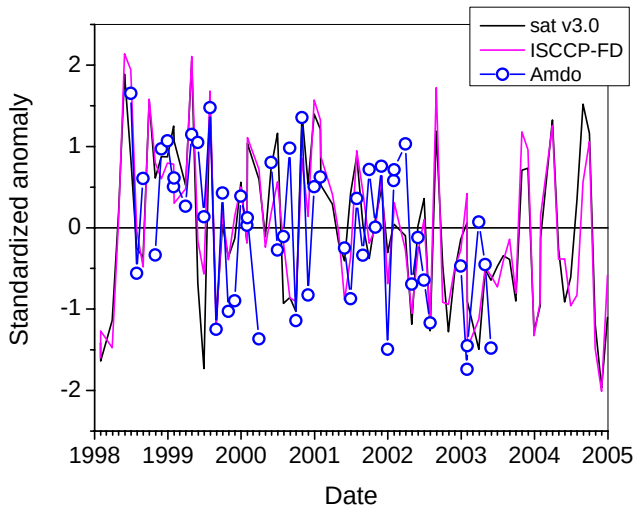
The ISCCP-FD and CERES SRBAVG-TRMM PFM Ed2B data were obtained from the GEWEX Radiative Flux Assessment web site.

Histogram, Annual cycle and Anomaly









Summary and Plan

- The newer SW algorithm (v3.0) significantly improves the surface SW flux over the Tibet Plateau, but
- except for winter months, v3.0 SW flux is still somewhat smaller than observed at the ground.
- Satellite-estimates of SW fluxes from v3.0 and ISCCP-FD are similar, but both are smaller than the irradiance observed at Amdo.
- A comparison of v3.0 SW flux with CERES / CRS & SRBAVG data is planned:
  - the CERES data will be used as a “transfer” data between the small (local) scale and the larger (ISCCP-D1) scale and
  - for quantifying the degree of spatial representativeness of the Amdo data.