CERES ISCCP-D2-like Data Product

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CERES ISCCP-D2-like Products

- Objective: produce monthly mean cloud properties product that emulates ISCCP D2 (NASA GISS) product to meet the needs of climate community.

- Three products: MODIS-day, MODIS-night, and GGEO-day

  - MODIS: use data from **Terra** or **Aqua,** sun-synchronous
  - GGEO: use data from Geostationary Satellites, 3-hourly

CERES ISCCP-D2-like Cloud types

Cloud top (mb)	Thin	Mid	Thick
High 10-440	Cirrus liq=13,ice=16	Cirrus-stratus liq=14,ice=17	Deep Convective liq=15,ice=18
Mid 440-680	Alto-cumulus liq=7, ice=10	Alto-stratus liq=8, ice=11	Nimbo-stratus liq=9, ice=12
Low 1000-680	Cumulus liq=1, ice=4	Strato-cumulus liq=2, ice=5	Stratus liq=3, ice=6
Cloud optical depth	0.0-3.6	3.6-23	23-380

- Stratify clouds in cloud pressure and optical depth bins
- CERES adds a liquid category to each of the high cloud bins

CERES ISCCP-D2-like Variables

Cloud Parameter	MODIS-only	GEO-only
Cloud Fraction	X	X
Effective Pressure	X	X
Effective Temperature	X	X
Optical Depth	X	X
Liquid/Ice Water Path	X	X
Particle size (liq radius, ice diameter)	X	
Infrared Emissivity	X	
# of obs/GMT box	X	X

ISCCPD2-like (MODIS) Method:

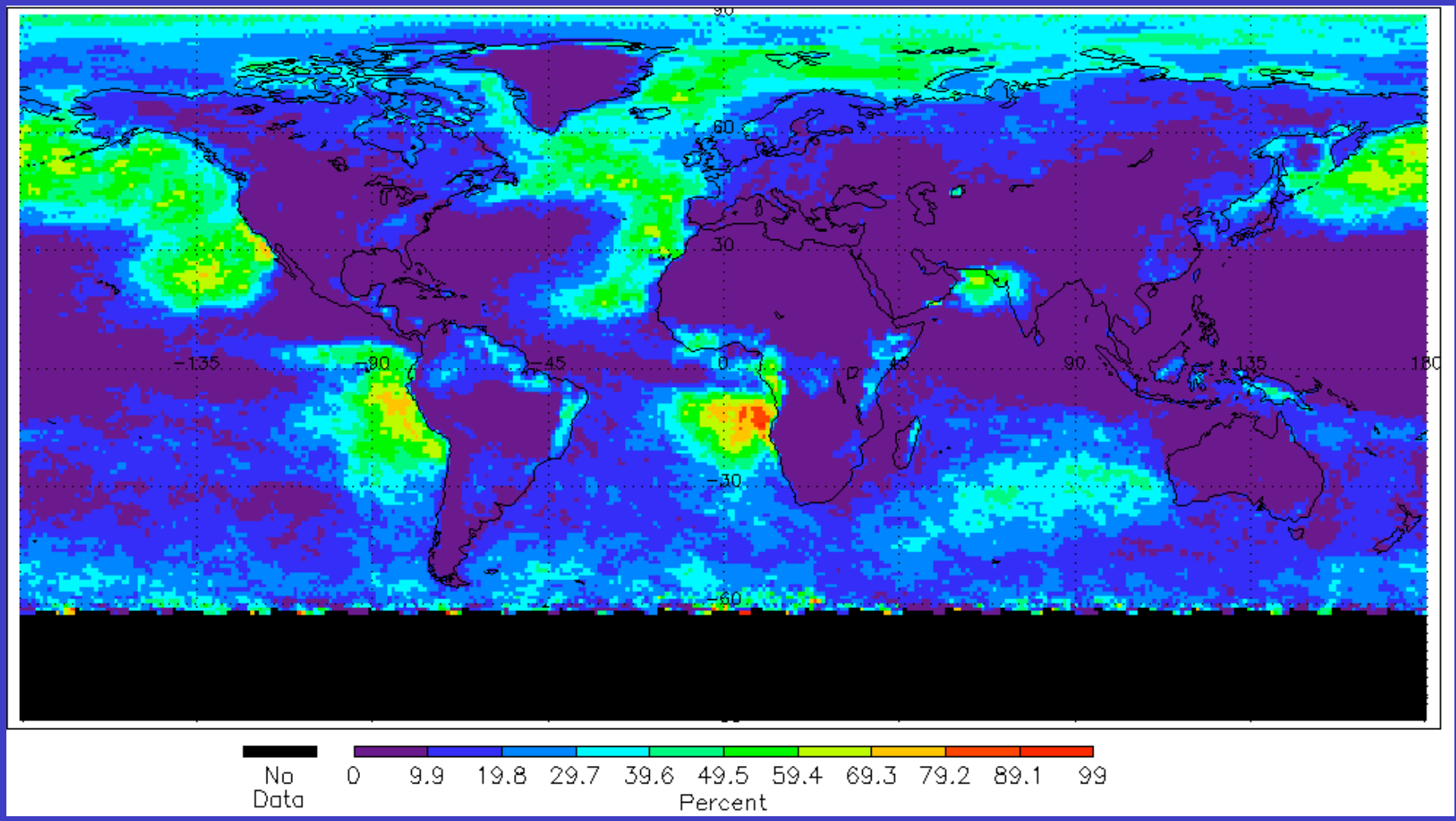
SSF Input

Grid
all valid footprints into 1x1 CERES Grid

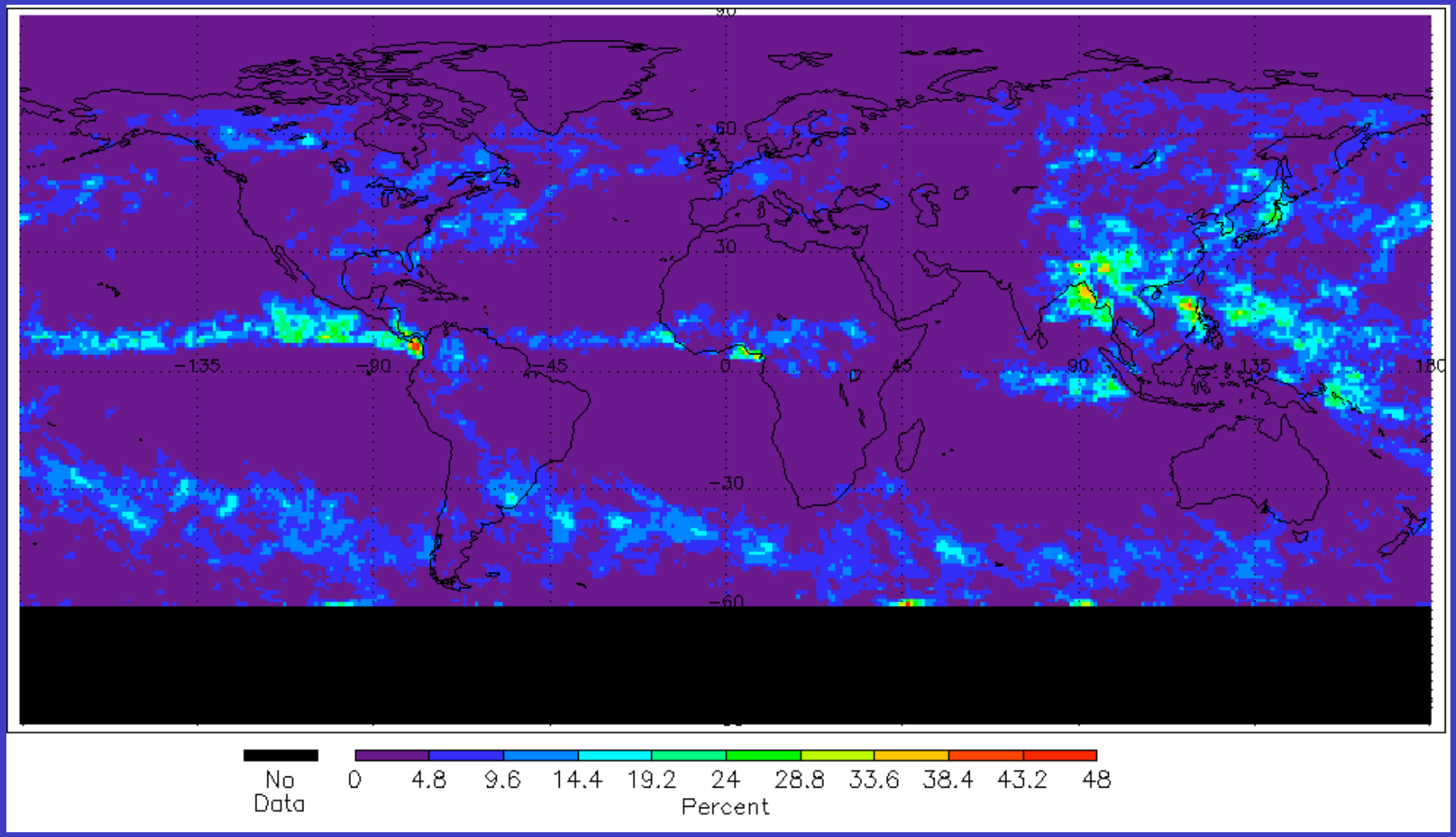
Sort
each SSF into 3x3x2 types based on Peff, optical depth and phase

Average
into monthly 3-hourly mean and monthly mean weighted by cloud fraction for cloud properties (opt, size etc)

Daytime Terra Stratocumulus (low,mid thin) Cloud Fraction, July 2002



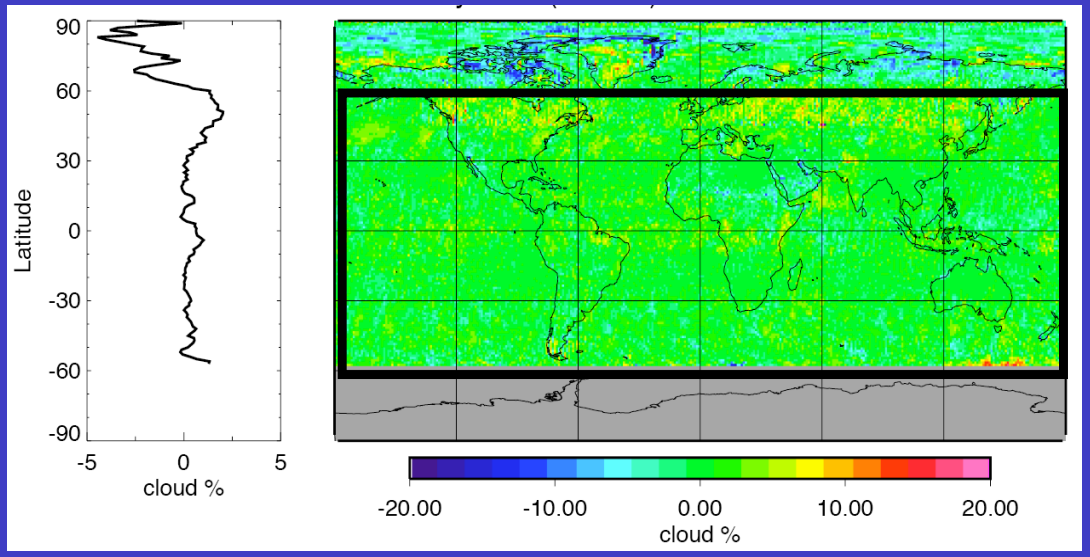
Daytime Terra Deep Convective (high,thick) Cloud Fraction, July 2002



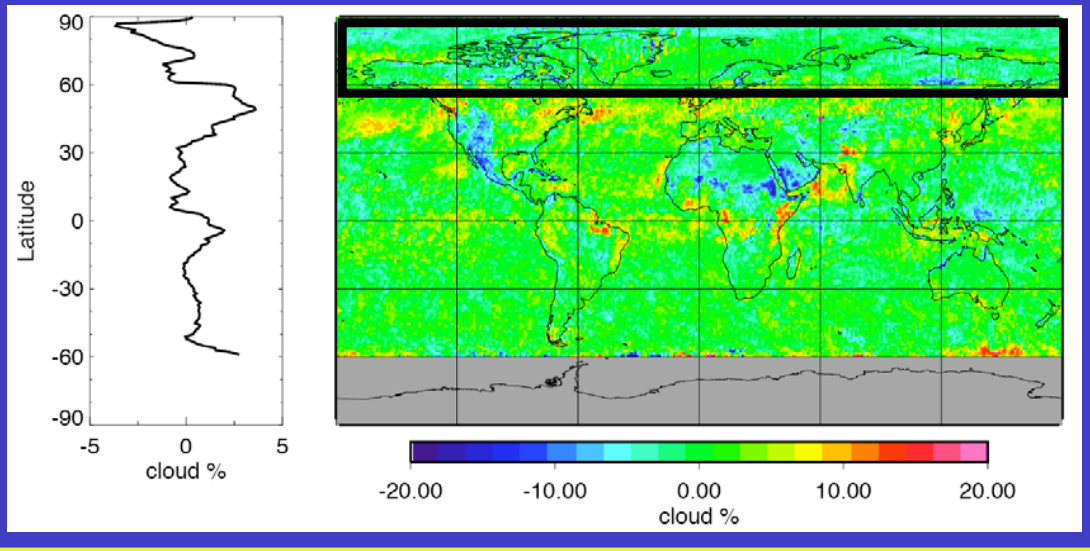
CERES ISCCP-D2-like MODIS Validation

- Derive total cloud property means from ISCCP-D2-like MODIS and SRBAVG3 (MODIS only) and compare for consistency
  - ISCCP-D2-like employs no temporal interpolation as SRBAVG
  - The Terra product contains cloud properties based on 10:30 AM LST sampling, and Aqua at 1:30 PM
  - From 60°S to 60°N compare with SRBAVG local hourbox 11, over polar regions all daytime/nighttime hours are considered
- Compare total cloud property means with the corresponding Cloud Working Group statistics

Daytime ISCCP-D2-like -- SRBAVG Cloud Fraction, Terra, July 2002

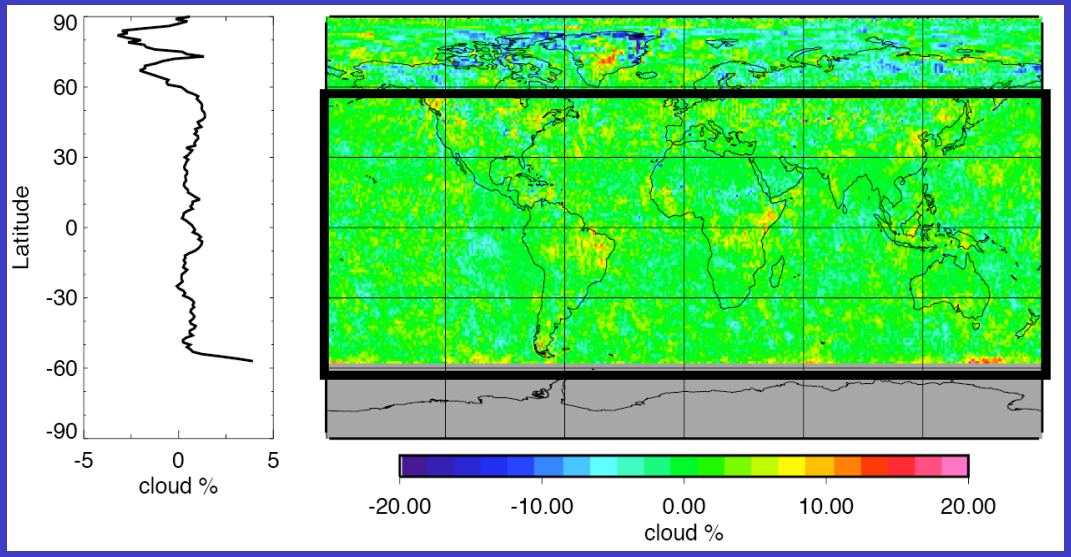


Local Hour=11

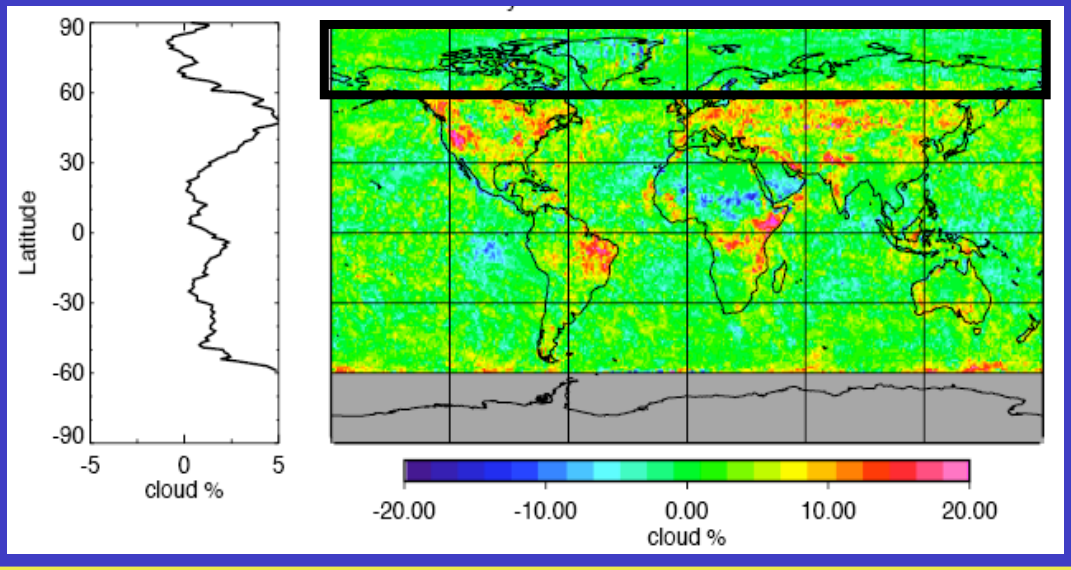


All daytime hours (SZA < 82)

Daytime ISCCP-D2-like -- SRBAVG Cloud Fraction, Aqua, July 2002

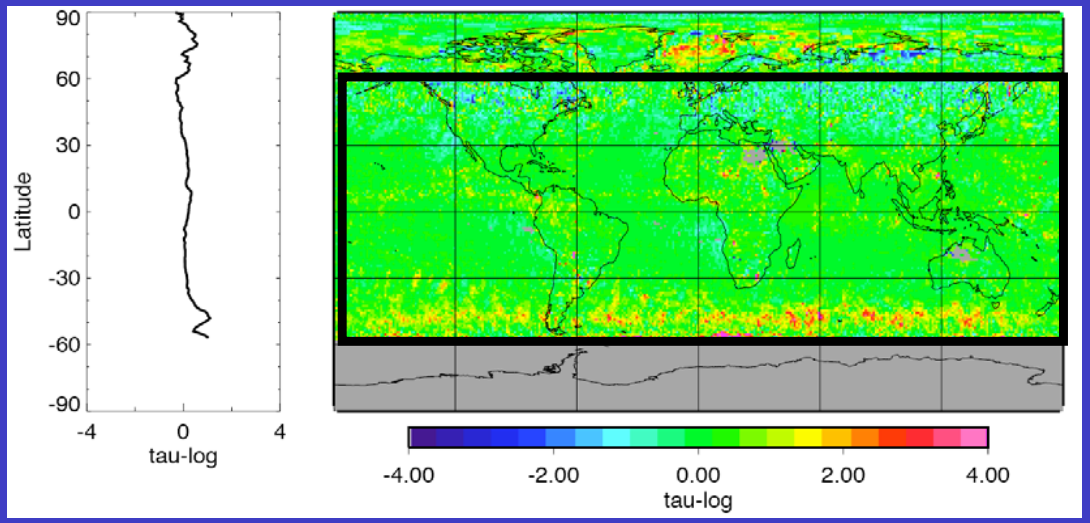


Local Hour=14

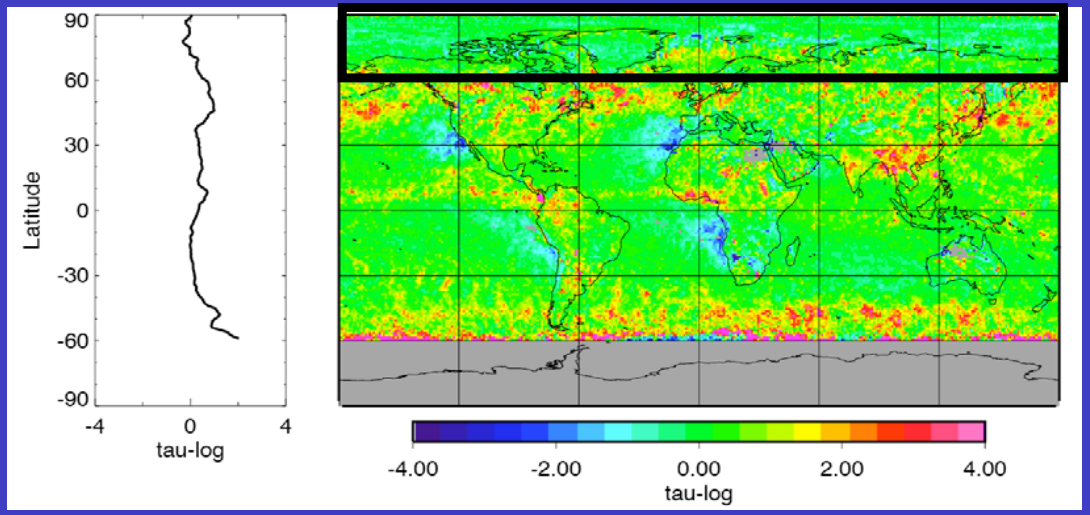


All daytime hours

Daytime ISCCP-D2-like -- SRBAVG log optical depth, Terra, July 2002



Local Hour=11



All daytime hours

Daytime Terra Summary, Global, July 2002

	ISCCP-D2like	SRBAVG	BIAS	Relative BIAS(%)	Cloud Group	
					Day	Night
cld	62.95	62.04	0.92	**1.48**	65.1	
peff	645.02	623.28	21.74	**3.49**	x	
teff	264.47	262.52	1.95	**0.74**	x	
log_tau	4.85	4.43	0.42	9.48	x	
lwp	112.34	78.37	33.97	43.35	103.34	72.45
reff	13.99	13.2	0.79	5.98	13.53	
iwp	256.27	170.08	86.19	50.68	249.95	78.10
deff	53.88	50.2	3.69	7.35	55.36	
emiss	0.85	0.81	0.03	**3.70**	x	

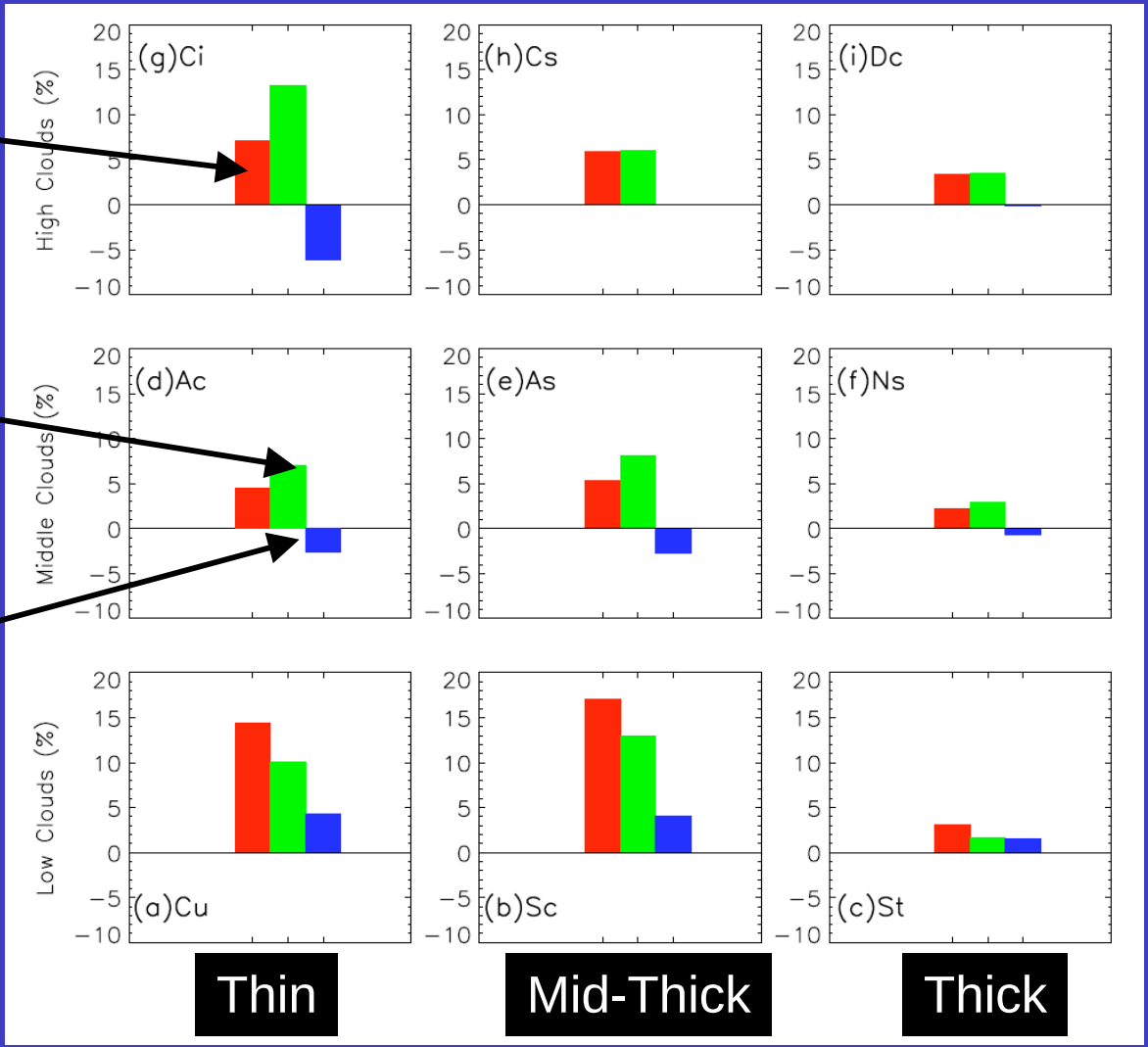
- Statistics are based on the SRBAVG daytime comparison
- The large LWP/IWP differences between ISCCP-like and SRBAVG are due to the large differences between the MODIS day and night retrievals. SRBAVG temporally interpolates between day and night.

ISCCP-D2-like MODIS vs. ISCCP D2
July 2002, Global

D2-like

ISCCP

Diff



CERES ISCCP-D2-like GGEO Product

- Use existing GGEO product
  - 5 geostationary satellite, 3-hourly GMT, nominal 8km, 2-channel (visible and IR), (60°S to 60°N) daytime cloud property retrievals
  - GEO radiance are normalized to MODIS calibration
  - Clear-sky determined by GEOS4 clear-sky predicted brightness Temperatures and MODIS monthly clear-sky albedo maps
  - Assume 10μm radii liquid and 60 diameter μm ice particle sizes (same as ISCCP project)
  - Retrieve cloud amount, temperature, pressure, optical depth and LWP or IWP based subset of CERES-MODIS algorithm
  - Spatially gridded into 1° latitude by longitude regions and 4 static cloud pressure layers (SFC-700mb, 700-500mb,500-300mb, 300-100mb)

GGEO Product method

- Use gamma distribution
  - using log and linear optical depth to back out optical distribution for each of the layers

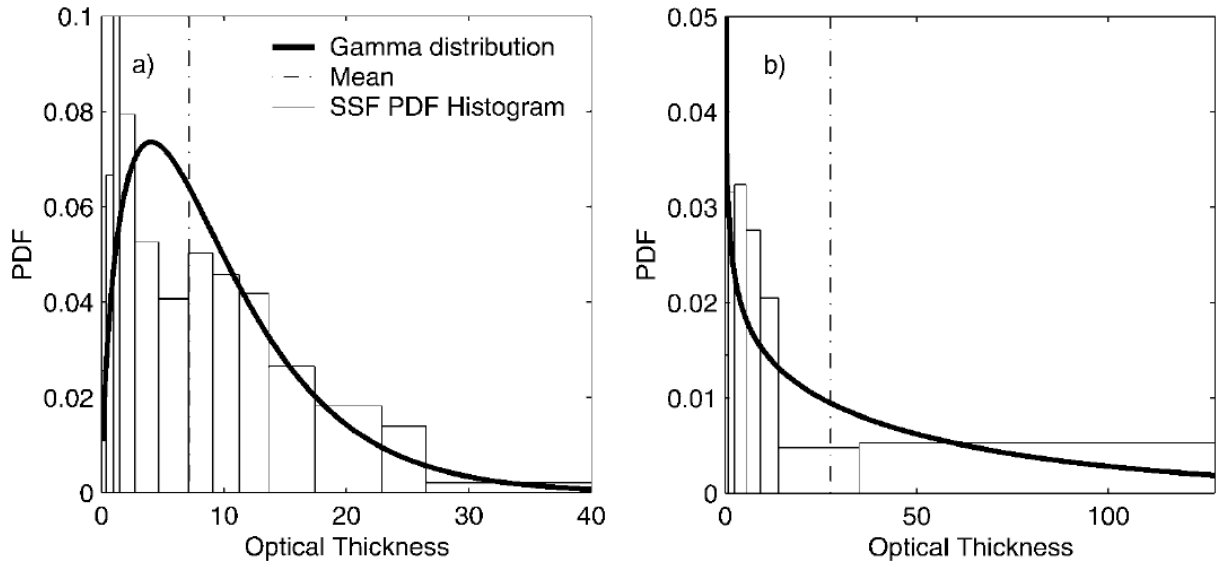
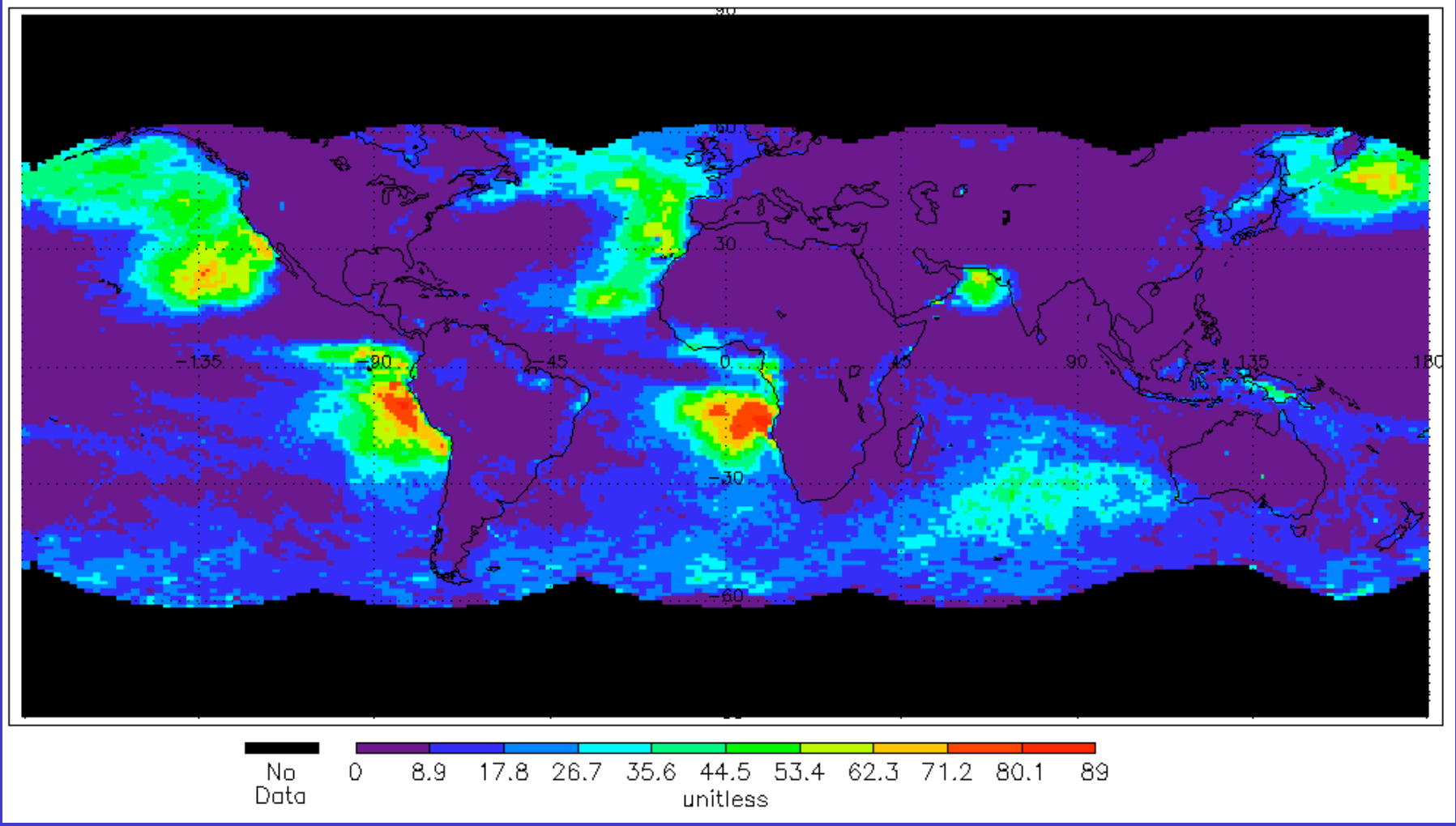


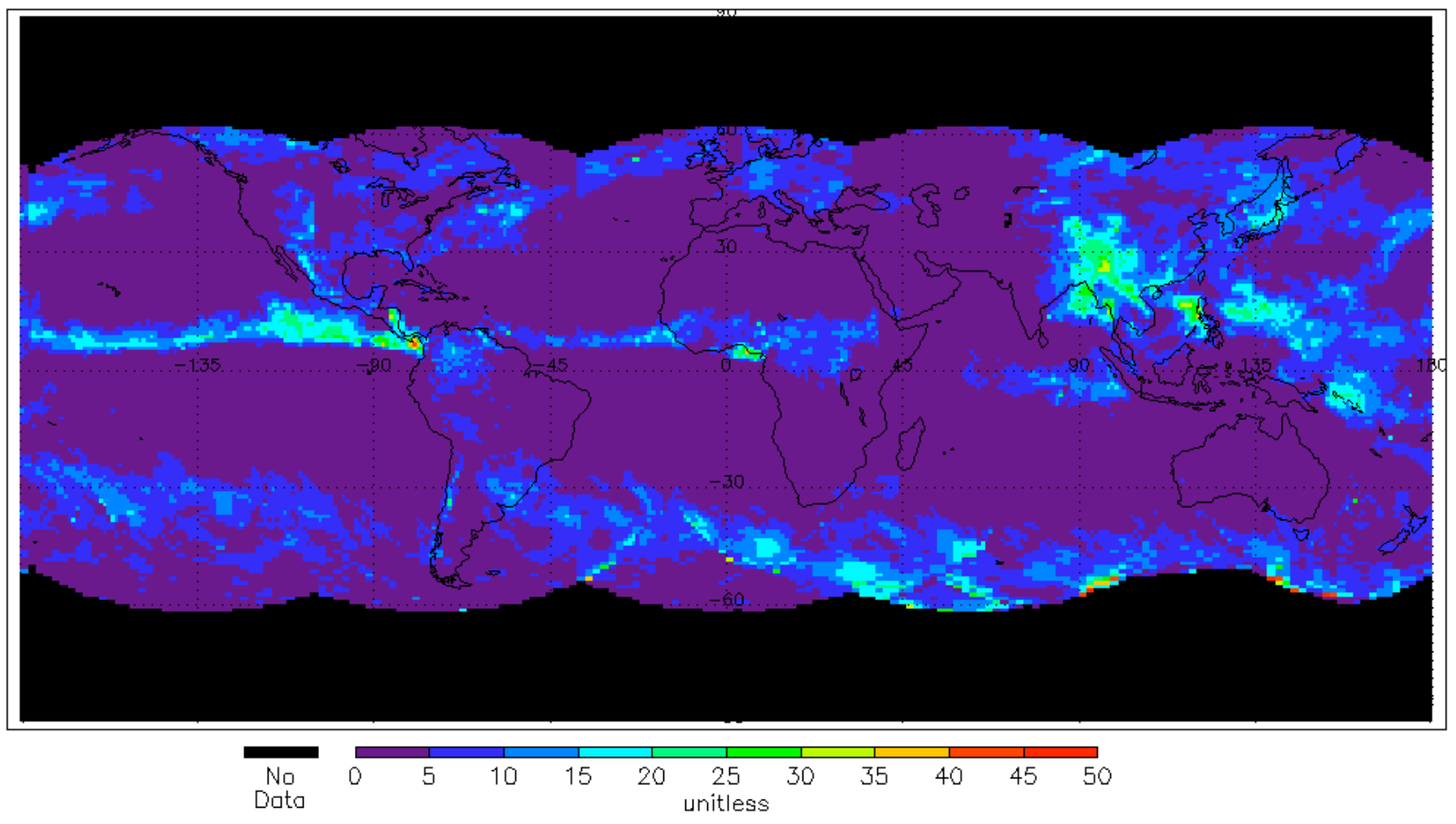
FIG. 8. Optical thickness probability density function from two footprints. The number of subgrid columns in each bin is divided by the width of the bin so that the area is proportional to the number of counts in the bin. Thick solid line is a gamma distribution obtained by the maximum likelihood method of Greenwood and Durand (1960). The vertical dashed–dotted line indicates the mean optical thickness computed by $\exp(\overline{\ln\tau})$.

Kato S., F. Rose and T. Charlock, P158., J. A.O. Tech. 2004

Daytime GGEO Stratocumulus (low,mid thin) Cloud Fraction, July 2002



Daytime GGEO Deep Convective (high,thick) Cloud Fraction, July 2002



CERES ISCCP-D2-like GGEO Validation

- Compare total cloud property summed from ISCCP-D2-like GGEO sub-cloud types to that of SRBAVG(GEO only) for consistency

  - SRBAVG product does not include GEO snow or glint retrievals.
  - SRBAVG daytime is based on all daylight hourboxes and includes interpolation,ISCCP-D2-like daytime is defined by SZA < 82° and performs no interpolation.

Daytime D2-like GGEO Summary, Global July 2002

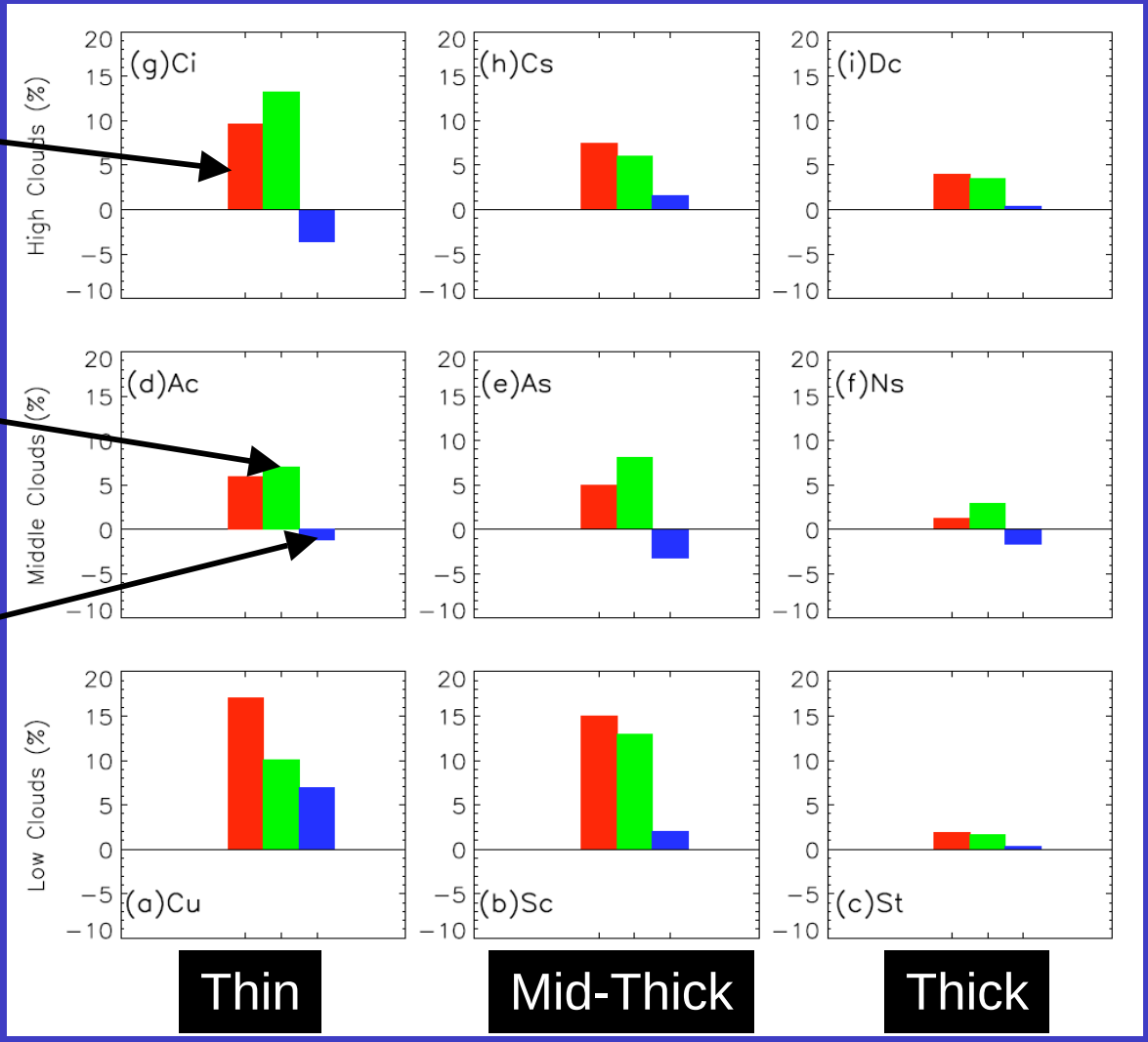
	ISCCP-D2like	SRBAVG	BIAS	Relative BIAS(%)
cld	65.32	64.12	1.20	**1.87**
peff	638.99	638.54	0.44	**0.06**
teff	264.08	264.48	-0.40	**-0.15**
log_tau	3.62	3.77	-0.16	**-4.24**
lwp	30.76	x		
iwp	162.14	x		

ISCCP-D2-like (GGEO) vs. ISCCP July 2002 Global

D2-like

ISCCP

Diff

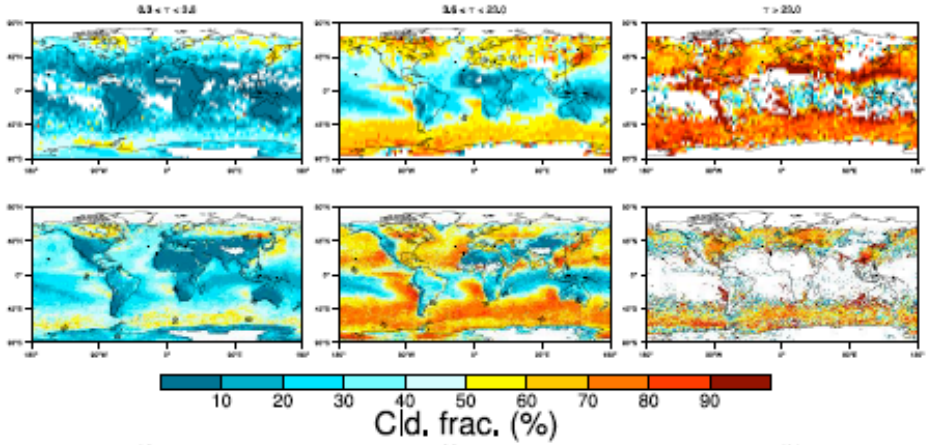


Current Status and Future plan

1. ISCCPD2-like MODIS (Day and Night) has been submitted (03/28).
2. ISCCPD2-like GGEO close to delivery subject to further validation (~1 month).
3. Propose to combine MODIS and GEO datasets to form one optimal ISCCPD2-like dataset.
4. Propose to add CERES fluxes associated to ISCCPD2-like cloud types.

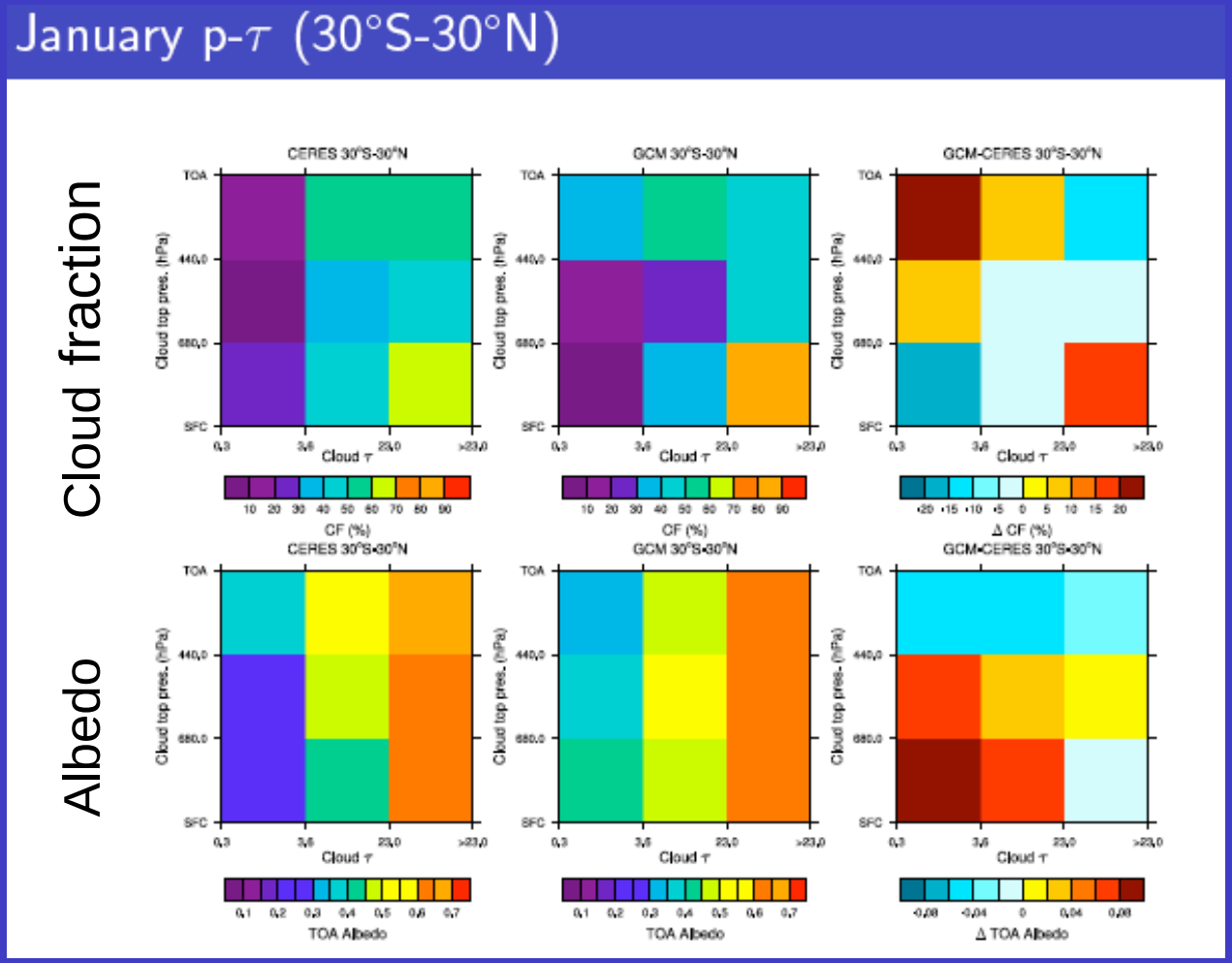
Propose future ISCCP-like cloud properties with associated CERES fluxes Product

Low cloud cloud fraction and TOA albedo (January)



J. Cole etc.

Propose future ISCCP-like cloud properties with associated CERES fluxes Product



J. Cole etc.

Thank You!

Back up

ISCCPD2-like Flux Proposal

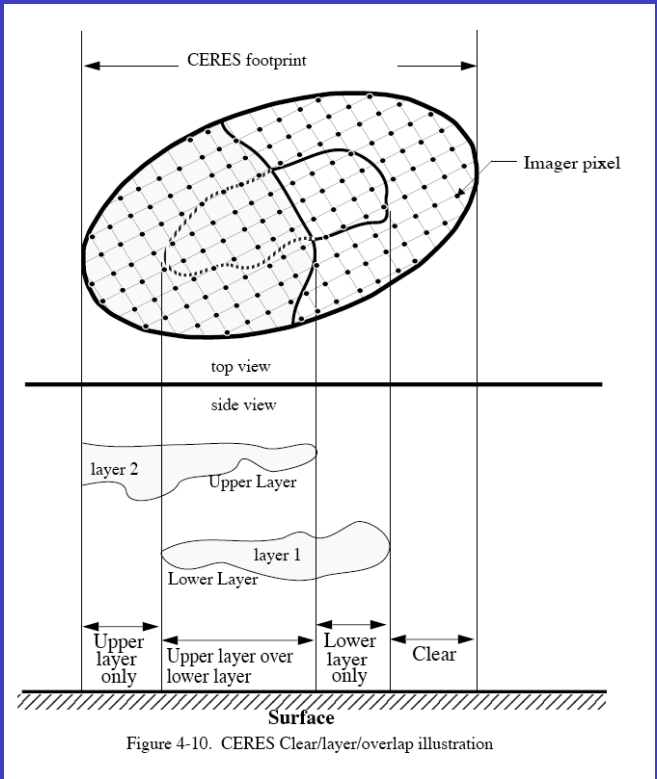


Figure 4-10. CERES Clear/layer/overlap illustration

Assumption:

- clear-sky BB flux can be estimated using a narrow-to-broadband radiance+ADM conversion.
- broadband flux (F1_est and F2_ext) for each of the two cloud layer can be estimated by MODIS radiance.
- The ratio of the BB flux for the two cloud layers is equal to the ratio of the two estimated BB flux as above.

By Norman Leob