New CERES Directional Models: Albedo vs. Solar Zenith Angle

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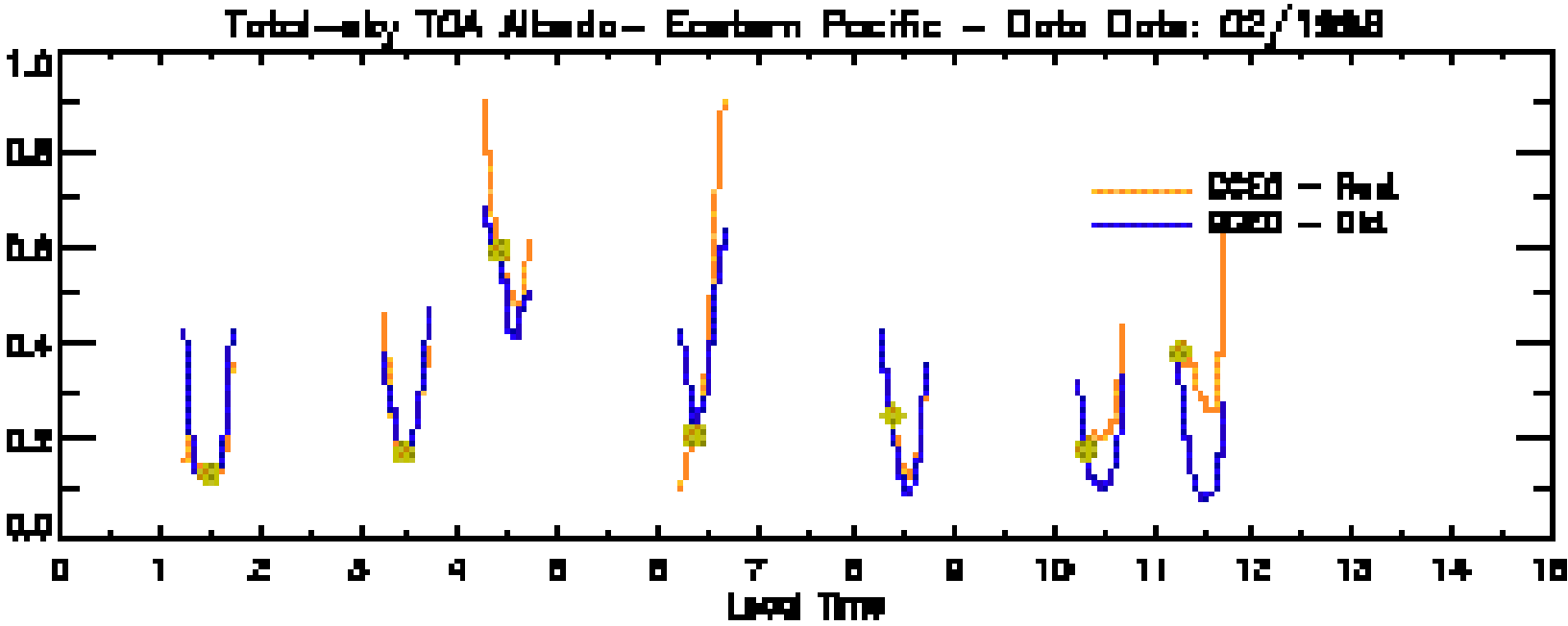
Directional Models (DRMs) (Albedo vs. Solar Zenith Angle)

DRMs are used to estimate the albedo between CERES observations



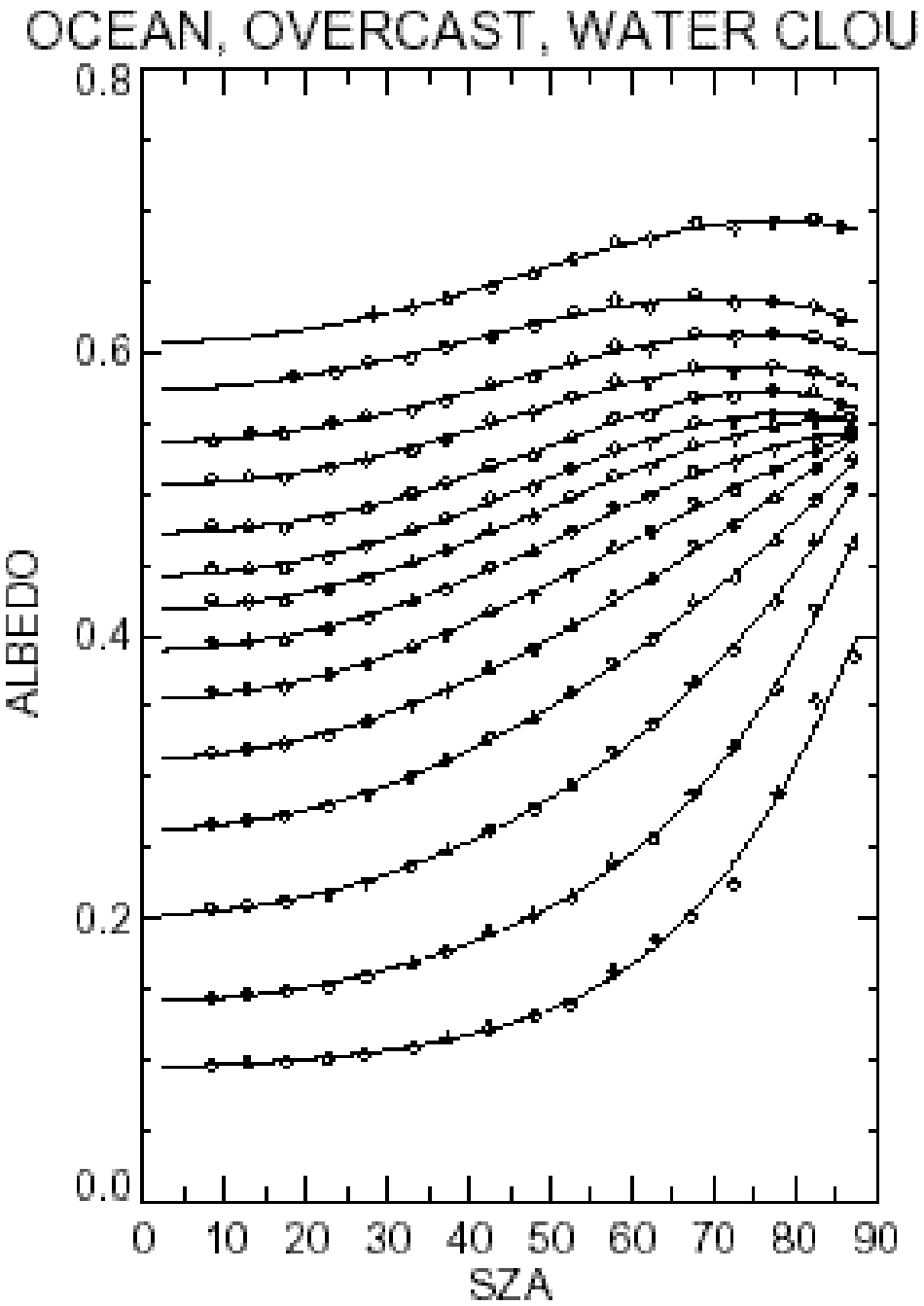
592 CERES SW Scenes

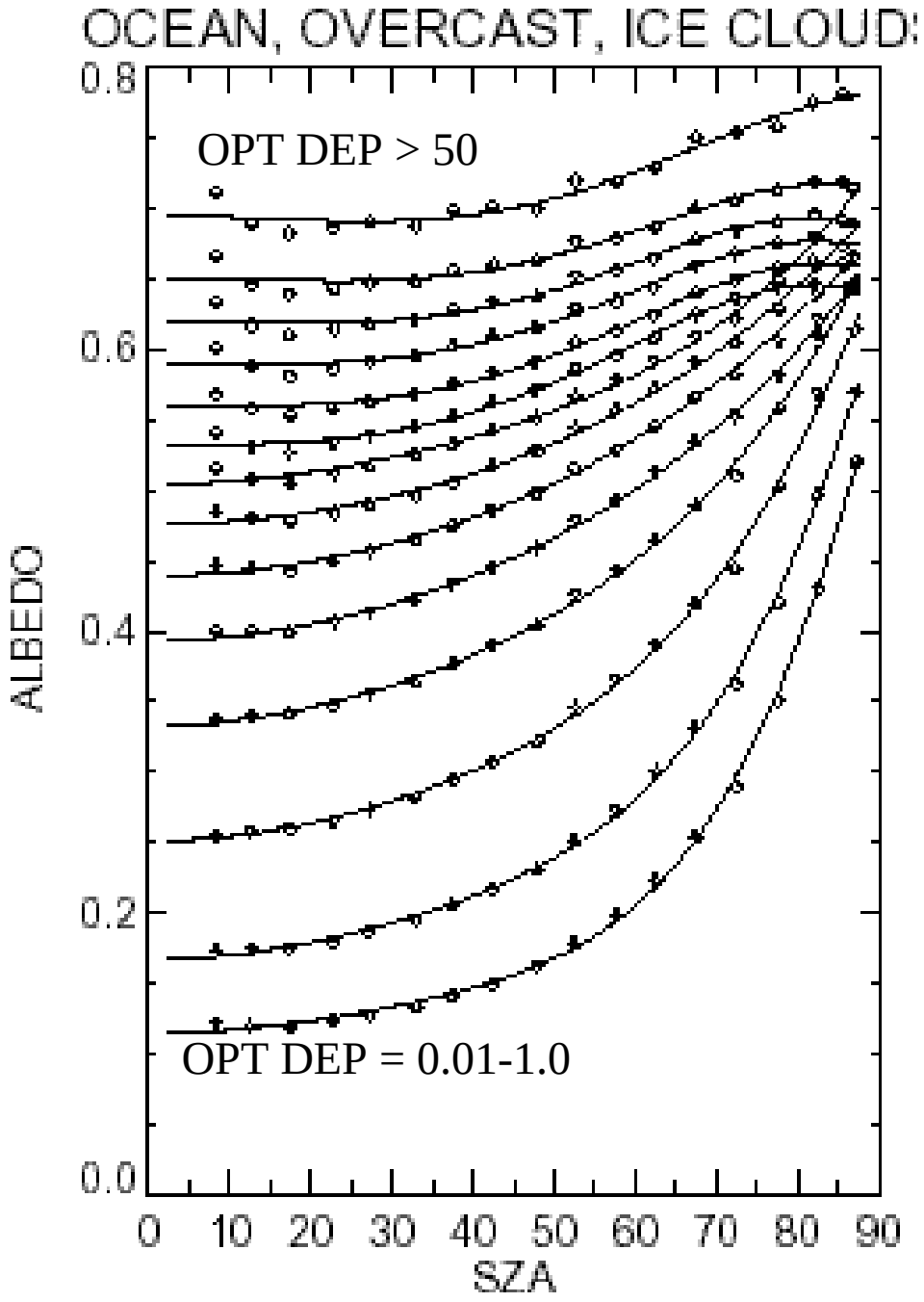
- **Surface** : Ocean, High Tree, Low Tree, Dark Desert, Bright Desert, Snow
- **Percent Cloudy** 6 – 13 bins

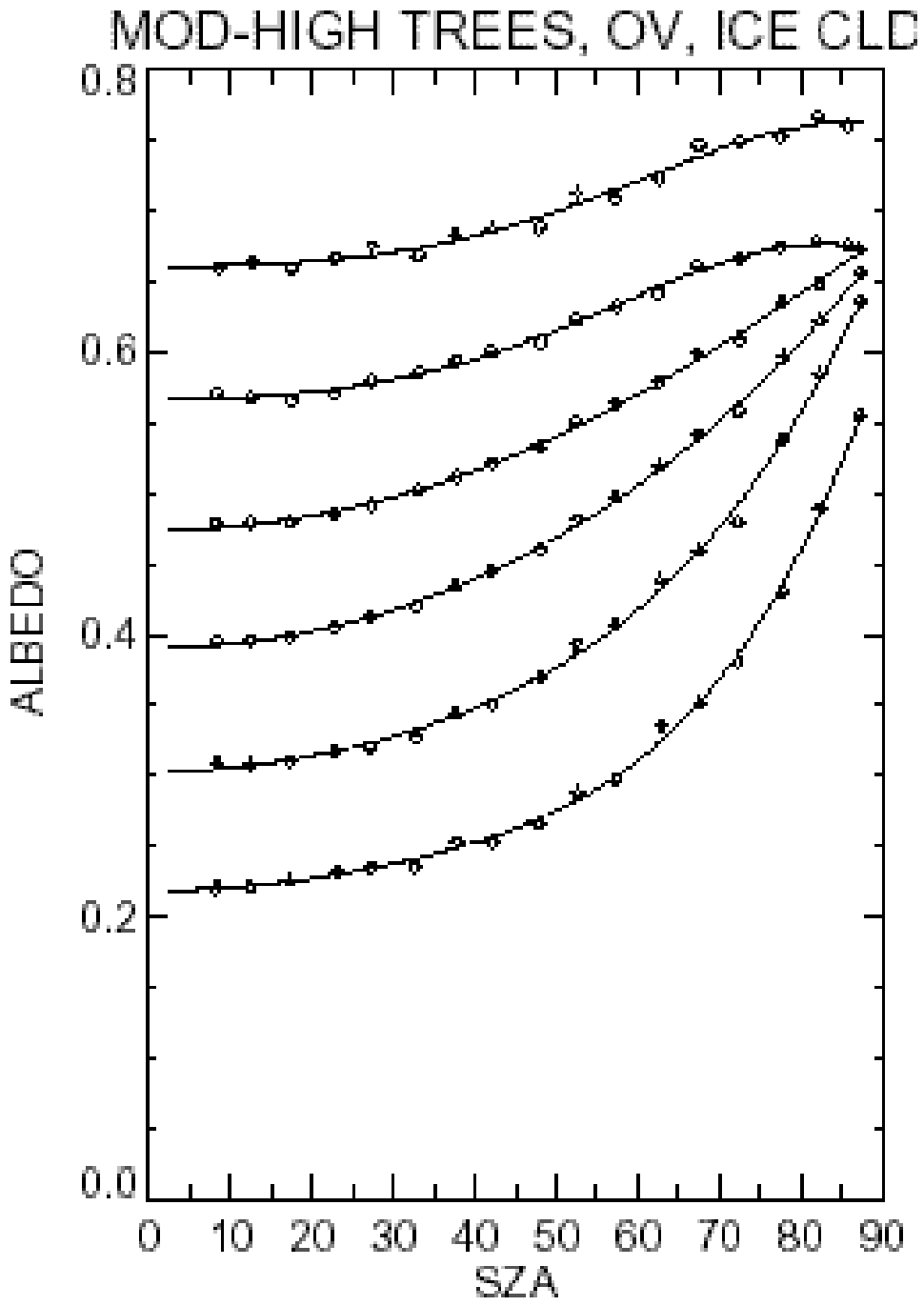
  (Clear, 0.1-10%,…95-99.9%, 99.9-100%)
- **Cloud Phase** (liquid < 1.5, ice >1.5)
- **Optical Depth** 6 - 14 bins
  (0.01-1.0, 1.0-2.5, …, 40-50, >50)

Creating Directional Models: Each Hour Box in SFC Product

	SW Scene ID	Area Fraction	Albedo
1.)	16	16 %	0.09
2.)	411	13 %	0.16
3.)	351	13 %	0.17
4.)	592	10 %	0.17
5.)	1	8 %	0.07
6.)	31	8 %	0.11
7.)	370	5 %	0.28
8.)	417	5 %	0.20

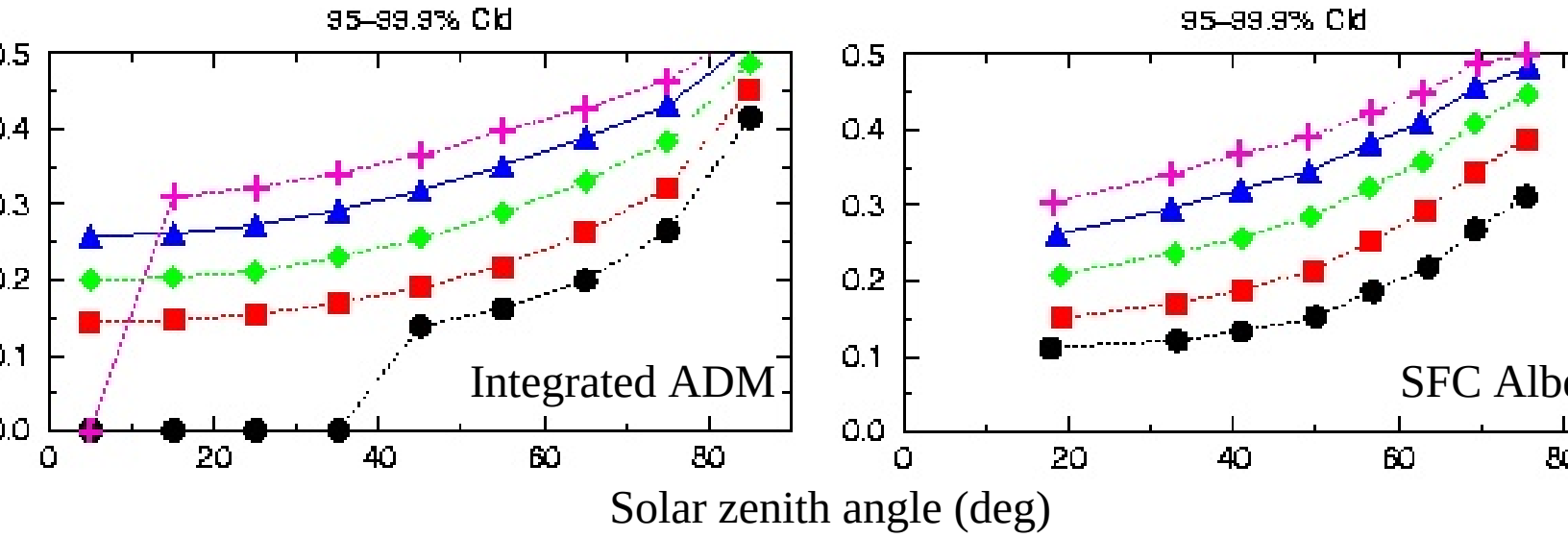

OCEAN, OVERCAST, WATER CLOU
ALBEDO
0.0
0.2
0.4
0.6
0.8
0
10
20
30
40
50
60
70
80
90
SZA


OCEAN, OVERCAST, ICE CLOUDS
OPT DEP > 50
OPT DEP = 0.01-1.0
ALBEDO
SZA
0.0
0.2
0.4
0.6
0.8
0
10
20
30
40
50
60
70
80
90


MOD-HIGH TREES, OV, ICE CLD
ALBEDO
0.0
0.2
0.4
0.6
0.8
0
10
20
30
40
50
60
70
80
90
SZA

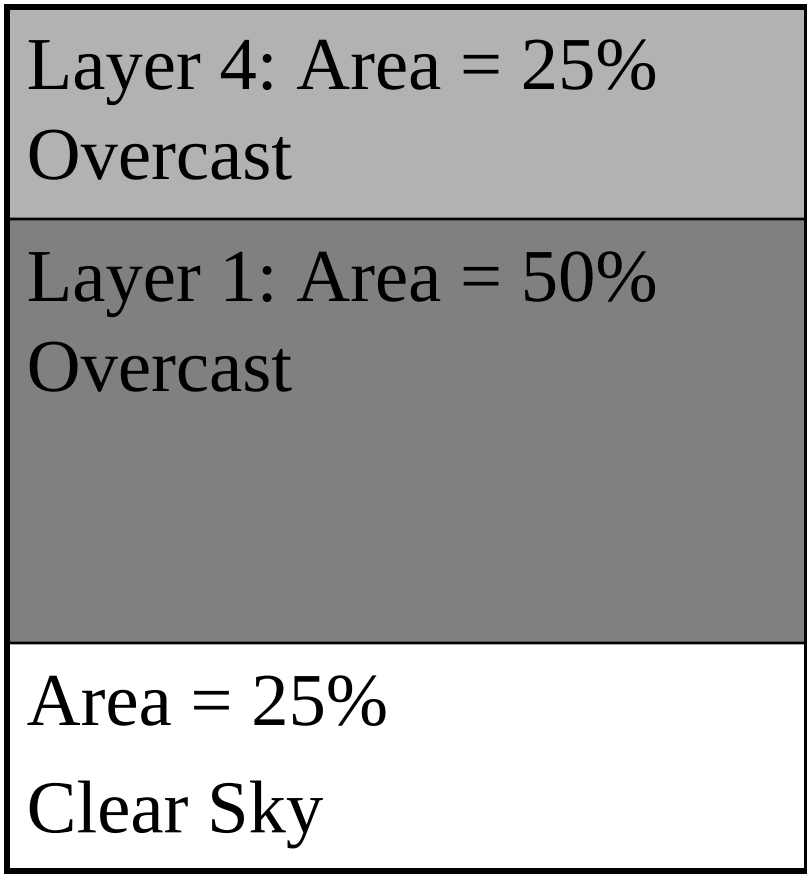
ADM Integration vs Directional Models

- Directional models can also be derived by integrating ADMs over all angles
- All (more than 75%) of the ADM angular bins must contain data to build a reasonable directional model
- Look for consistency between the two approaches



Interpolation Method using 4-Layer Clouds

- Use merged CERES and GEO cloud data
- Interpolate clouds
- Assume layers do not overlap
- Assign Scene ID
- Normalize to CERES albedo



Albedo Comparison at CERES observation (All Surfaces)

	Mean Bias %	**RMS %**
SW Scene ID (top 20)	0.2	10.2
Geo Clouds	-0.2	17.0
Geo Radiance	-1.5	28.5

Albedo Comparison at CERES observation

Method	Surface	Mean Bias %	RMS %
Scene ID	Ocean	0.2	8.2
Geo Clouds	Ocean	-0.5	9.7
Geo Rad	Ocean	-1.8	30.0
Scene ID	Land	0.3	15.2
Geo Clouds	Land	-1.2	21.8
Geo Rad	Land	-0.8	20.9

Current Research

- Investigate DRM at high SZA and low SZA
- Test Geo Cloud vs. Geo Radiance:
  - Terra and Aqua Data
  - Multiple CERES observations
  - Surface Validation Sites