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Mean cloud cover for BBC as derived using the AVHRR Cloud Type algorithm
Accuracy, reliability and error sources

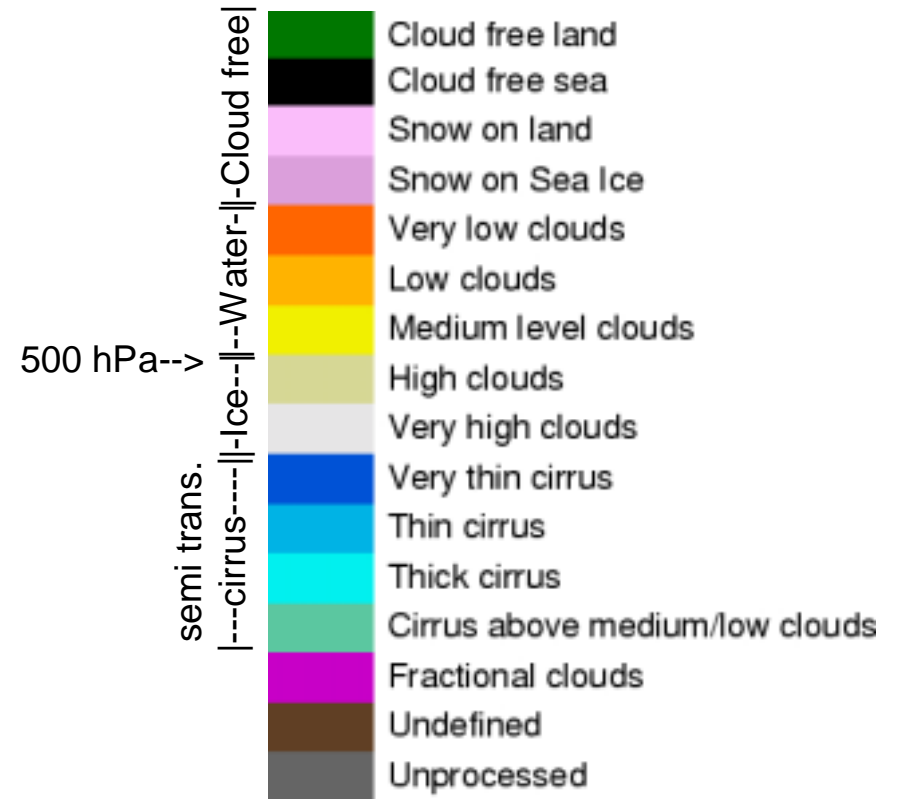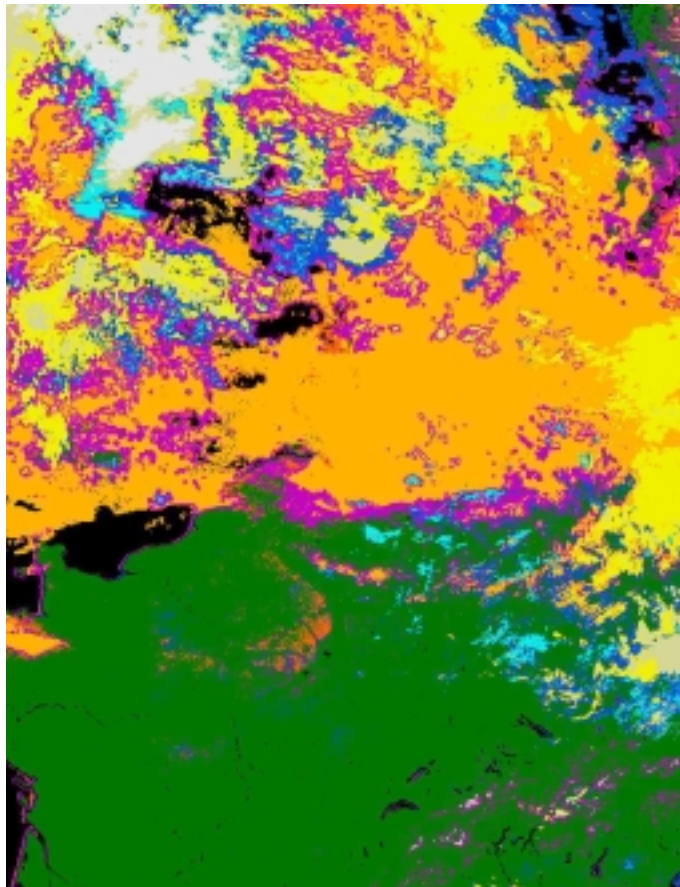- **Background**
- **Cloud Type validation results …again**
- **New mean cloud cover maps for BBC**

Adam Dybbroe

Background

- The Cloud Mask and Cloud Type algorithms have been introduced at previous meetings. More details can be found at www.smhi.se/saf

- Results for CNN-I/II and BBC are summarised at www.smhi.se/cliwanet

Background

The AVHRR Cloud Type:

500 hPa-->

semi trans.
|--cirrus----||-Ice--||--Water-||-Cloud free|

- Cloud free land
- Cloud free sea
- Snow on land
- Snow on Sea Ice
- Very low clouds
- Low clouds
- Medium level clouds
- High clouds
- Very high clouds
- Very thin cirrus
- Thin cirrus
- Thick cirrus
- Cirrus above medium/low clouds
- Fractional clouds
- Undefined
- Unprocessed

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Summary of known problems:

- Misses small cumuli and thin cirrus over land (especially wintertime)

- Sometimes low clouds at twilight go undetected – especially a problem in situations with a low level temperature inversion

- Misses arctic low clouds at night in wintertime (ice contamination or big water droplets)

- Ambiguous separation between thin cirrus and small cumuli and cloud edges: Often small cumulus and edges of water clouds are classified as thin cirrus

- Thin cirrus over mid-level or low cloud may be mis-classified as mid-level (opaque) cloud

- Sunglint may be classified as low or very low stratus
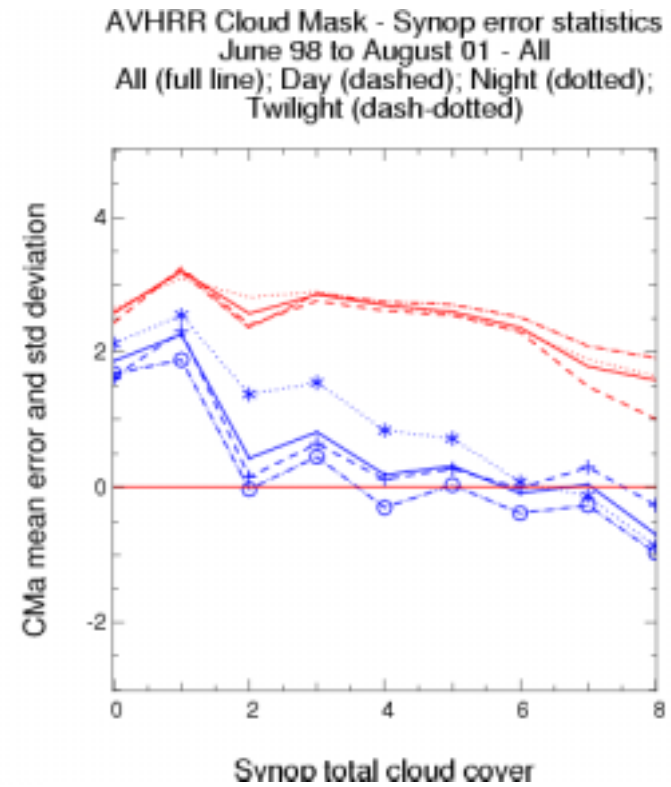
But now some "hard facts"....

Cloud Type validations against Synop

Mean error and standard deviation - all data (34 months from 1998 to 2001):

(Treating all cloud contaminated pixels as 100% cloudy)
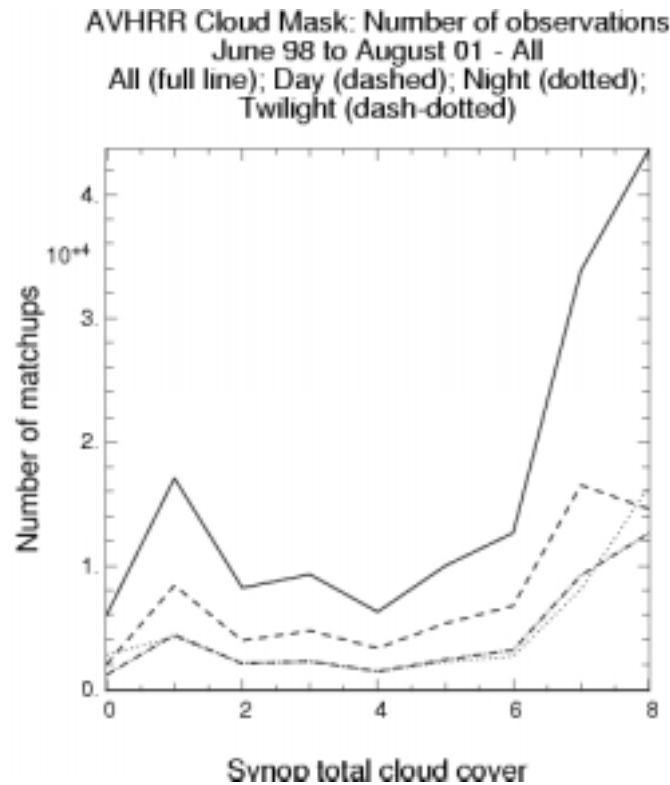

N=146963

Mean error & **STDV**

Mean bias = 3.6%

Cloud Type validations against Synop

Central European stations only:

Best verification results
are found in central
Europe:

- Lower mean
  abolute error

- Lower stdv

- Less bias

AVHRR Cloud Mask - Synop error statistics
June 98 to August 01 - Central Europe
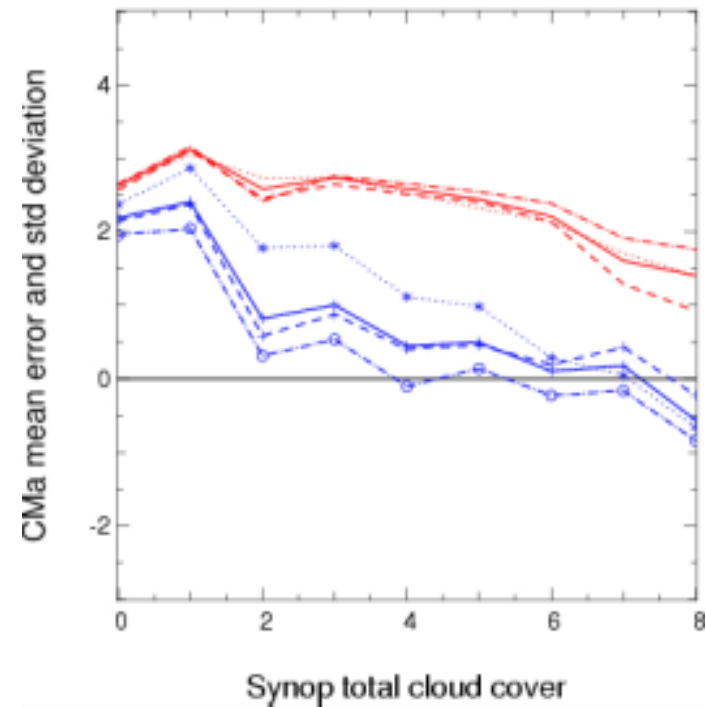All (full line); Day (dashed); Night (dotted);
Twilight (dash-dotted)

CMa mean error and std deviation

Synop total cloud cover
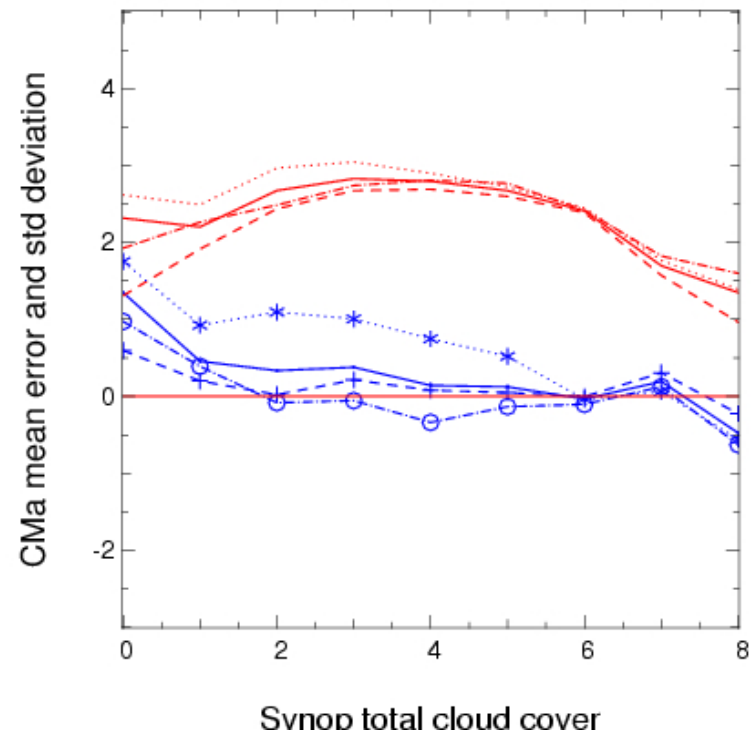
Mean error & **STDV**

Mean bias = 1.7 %

Cloud Type quality
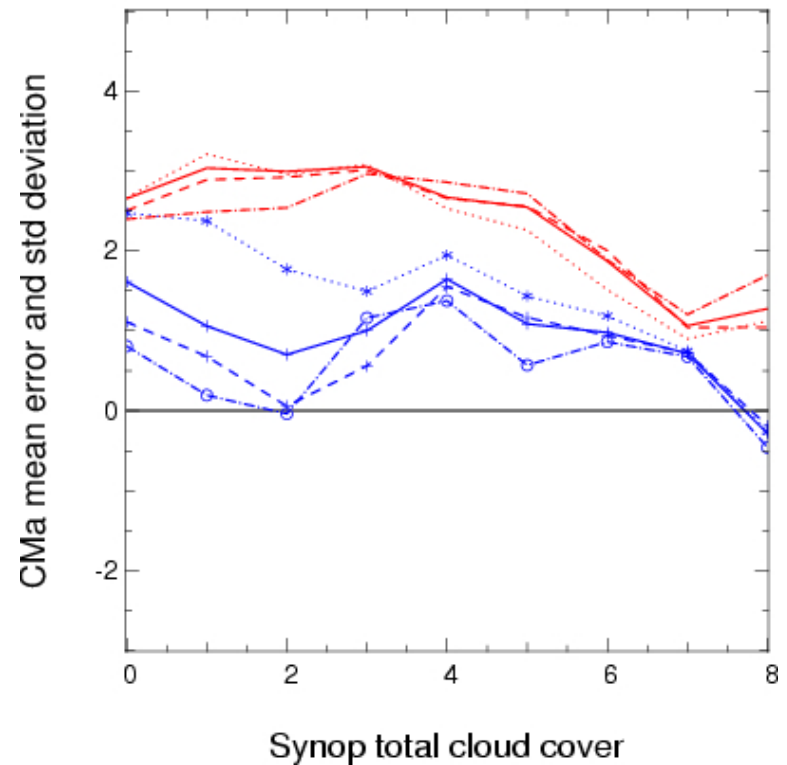
Inland versus coastal conditions:

Cloud Type quality

Oceanic conditions:

Ekofisk (N=1745)

Cloud Mask - Synop report error statistics
June 98 to August 01 - Station 01400-saf
All (full line); Day (dashed); Night (dotted);
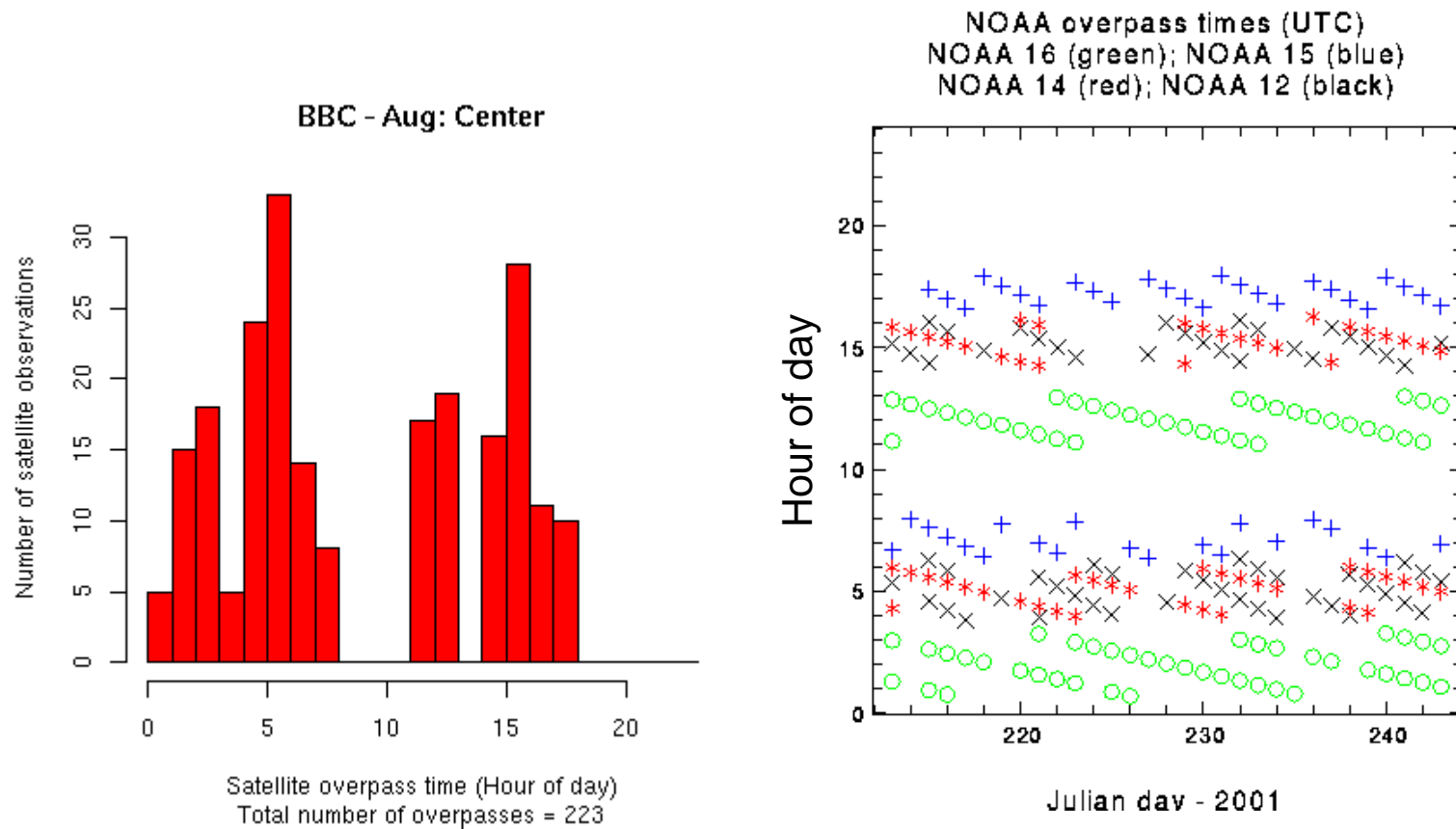Twilight (dash-dotted)

Mean error & **STDV**

Mean bias = 8.3 %

BBC mean cloud cover – data distribution

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The AVHRR dataset is unevenly distributed in time and space:
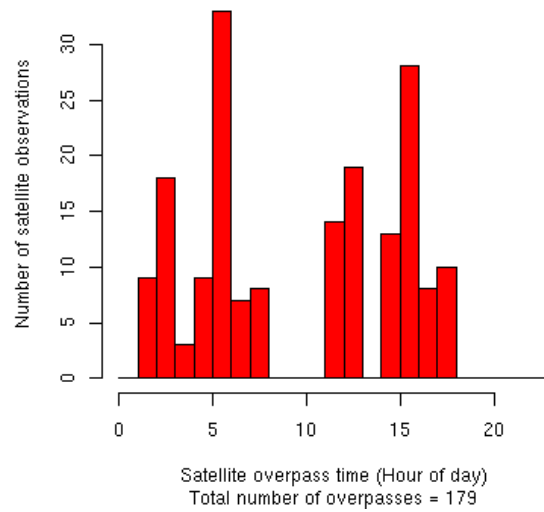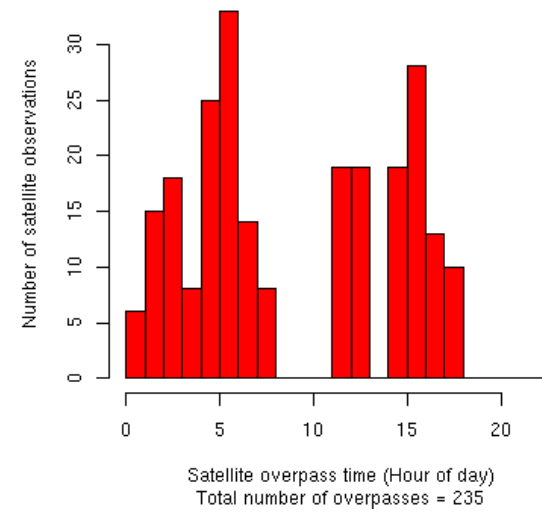
August 2001

BBC - Aug: Center

Number of satellite observations

Satellite overpass time (Hour of day)
Total number of overpasses = 223

NOAA overpass times (UTC)
NOAA 16 (green); NOAA 15 (blue)
NOAA 14 (red); NOAA 12 (black)

Hour of day

Julian day - 2001

BBC mean cloud cover – data distribution
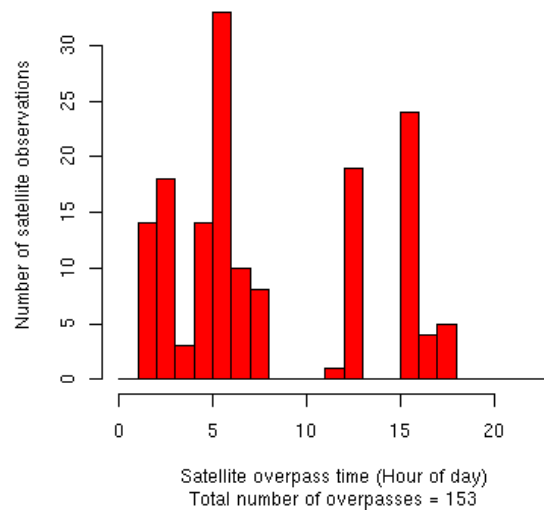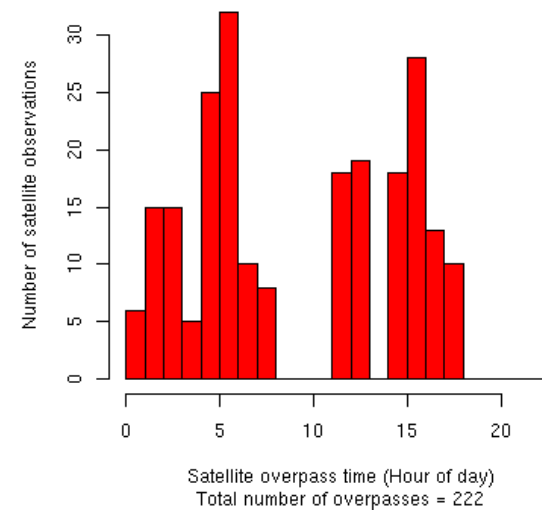
BBC mean cloud cover

(Treating the fractional cloud class as 50% cloudy)

BBC mean cloud cover
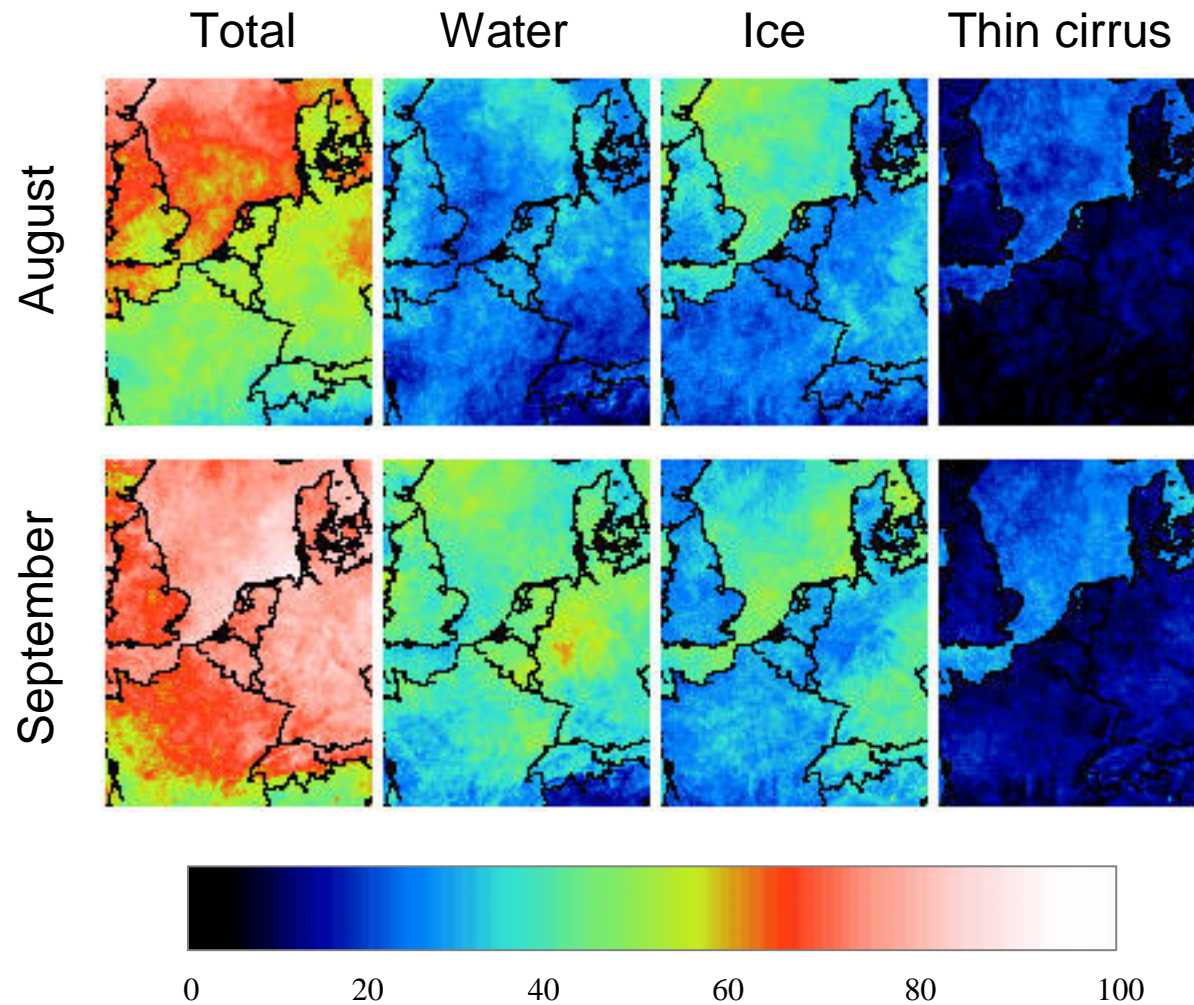
Problem: The mean fields show an artificially looking difference between the cloud cover over sea and land. The discrepancy is most evident in the ice-cloud (and thin cirrus) cover and is mainly due to a higher detection senitivity towards thin cirrus and sub-pixel water clouds over sea as compared to over land. In addition we know that the separation between fractional and thin cirrus is ambiguous.
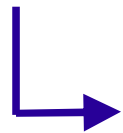
Slight overdetection over sea and a slight underdetection over land

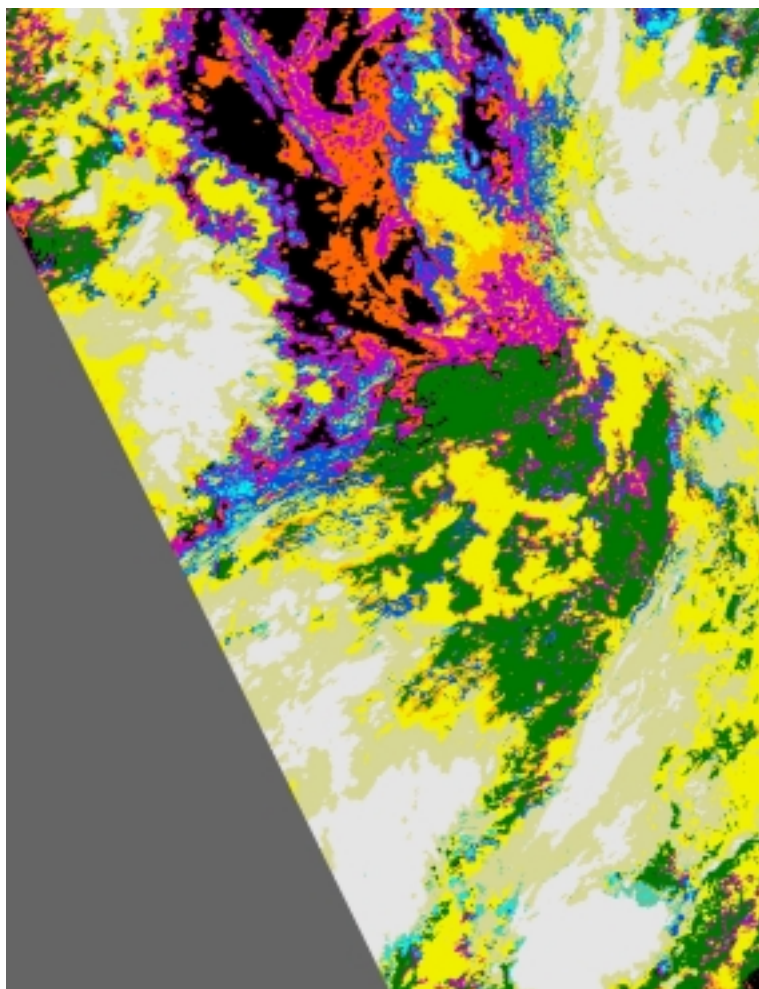The validation results against Synop support this conclusion: Overall bias

- All stations in matchup-database = 3.6 %
- Central Europe = 1.7%
- Inland stations = 2.4%
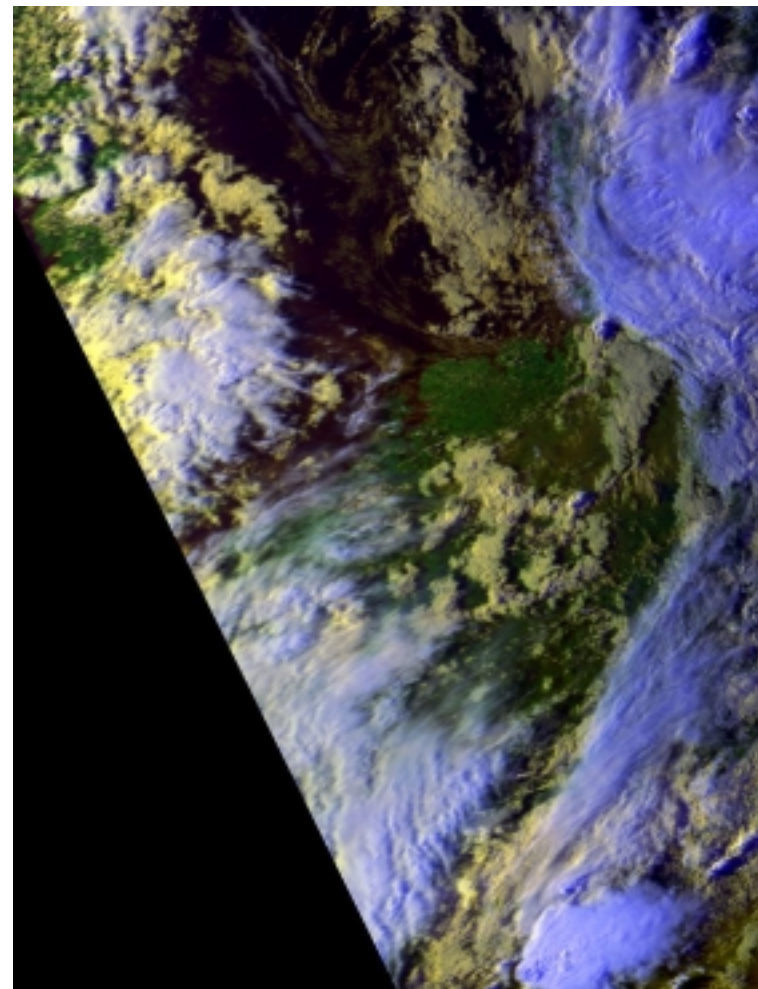- Coastal stations = 5.8%
- Over sea (ekofisk) = 8.3%

Cloud Type Example: BBC: NOAA 15, 4 August 2001, 16:59 UTC

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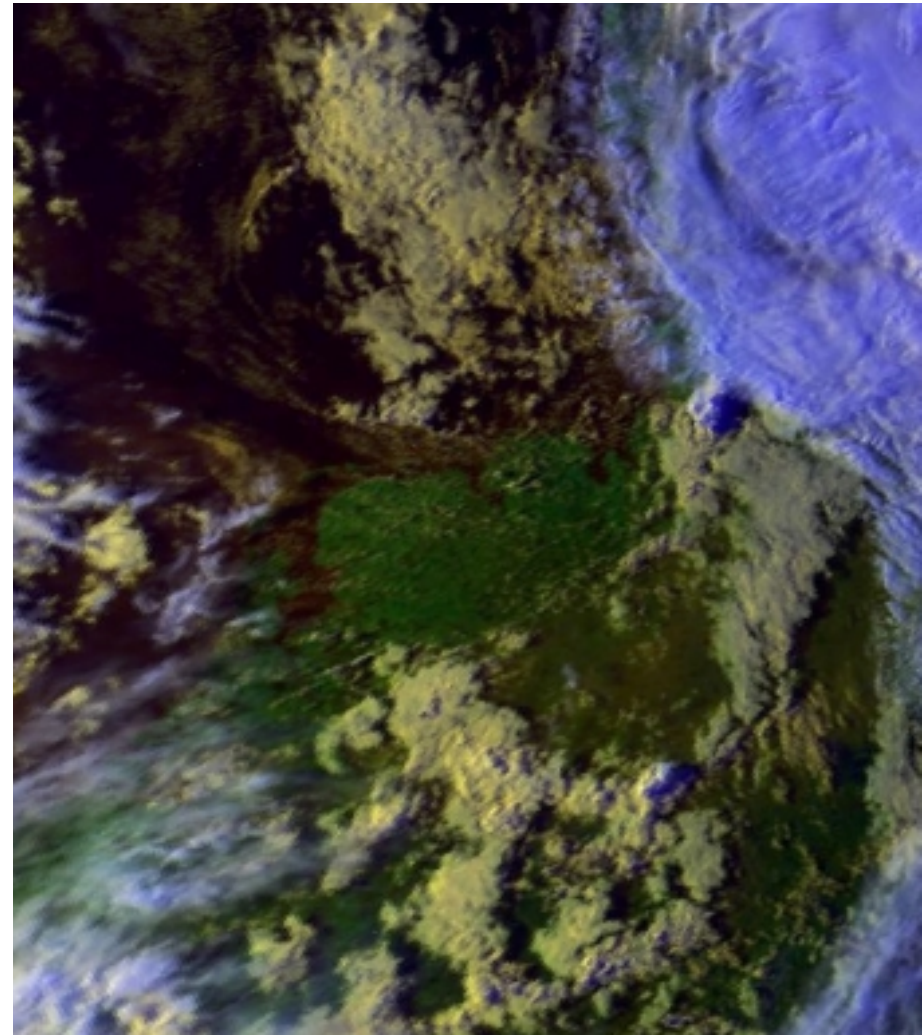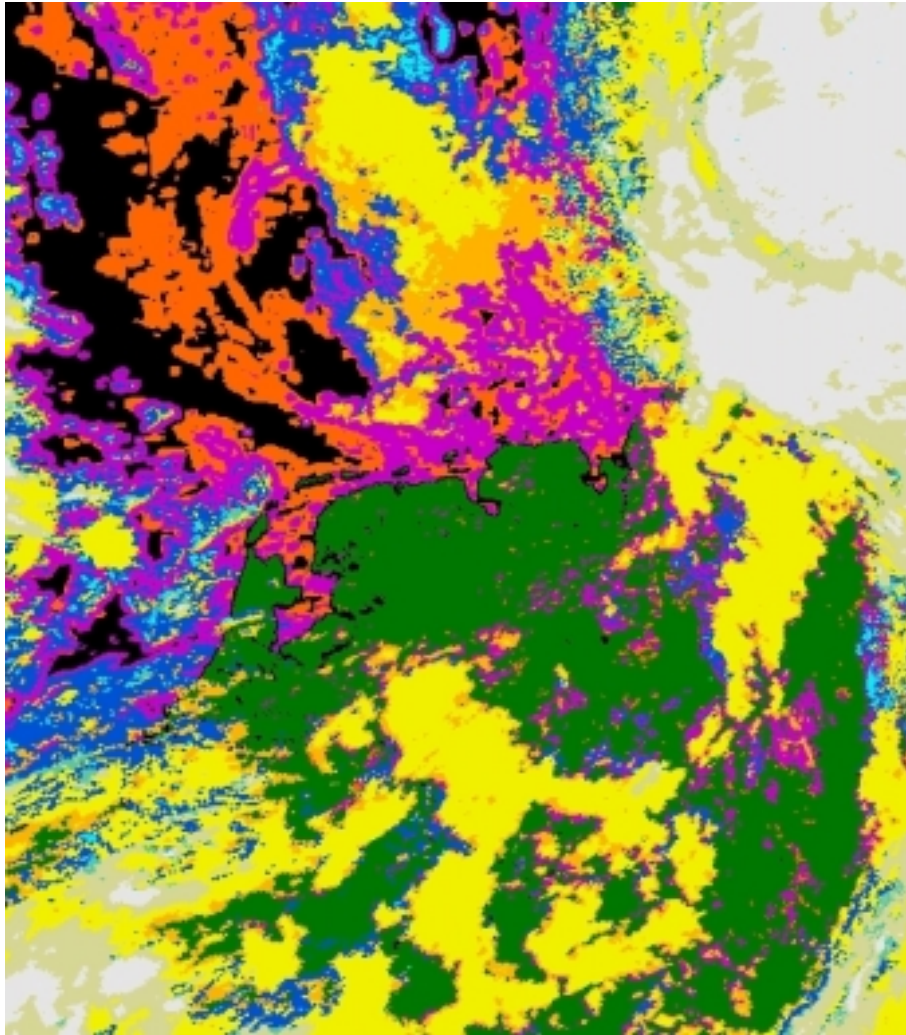Thin cirrus and small (sub-pixel) clouds are detected with greater efficiency over sea:

Cloud Type

RGB: Channel 1,2,4

A rather "extreme case" but still fairly frequent during BBC
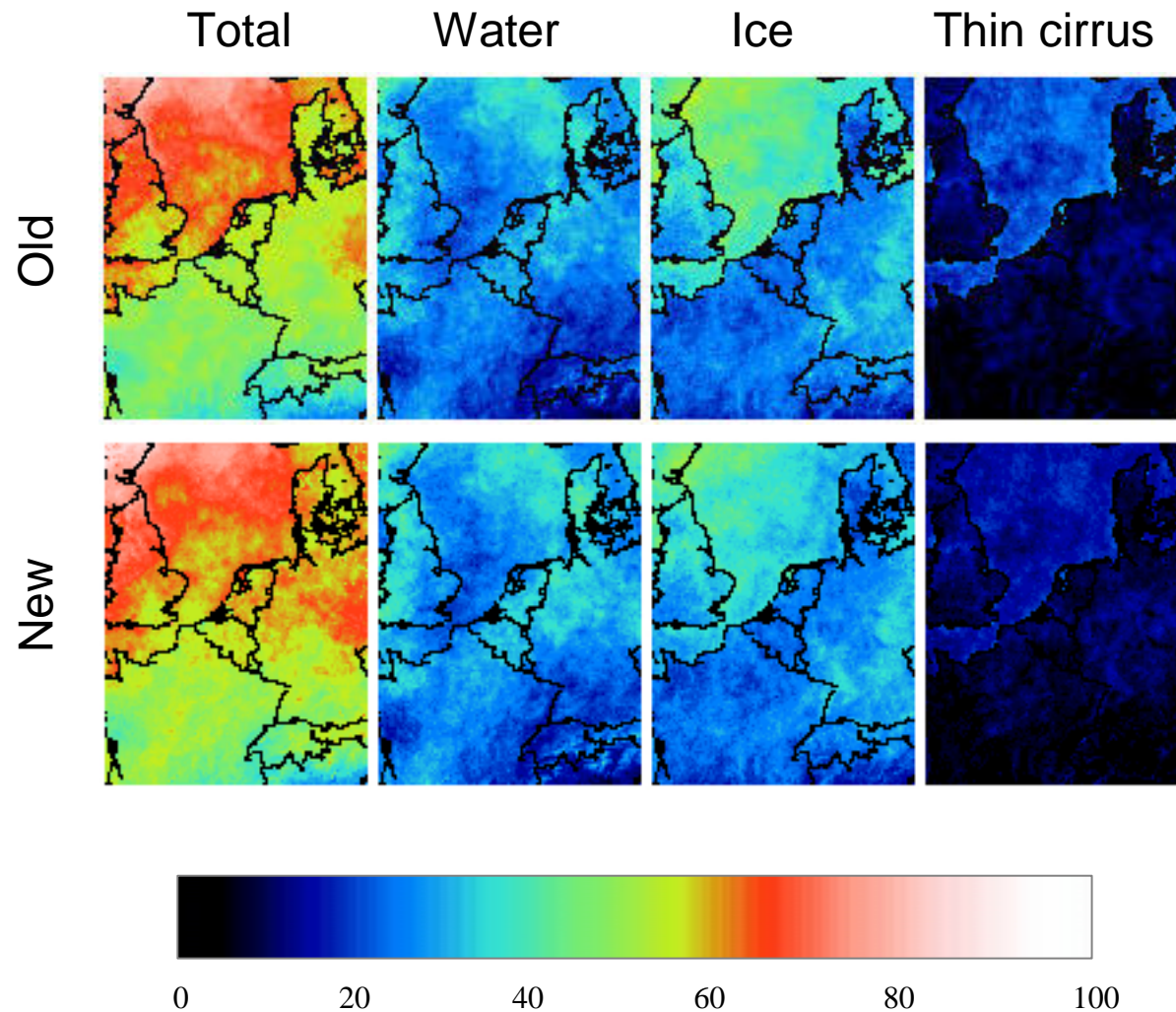(and especially during August 2001

BBC: NOAA 15, 4 August 2001, 16:59 UTC

BBC mean cloud cover – August 2001

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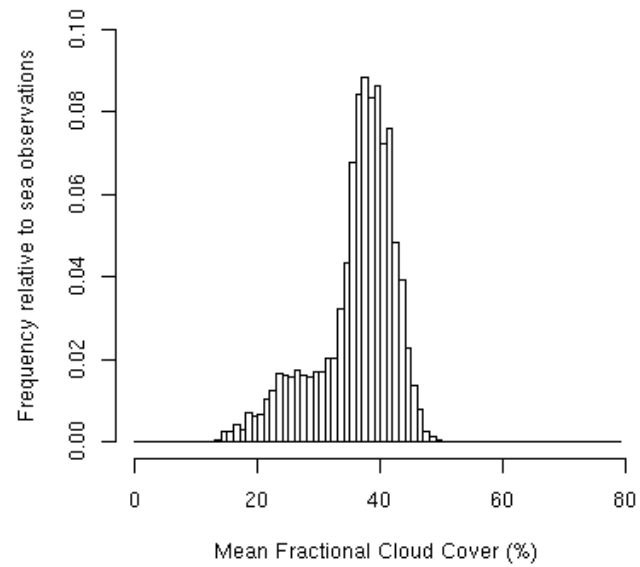New mean retrieval: Treating the *fractional* and the *very thin cirrus* classes as 50% cloudy over sea only

Old

Sea: iceclouds - total - 200108

Frequency relative to sea observations

Mean Fractional Cloud Cover (%)

Land: iceclouds - total - 200108

Frequency relative to land observations

Mean Fractional Cloud Cover (%)

New

Sea: iceclouds - total - 200108

Frequency relative to sea observations

Mean Fractional Cloud Cover (%)

Land: iceclouds - total - 200108

Frequency relative to land observations

Mean Fractional Cloud Cover (%)
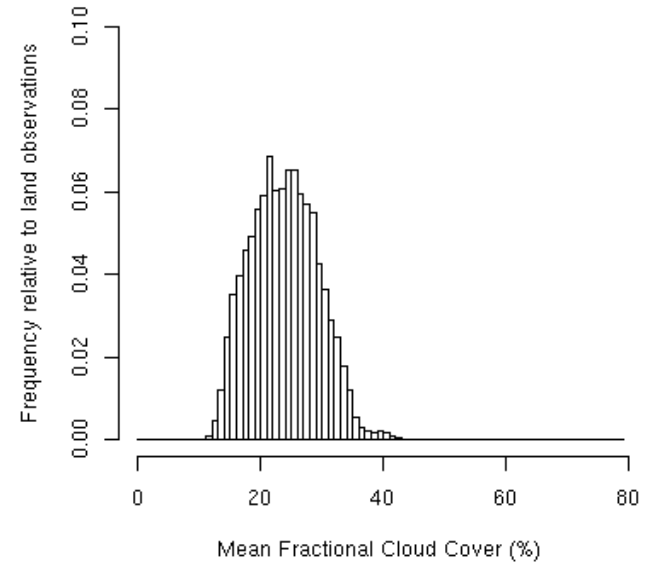
BBC mean cloud cover – September 2001

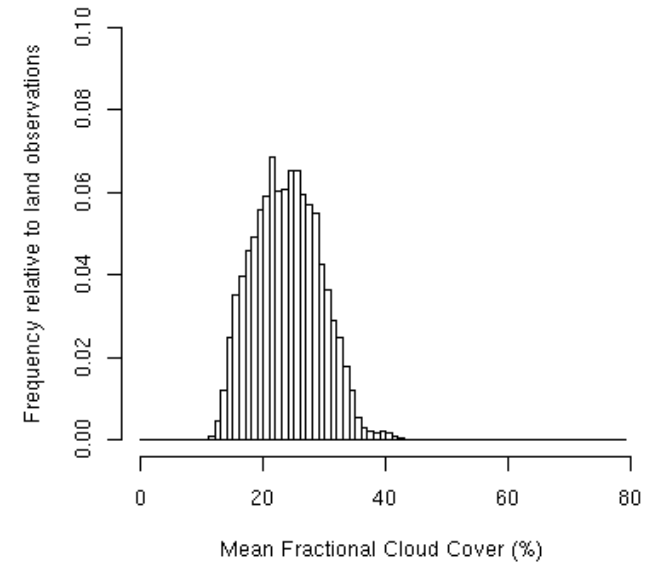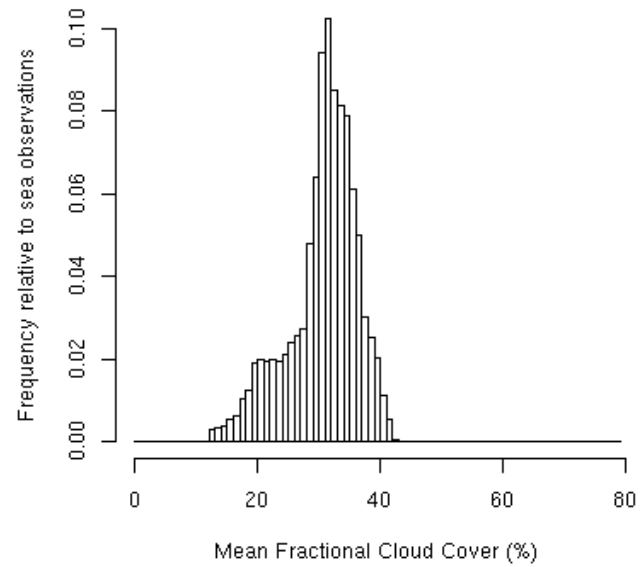New mean retrieval: Treating the *fractional* and the *very thin cirrus* classes as 50% cloudy over sea only