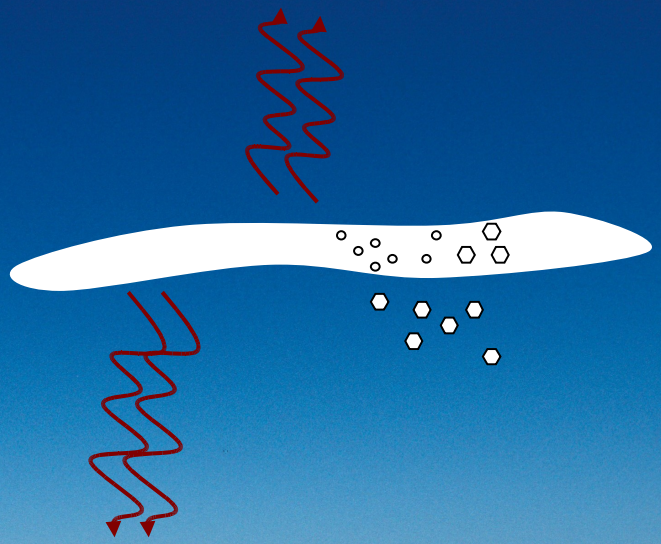
An incomplete list of challenges for one application of IASI data: *surface temperature retrievals*.

michael town

mtown@lgge.obs.ujf-grenoble.fr



10 December 2008

Toulouse, France

The incomplete list:

atmospheric emission
surface emissivity
spatial variability of surface temperature
temporal variability of surface temperature
clouds

The incomplete list:

atmospheric emission

surface emissivity

spatial variability of surface temperature

temporal variability of surface temperature

clouds

Surface temperature retrievals:

surface emissivity

accuracy can depend sensitively on $\varepsilon_\lambda(\theta,r)$

knowledge of snow conditions will be important.

knowledge of surface topography may be important.

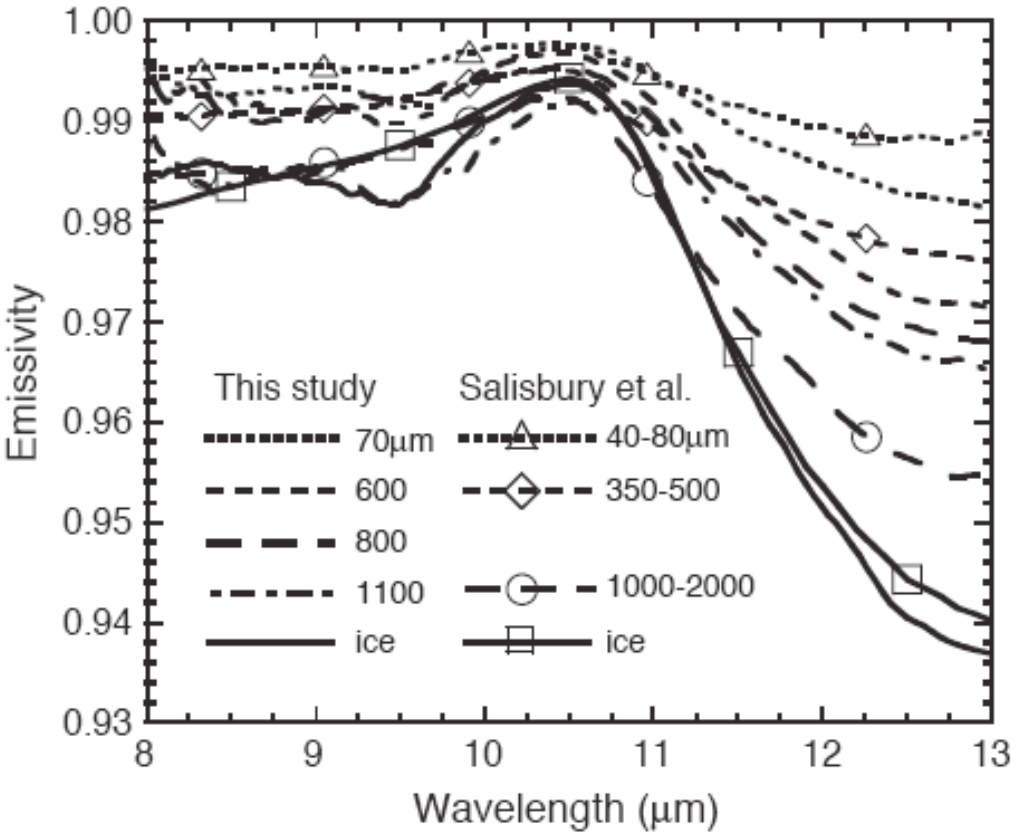


Fig. 9. Emissivity spectra at the exitance angle $\theta_{ext}=10°$ measured for various snow types by this study and Salisbury et al. (1994). The spectra of this study

Hori et al. (2006)

Surface temperature retrievals:

surface emissivity

accuracy can depend sensitively on $\varepsilon_\lambda(\theta,r)$

knowledge of snow conditions will be important.

knowledge of surface topography may be important.

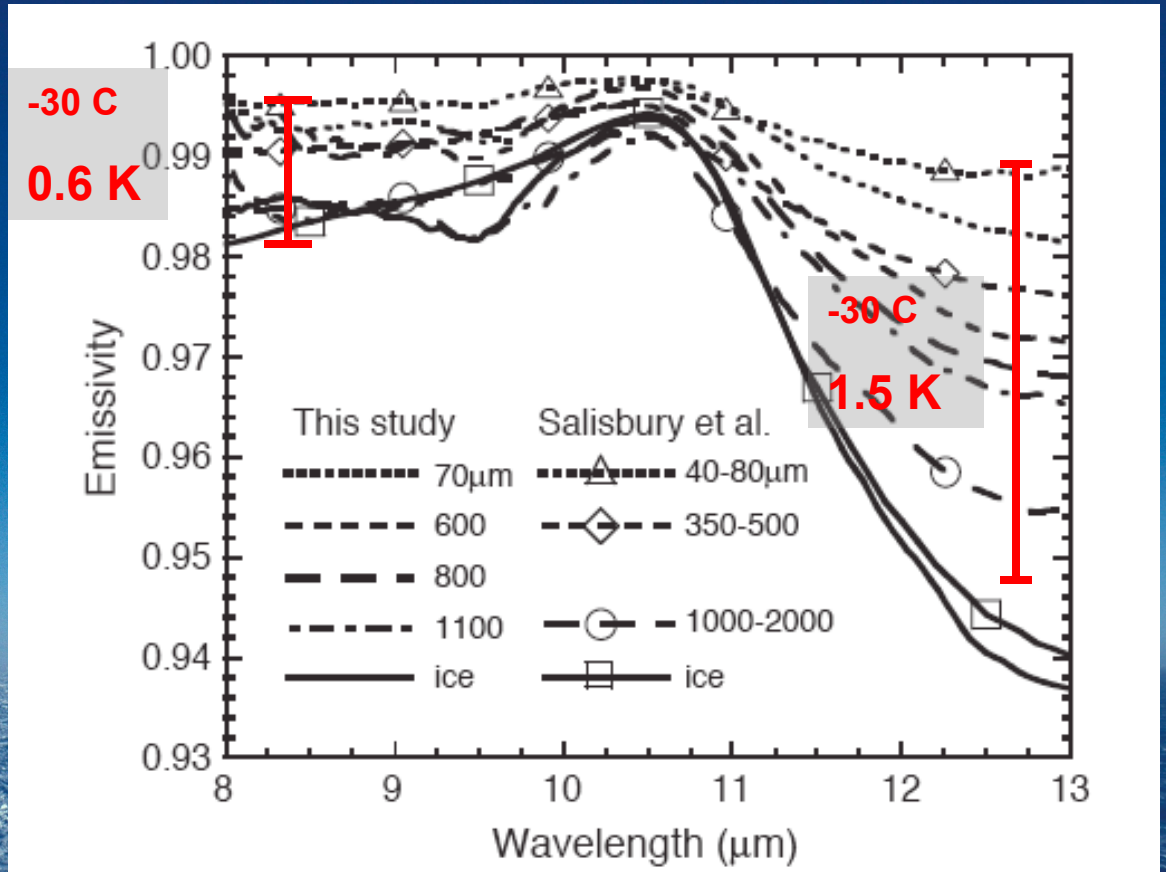


Fig. 9. Emissivity spectra at the exitance angle $\theta_{ext}=10°$ measured for various snow types by this study and Salisbury et al. (1994). The spectra of this study

Hori et al. (2006)

Surface temperature retrievals:

temporal variability

surface temperature is variable on daily and sub-daily time scales.

particularly during winter due to temperature inversion.

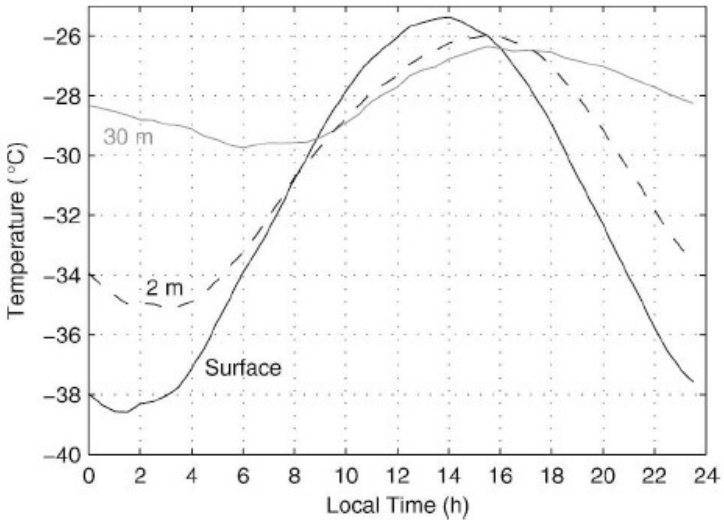
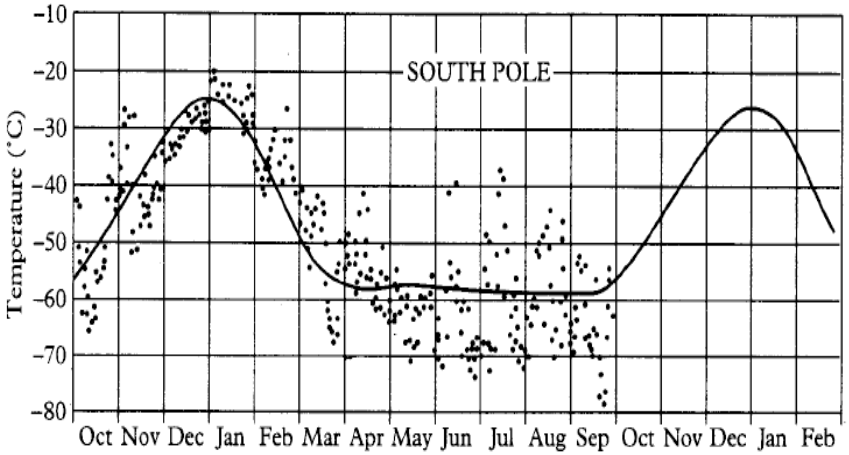


FIG. 20. Half-hourly mean surface temperature and air temperature at 2 and 30 m at Dome C Station for the 2004/05 summer. Time is given in local standard time, UTC+8

Hudson and Brandt (1996)



ANTARCTICA. Figure 2. *Surface air temperatures at South Pole Station.* Solid line: 20-year mean for each day. Dots: daily mean temperatures for the year October 1985–September 1986.

Warren (1996)

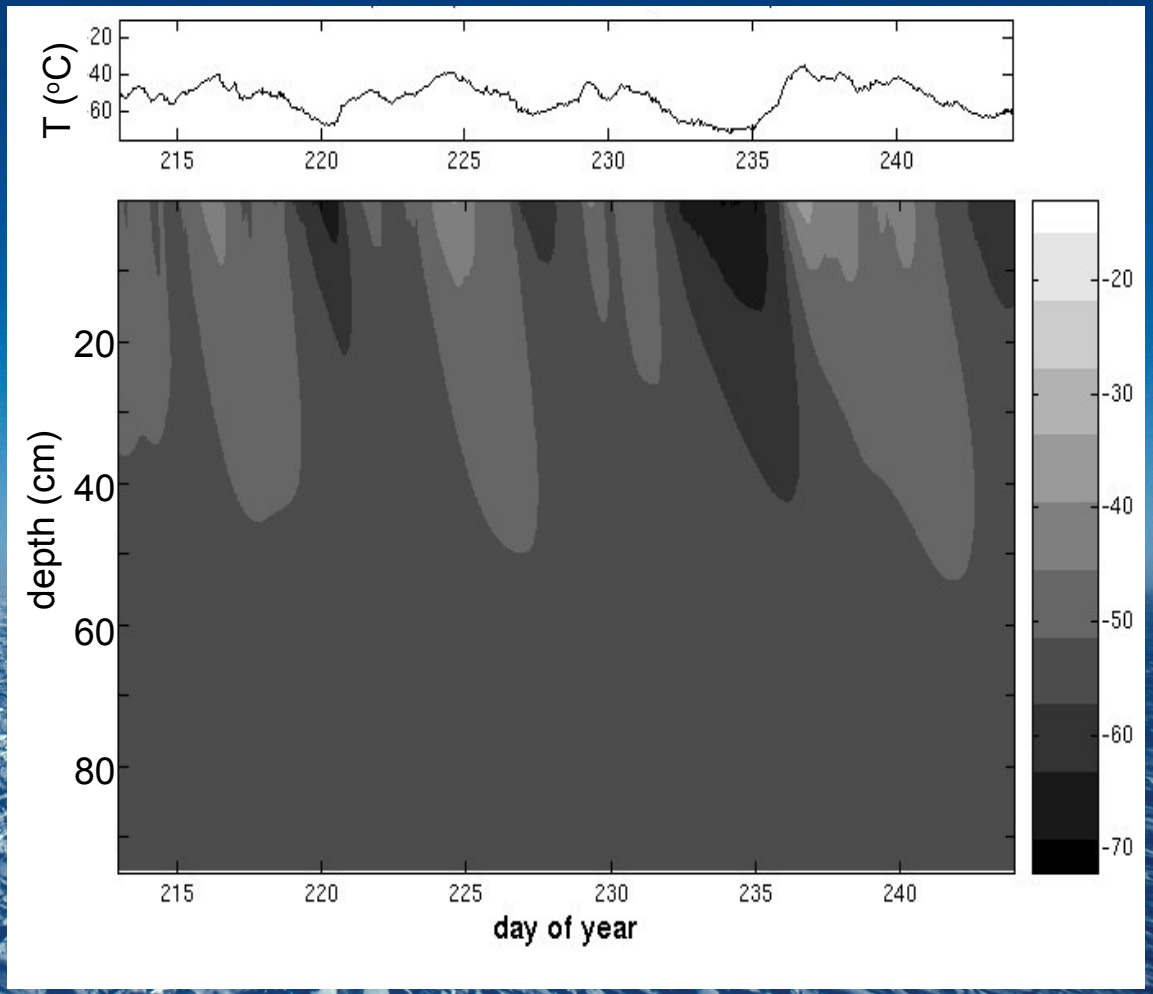
Surface temperature retrievals:

temporal variability

skin-surface and subsurface temperatures can change rapidly. (Town et al., 2008)

for validation: important to match times

for science: important to recognize temperatures are variable.



Surface temperature retrievals:

clouds

Surface temperature retrievals:

clouds

characterization of conditions over Antarctic Plateau as either clear or overcast not strictly accurate.

visible channels have strong potential over poles (MISR; Meuller et al. 2008).

IR methods more difficult.

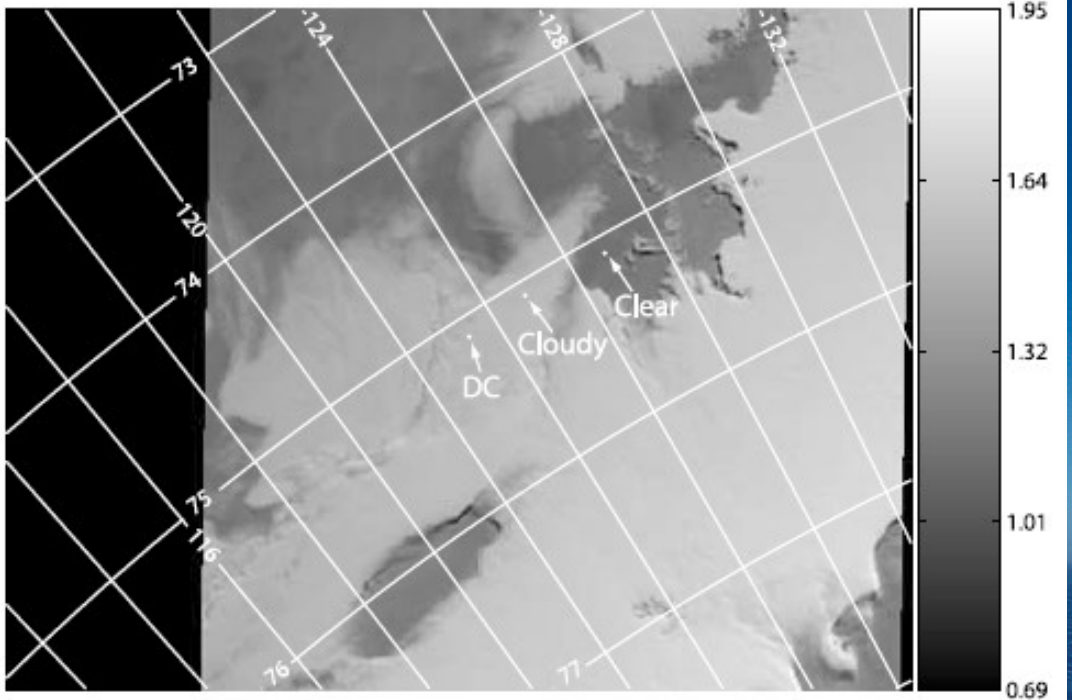


Figure 10. BRF at 866 nm observed by MISR near Dome C at 0006 UTC, 17 January 2005, at viewing zenith angle 71° and relative azimuth angle near 30°. The two marked

Hudson and Warren (2007)

Surface temperature retrievals:

clouds

IR monospectral methods are not adequate over snow and ice.

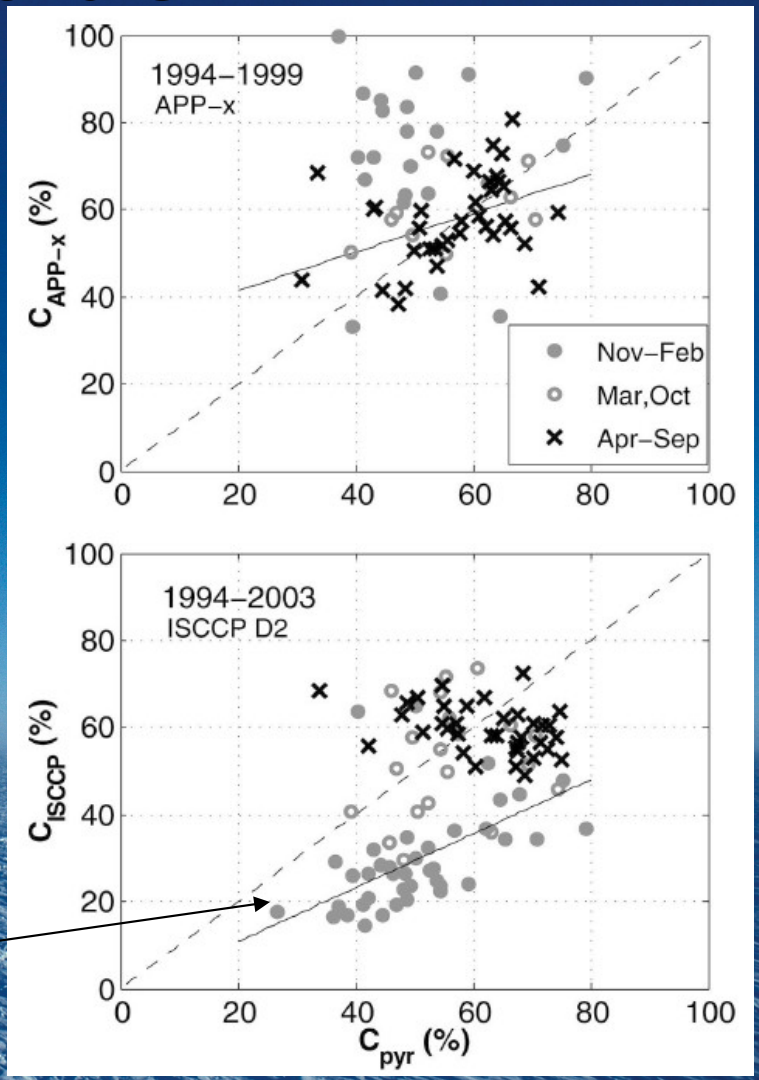
APP-x (Key 2002)

ISCCP D2 (Rossow and Schiffer, 1999)

crosses (x) = polar night

circles (O, ●)= polar day

visible channel used here (filled circle, ●)



Town et al. (2007)

Conclusions:

decide what accuracy is desired from data product

surface temperature retrievals are affected by several factors:

atmospheric emission, surface emissivity, spatial and temporal temperature varibility, and clouds.

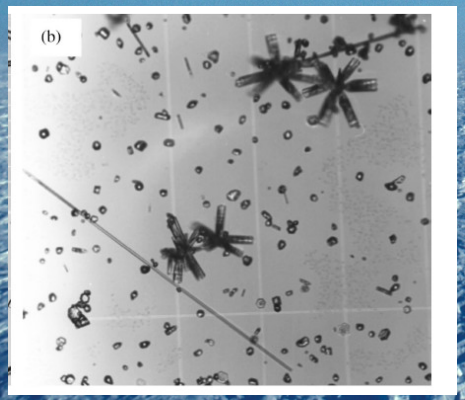
Surface temperature retrievals:

clouds

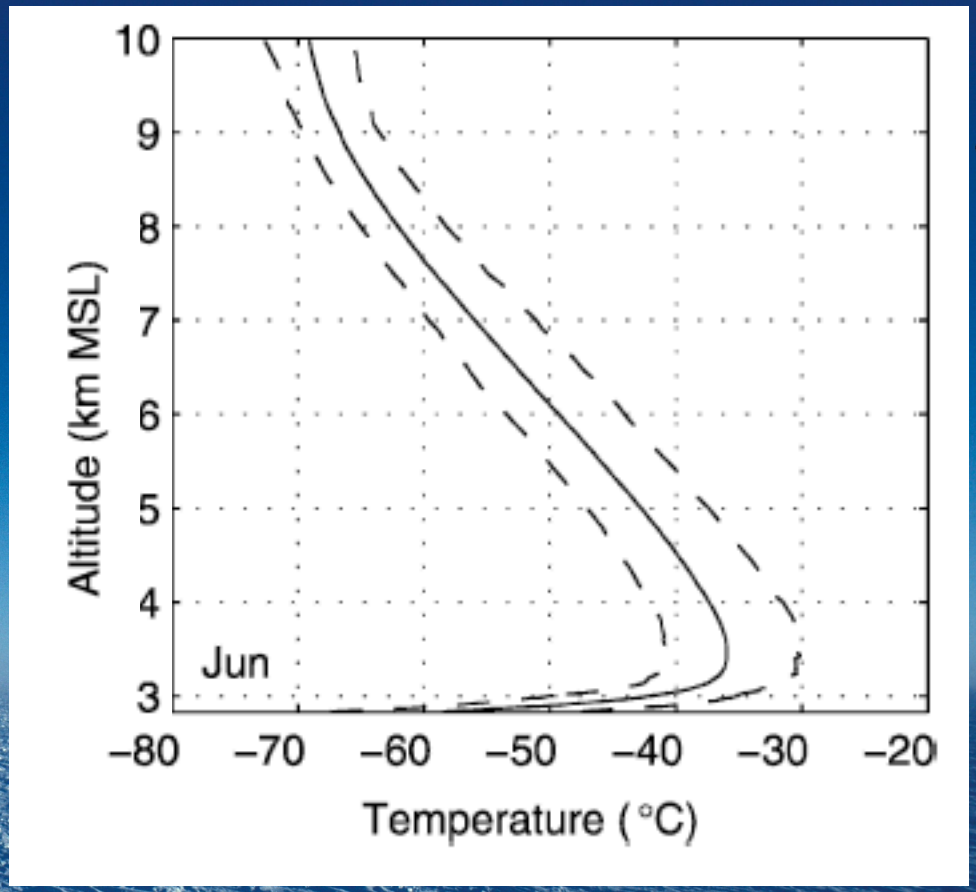
liquid water clouds exist during summer.

we must be prepared to accept the fact that they may also exist during winter.

assuming wrong phase will affect surface temperature retrievals.



Walden et al. (2003)



Hudson and Brandt (2005)

Surface-based observations at the South Pole:
IR and clouds

U-shaped distribution allows simple retrievals of clouds form broadband IR.

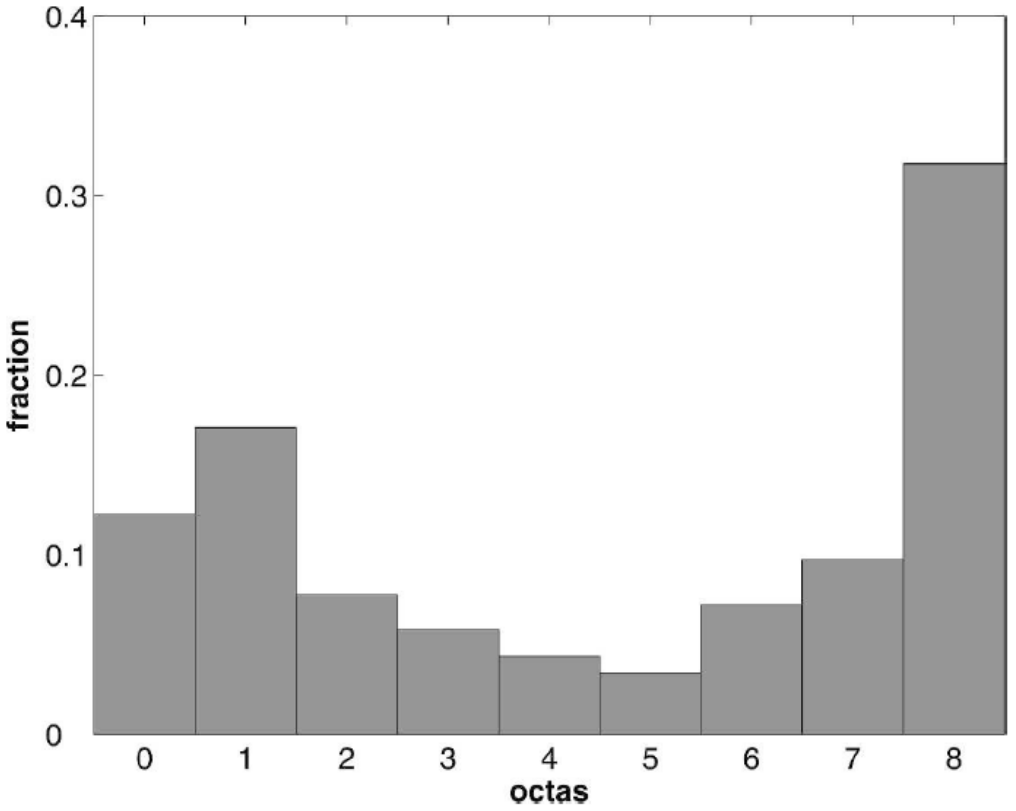


FIG. 1. A histogram of daytime visual observations of cloud cover from 1994 through 2003 (7280 observations total). Cloud cover exhibits a U-shaped distribution, with the result that cloud

Town et al. (2007)

Surface-based observations at the South Pole:

IR and clouds

Use flux and standard deviation thresholds to identify clear and overcast scenes

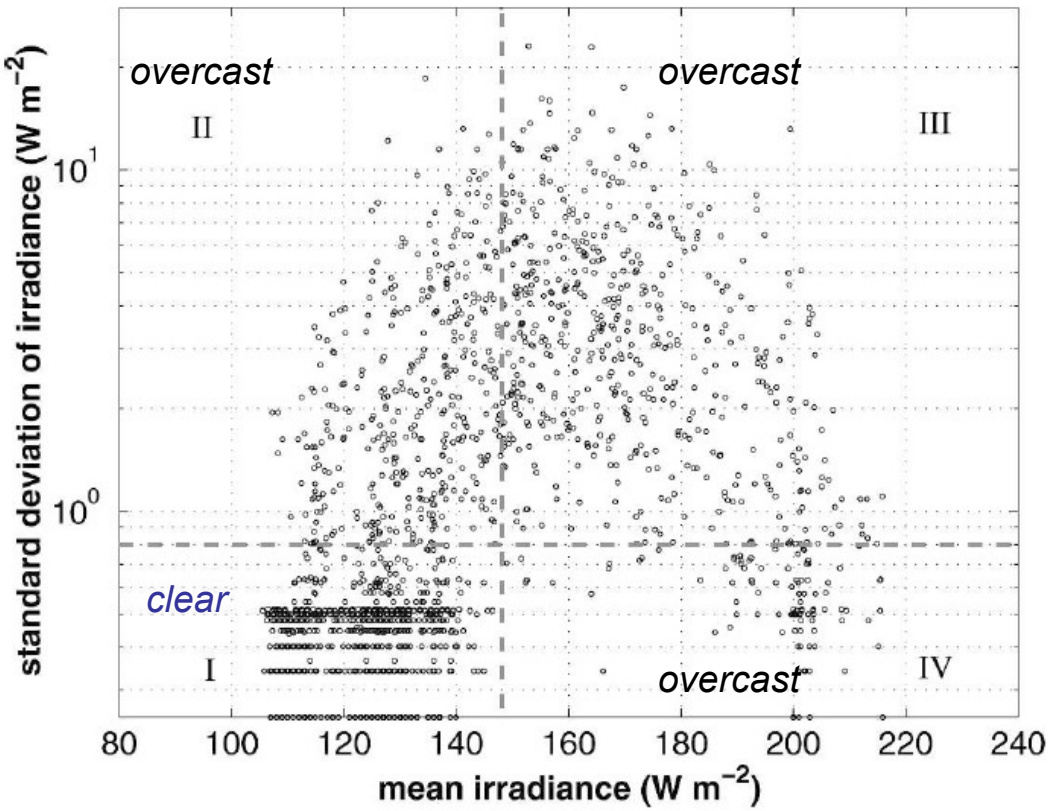


FIG. 2. Scatterplot of standard deviation of downward irradiance over a 20-min time period plotted against mean downward irradiance for the same time period for December 2001. The

Town et al. (2007)

Surface-based observations at the South Pole:

IR and clouds

Even when corrected for ‘adequate’ moonlight, human observers miss clouds in polar night.

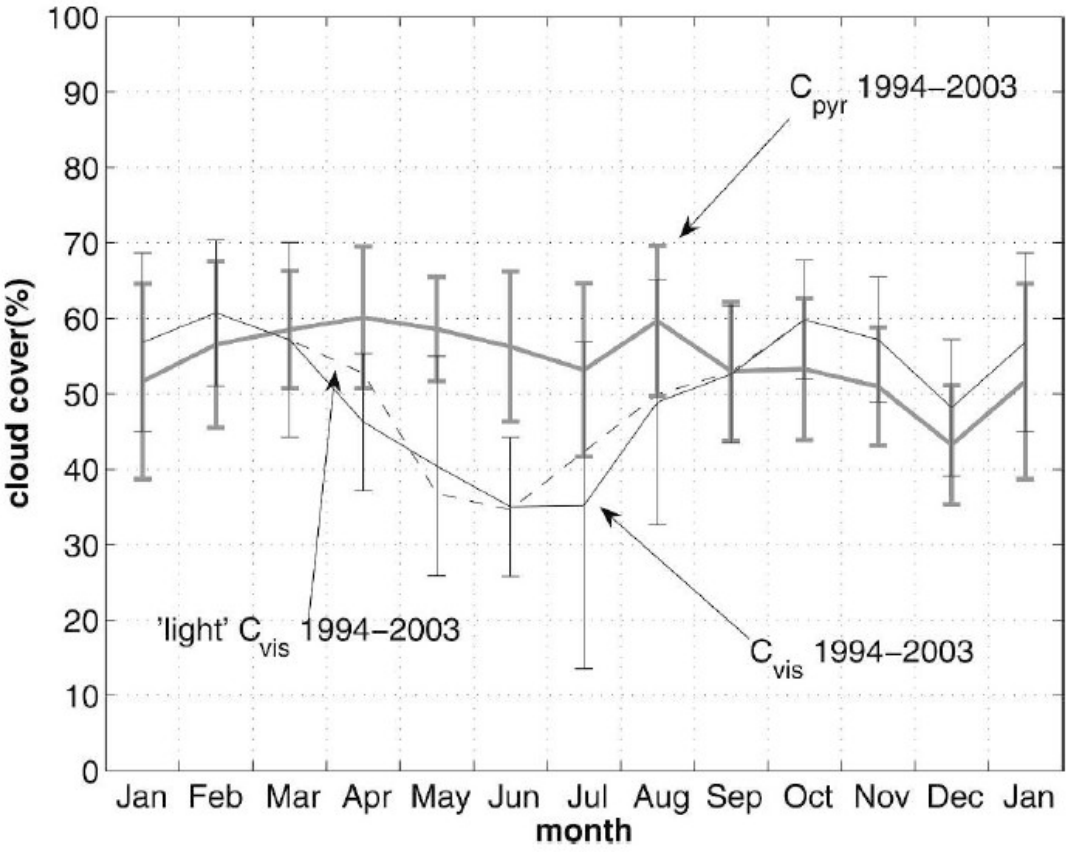


FIG. 6. Seasonal cycles of C_{pyr} and C_{vis} based on data from 1994 through 2003. The error bars indicate one standard deviation of

Town et al. (2007)

Surface-based observations at the South Pole:

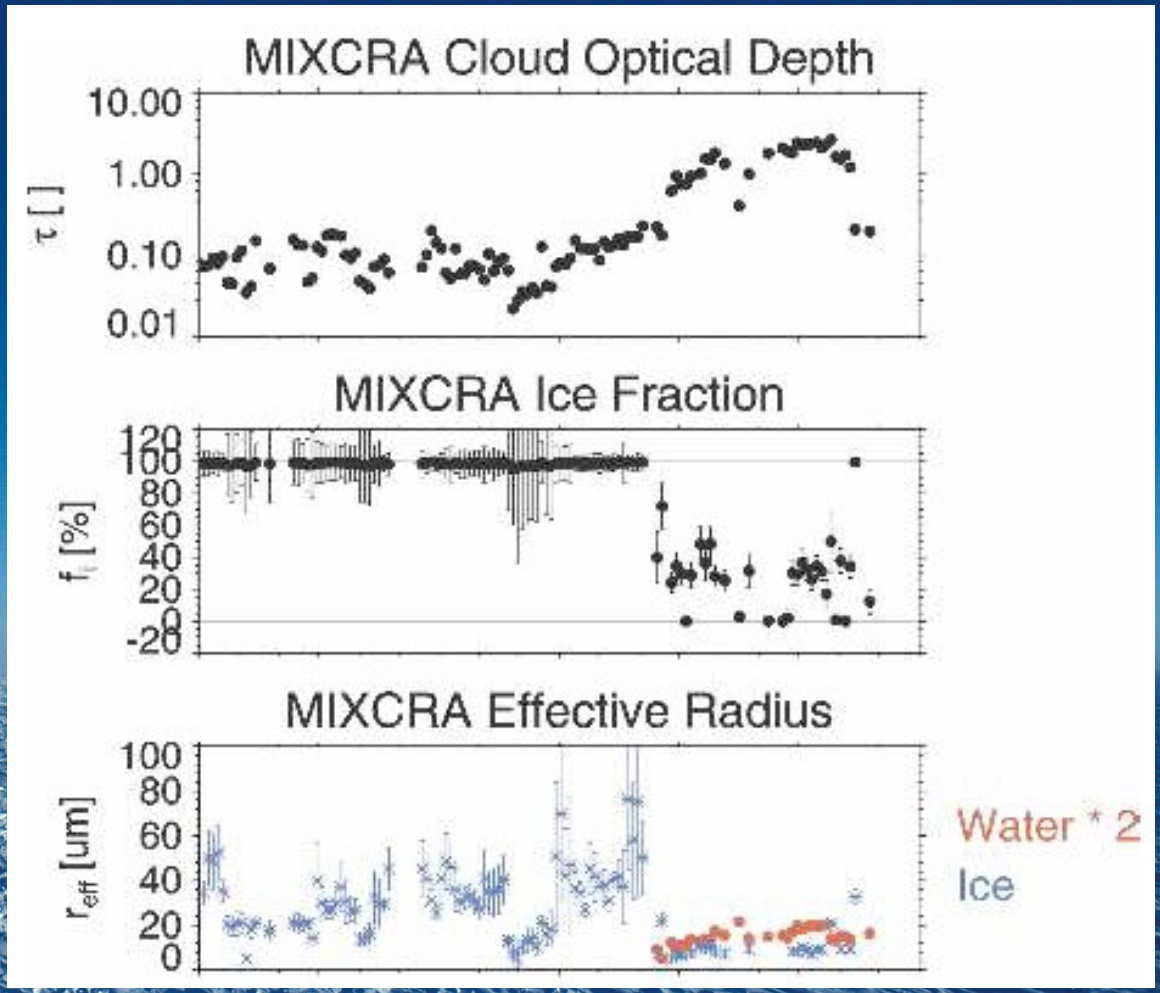
IR and clouds

Spectral IR methods recently developed to retrieve cloud properties from surface data.

LBLRTM + DISORT = LBLDIS (*forward model*)

MIXCRA (*inverse model*)

Might this work from space?



Turner (2005)