SMILES Ice Clouds products guidelines

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Introduction

A description of the retrieval methodology is given by,

Millán et al. (2012), Smiles Ice Cloud products, pending publication

In short, cloud induced radiances (Tcir) were mapped onto partial Ice Water Path (pIWP) or Ice Water Content (IWC) using Tcir–pIWP or Tcir–IWC relationships found using simulations of the 2D Cloud-Sky Radiative Transfer model. These simulations were driven with a CloudSat-CPR and CALIPSO-CALIOP IWC merged field and the nearest EOS-MLS temperature and gas concentrations conditions. pIWP was derived from mostly negative Tcir measured when the SMILES Field of View (FOV) direction limb tangent is between 1000 hPa and 180 hPa while IWC was derived from limb tangents between 120 hPa to 80 hPa from mostly positive cloud induced radiances. Between these pressure ranges, the lack of contrast between clouds and the clear-sky background makes any cloud information difficult to infer. Systematic uncertainties affecting these products were investigated, the total systematic error was found to vary from 50% to 80% depending on the tangent pressure.

As part of the computation of the Tcir, relative humidity with respect to ice (RHi) was retrieved directly from the water vapour continuum, modifying the water vapour Jacobians using the Goff-Gratch function, an empirical function that estimates the saturation water vapour pressure as a function of temperature.

Data format

All the SMILES pIWP, IWC and RHi described here can be found at

ftp://mls.jpl.nasa.gov/pub/outgoing/smiles

The data is stored in the standard HDF version 5 on a one-day granularity, and named according to

```
SMILES_icecloud_yyyy-mm-dd_vXX_XX.h5
```

1

where `yyyy`, `mm` and `dd` are the calendar year, month and day respectively, and where `vXX_XX` is the version number. Each file contains three fields, RHi, IWC and pIWP and each of them contains three more fields 'A','B' and 'C' which correspond to the data obtained from each of the SMILES bands.

Each of these A/B/C fields contain data fields called 'val' and 'precision' which describe the value and the precision of the data, either in % for RHi, in mg/m^3 for IWC or in g/m^2 for pIWP. In addition to these fields, the geolocation information is given by the fields 'latitude' and 'longitude', the universal time and date are given by the fields 'ut' and 'date' and the local time and local date are saved in the fields, 'localtime' and 'localdate'.

Furthermore, the IWC and RHi swaths include the field 'pressure', in hPa, which indicates the pressure surface of the measurement. The RHi field also contains temperature in kelvins, water vapour and water vapour precision in ppmv and radiance χ^2 (chisq) fit value.

In addition to all these fields, each of the A/B/C fields contain an 'status' field. This is merely a flag indicating if that specific SMILES band was used that particular day. Values of 'status' equal to zero indicate that there is no data in that swath.

Data Characteristics

Data availability: 21 October 2009 to 21 April 2010

Data coverage: 38S to 65N (occasionally, the coverage will be 65S to 38N during periods when the ISS yaws to accommodate manned space flight vehicle dockings).

IWC   Pressure range: 110 - 80   hPa
pIWP Pressure range: 1000 - 180 hPa
RHi   Pressure range: 215 - 83   hPa

IWC and pIWP general characteristics

	Ptan [hPa]	Resolution	Sensitivity	Systematic Errors
	80	Measurement box of	0.02 mg / m^3	77%
IWC	90	275 km along track	0.04 mg / m^3	66%
	100	and 3.3 vertical	0.07 mg / m^3	60%
	110		0.13 mg / m^3	54%
	180	Ice water column	0.22 g / m^2	83%
pIWP	220	above 12.5 km.	0.07 g / m^2	73%
	600		0.13 g / m^2	61%
	1000		0.21 g / m^2	57%

| | RHi characteristics | | | |
| | at the tropics | | at high latitudes | |
Ptan [hPa]	Resolution	Precision	Resolution	Precision
83	6.3 km	25%	1.6km	10%
100	4.3 km	23%	1.6km	10%
121	3.4 km	18%	1.6km	10%
147	3.0 km	17%	1.6km	10%
178	1.8 km	12%	1.5km	9%
215	1.9 km	20%	1.4km	6%

Data screening

Bad value points are set to -999.99 and should be avoided.

For RHi only use those values with χ^2 less than 20.

Many negative values for IWC and pIWP are found in this dataset. Most of the time these will be, along with small positive values less than the cloud detection value, that is a clear sky scene. These values need to be included in any data averaging to avoid high biases.