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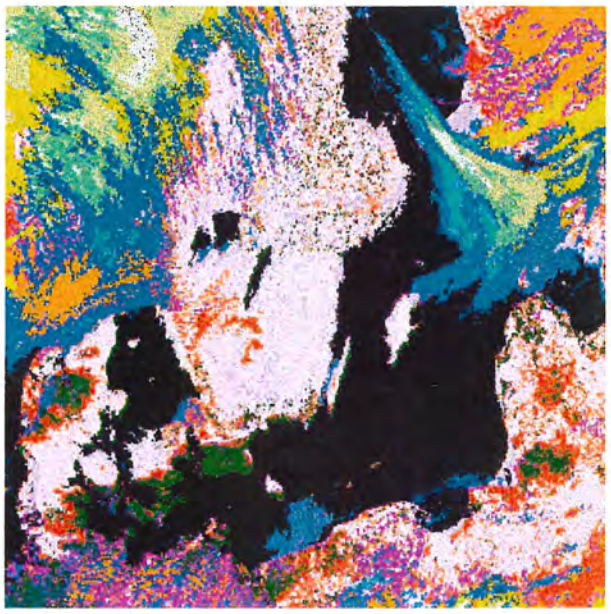
Nowcasting SAF

Validation of AVHRR cloud products



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Visiting scientist report

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Acknowledgements

This work was performed during a 2 ½ month visiting scientist stay of Andrei Diamandi at the Swedish Meteorological and Hydrological Institute within the framework of EUMETSAT's Nowcasting Satellite Application Facility.

Front Image

The front cover shows the visualization of the Cloud Type (right) classification and the RGB combination of AVHRR channel 1, 3A and 4 (left) of the **sswe** region. The utilization of the new 3A, 1.6 um channel helps identification of snow covered areas during daytime: red and dark red on the left image, pink on the Cloud Type classification. The Cloud Type model classifies very well snow covered surfaces as we can easily see comparing the 2 images.

Satellite pass is: NOAA 16, 05 March 2001, 11:55 UTC

Abstract

The main objective of this study was to find the situations when the present implementation of the Cloud Mask and Cloud Type models are not able to correctly classify the cloud scenes or the surface features and to describe under which circumstances this occurs.

The method chosen was to compare the model output, i.e. the cloud type classification with the subjective, human interpretation of the satellite images resulting in cloud type. Until now, such a method has not been used in the validation of the CT and CMa products

More than 600 pairs of Cloud Type Classification images and AVHRR 5 bands images and RGB combinations of them were analyzed in order to get information on the behavior of the Cloud Type Model in summer and winter conditions. In about 145 cases, the human interpreted cloud type was found to show significant differences requiring a more thorough analysis. It has been found that 8 classes of clouds in summer conditions (August 2000) and 11 classes in winter conditions (February-March 2001) were classified as other cloud types when compared to the outcome of the subjective analysis.

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CHAPTER 1 Introduction

The purpose of any validation scheme is to find those cases when the output of a model differs in quite a significant way from reality (a measured value, a class etc) or from what is a priori expected (1), and to gather all useful information about the *circumstances* (conditions) under which this occurred (2). This information is crucial for the understanding of weaknesses of a model and for realizing improvements.

Validation schemes can be *quantitative* or *qualitative*. Quantitative validation utilize independent, quantitative measurements of the parameters. The lack of surface and altitude data over oceans makes *quantitative validation* a very difficult task.

Since the classification algorithms have inherited from (at least in what concerns the taxonomy) and try to copy the *human interpretation* of cloud features into classes, it comes quite natural to use *qualitative validation* as a testing tool of model behavior.

It is obvious that *qualitative validation* as opposed to *quantitative validation* cannot be applied on large datasets since the process of visual interpretation requires not only a skilled operator but also a lot of time.

This report describes the work done, and the results, of such a qualitative validation of the SAFNWC Cloud Mask and Cloud Type products. When drawing conclusions on this qualitative validation it is of course important to acknowledge the inherent limitations of the approach. Not only will the validation results to some extent depend on the person doing the nephanalysis, but there are also some features which simply cannot be verified with a good confidence, like for instance the ability of the Cloud Type to correctly distinguish between low and middle level clouds. For such a validation auxiliary data (NWP model output or radio soundings) are required, and the validation is this case better performed using e.g. data from the SMHI interactive training database (see Dybbroe et al., 2000).

The validation was performed on two time periods, a *summer* period (August 2000) and a *winter* period (February - March 2001), since classification models tend to behave quite differently depending on the season, because of the differences in illumination, temperature contrast between clouds and earth surface, etc. The cloud products validated were the results of the running (in real time) prototype software version 0.21 (August-September 2000) and version 0.23 (NOAA 16 winter cases). Thus no re-processing was done and therefore short range NWP forecast output was utilized rather than analyzed fields, as input to the cloud classification schemes.

In the following chapter we shortly describe the Cloud Mask and Cloud Type Nowcasting SAF Products. In chapter 3 we describe the method used in the qualitative validation. In chapter 4 we describe the utilized dataset, and in chapter 5 we present and discuss the *cases* identified. Finally, in chapter 6, we summarize and conclude the report.

In annex A we present a few images of some of the identified cases, and in annex B the complete material for the cases summarized and discussed in the report is presented in table form.

CHAPTER 2

The Cloud Mask and Cloud Type products

Below follows a short introduction to the The Cloud Mask and Cloud Type products developed within the Nowcasting SAF and Ocean and Sea Ice SAF. For a complete and more detailed description of the algorithms we refer to Dybbroe et al. (2000). It should be mentioned, however, that since the publication of the MTR-Scientific Report (Dybbroe et al., 2000) the 1.6μm scheme has been implemented and verified on a test dataset of approximately one month of NOAA 15 data from the spring of 1999. And the cloud schemes have been running in semi-operational mode also on NOAA 16 data since beginning of February 2001.

2.1 The Cloud Mask Product (CMa)

The SAFNWC CMa scheme is a multispectral thresholding scheme utilizing all six spectral bands of the AVHRR/3. The scheme (or model) makes use of dynamic thresholds determined using radiative transfer models (RTM's) and available information on the atmospheric state and surface characteristics as given by NWP short range forecasts, landuse and DEM data. See the Scientific Report for further details.

The central aim of the SAFNWC CMa product is to delineate all absolutely cloud-free pixels in a satellite scene with a high degree of confidence.

The main product output consists of the following seven categories:

- Unprocessed
- Cloud free (sea or land)
- Cloud contaminated
- Cloud filled
- Snow/Ice contaminated
- Unclassified
- Low quality

The category "Snow/Ice contaminated" only exists during daytime, when illumination allows snow and ice detection. Since from the cloud processing point of view, cloud free land and cloud free sea represent here one and the same category (cloud free pixel).

The mandatory AVHRR channels are channel 1, 3B/3A, 4 and 5. Ancillary data used are the Sun zenith, satellite view zenith and sun-satellite view relative azimuth differences angles. Auxiliary data are represented by the static threshold data, land use and digital elevation (1km) data and NWP surface and 950 hPa temperatures and total precipitable water

Quality control is achieved through the utilisation of 11 processing flags (listed in the table below), and provides the user with valuable information on the conditions under which the cloud mask processing was performed, and on the quality of the thresholding. The information in the processing flags is available for each individual pixel.

Bit	Meaning of the bit
0	Land/Not land
1	Coast/Not coast
2	Night/Not night
3	Twilight/Not twilight
4	Sunglint/No sunglint
5	High terrain/Low terrain
6	Inversion/No inversion (Low level inversion present, or not)
7	NWP data used/Not used
8	AVHRR channel missing/No channels missing
9	Low quality (a value in one or more features is close to the decisive threshold)/High quality
10	Reclassified (isolated pixels classified using channel 3b may be smoothed out)/No reclassification performed

Table 1 : Cloud Mask categories

The AVHRR Cloud Mask output consist of:

- Main output (classification categories)
- Processing flags

The algorithm is performed in two separate processing stages: *the pre-processing stage* and the *on-line processing stage*. This distinction is caused by the fact that some computations can be made in advance of satellite data reception (pre-processing) while others demand access to real satellite data (on-line processing)

In the pre-processing stage the thresholds for IR and VIS channels are dynamically updated by utilisation of pre-computed tables from RTM simulations.

The parameters derived from data sources having a coarser horizontal resolution than AVHRR are interpolated (this concerns all parameters derived from NWP model data).

At the on-line processing stage, AVHRR level 1b data is calibrated and re-mapped from satellite projection to the specified product region in polar-stereographic map projection. and texture parameters are computed.

The CMa algorithm consists of a large number of multispectral thresholding sub-schemes applied according to prevailing illumination, atmospheric, viewing or geographical conditions. These conditions are determined from the auxiliary, NWP and viewing geometry input data sets supplied by the pre-processing stage. All sub-schemes fetch their applicable thresholds and parameters from the pre-calculated threshold tables and the static threshold parameters provided in configuration files.

2.2 The Cloud Type Product (CT)

The Cloud Type product provides information on the type of cloud - the cloud class - within every satellite FOV, and is dependent on the Cloud Mask product. The classification concentrates on separation of the following main cloud groups:

sub pixel (or fractional) clouds

semi-transparent clouds

high level clouds (HLC)

medium level clouds (MLC)

low level clouds including fog (LLC)

The main objective of the Cloud Type product is to support detailed cloud analysis.

From the 21 different categories listed in the table below, in the current stage of development, the model is able to classify clouds in 16 classes, i.e. there is yet no distinction between stratiform an cumuliform clouds. A cumuliform cloud is currently assigned the associated stratiform cloud class.

0	Unprocessed
1	Cloud free land
2	Cloud free sea
3	Snow contaminated land
4	Snow or Ice contaminated sea
5	Very low clouds – stratiform
6	Very low clouds – cumuliform
7	Low clouds – stratiform
8	Low clouds – cumuliform
9	Medium level clouds – stratiform
10	Medium level clouds – cumuliform
11	High opaque clouds – stratiform
12	High opaque clouds – cumuliform
13	Very high opaque clouds - stratiform
14	Very high opaque clouds - cumuliform
15	Very thin cirrus
16	Thin cirrus
17	Thick cirrus
18	Cirrus superimposed on low clouds
19	Fractional clouds
20	Unclassified

Table 2: Cloud Type categories

The mandatory AVHRR channels are channel 1, 3B/3A, 4 and 5. Ancillary data used are the Sun zenith, satellite view zenith and sun-satellite view relative azimuth differences angles. Auxiliary data used are the land use and digital elevation (1km) data and NWP surface, 950,850,700,500 hPa, tropopause temperatures and total precipitable water.

Quality control is achieved through the utilisation of 11 processing flags (same as for the CMa).The information in the processing flags is available for each individual pixel.

In general, the use of image features in the cloud type algorithm is biased towards a heavier use of IR and shortwave IR features than of VIS features. The reason is that prototyping has shown that the information correlated to vertical variations in the atmosphere (i.e., temperature) is more important for cloud type separation than changes in reflection characteristics. However, this conclusion is not true for the derivation of cloud phase information.

The AVHRR Cloud Type output consist of

- Main output (classification categories)
- Processing flags

The Cloud Type product depends on the output from the Cloud Mask product.

As for the CMa product, the algorithm is executed in two separate processing stages: the *pre- processing* stage and the *on-line processing stage.*

The cloud type classification algorithm is based on the following approach:

IR and short-wave IR imagery are used to separate opaque from semi-transparent or fractional clouds and semi-transparent clouds from fractional clouds

AVHRR 11 μm imagery compared to NWP temperature profile information is used to vertically sub-divided opaque clouds into categories LLC, MLC and HLC

The main use of the CMa information is to identify Cloud free and Snow/Ice contaminated pixels to prohibit further processing of these pixels.

Since the CTy algorithm builds on the input from the CMa, any errors in NWP data causing errors in the Cloud Mask will obviously also effect the Cloud Type. Except for this dependency the CTy is less sensitive to the surface temperature being the most critical parameter for the CMa. The biggest impact is rather to be found from any general erroneous resolution of the actual vertical temperature profile in the lowest part of the atmosphere, causing the discrimination of mid-level and low and very low level clouds to fail.

CHAPTER 3 The dataset

The dataset for the qualitative validation of Cloud Mask and Cloud Type products. consisted in 31 days of summer data (1-31 August 2000) and 20 days of winter data (18 February – 9 March 2001). More than 300 pairs of RGB AVHRR and Cloud Type product images in jpeg format and corresponding AVHRR and Cloud Type, full resolution, image pairs in hdf5 format were analyzed.

3.1 The "summer" dataset :

- regions id: *cliwanet_north, cliwanet_south* (northern and southern part of the Baltex Sea drainage basin)
- resolution: 1000x1000 meters
- area extent:
  - lower left corner - cliwanet_south: (x,y)=(-726561.014,-1221494.003)
  - upper right corner - cliwanet_south (x,y)=(943438.986,-87494.003)
  - lower left corner - cliwanet_north: (x,y)=(-726561.014, -87494.003)
  - upper right corner - cliwanet_north (x,y)=(943438.986,1046505.997)
- projection: lambert azimuthal equal area: latitude of true scale = 60.0N, central meridian = 20.0E
- dimensions: 1670 pixels and 1134 lines.
- satellites : noaa 12, noaa 14, noaa 15

AVHRR Images:

- RGB band combinations : 124 (*daylight*), 3B45 (*night-time*)
- single spectral bands (viewed as *gray scale* images) : 1,3B,4 (*daylight*), 3B,4 (*night-time*)
- file formats: *hdf5, jpeg*

AVHRR Cloud products: Cloud Type

- file formats: hdf5, *jpeg* ,

3.2 The "winter" dataset :

- regions: nswe, sswe (covering northern and southern Scandinavia)
- resolution: 1000x1000 meters
- area extent:
  - lower left corner - sswe: (x,y)=(-400884.230,-3946631.714)
  - upper right corner - sswe (x,y)=(623115.770,-2922631,714)

  - lower left corner - nswe: (x,y)=(-392288.011,-3105279.353)
  - upper right corner - nswe (x,y)=(631711.989,-2081279.353)
- projection: polar stereographic - latitude of true scale = 60.0,N central meridian = 14.0E
- dimensions: 1024 pixels and 1024 lines
- file formats : hdf5
- satellites : noaa 16

AVHRR Images:

- RGB band combinations : 124, 1,3A,4 (*daylight*), 3B45 (*night-time*)
- spectral bands (viewed as *gray scale* images) : 1,3A,4 (*daylight*), 3B,4 (*night-time*)

AVHRR Cloud products: Cloud Type

- file formats: *hdf5*

CHAPTER 4 Method

The visual interpretation of the images, aiming at identifying where the human interpretation deviated significantly from the model classified cloud and surface types, was done as a 2 step process:

At first, the RGB image was compared to the CT image looking at the features visible with the naked eye. The RGB combinations of AVHRR channels 1,2,4 and 1,3A,4 (NOAA 16 only) were used for *daylight* images and 3B,4,5 for *night-time* images. Some times, the gray scale images of one or more channels were also displayed. The *area* found to have a different classification from the human interpretation was labelled as a "*case h / m*". The two indices, *h* and *m* are respectively, the class number of the area as assigned by the human classification and the class number as given by the model classification. Both indices can take values from 0 to 20, representing cloud type classes as established by the Cloud Type Model. The number of pixels in an area can range from a few pixels to several hundreds of pixels, but a typical size is about 60 to 80.

In a second step, the *case h / m* found was further analyzed looking at the radiometric values of the pixels in the *area of interest*, as well as in *neighboring areas*. Information stored in some of the *processing flags* was also used.

Looking at neighboring areas is in many ways useful. For instance comparing the channel 4 brightness temperatures, especially when the pixels represent the same type of cloud or surface might help decide on the cloud type. For example, in a sunglint area, if the difference in the relevant image features between a pixel classified as cirrus and a cloud free pixel, outside the sunglint area is small (e.g. a difference in channel 4 brightness temperature in the order of 10^{-1}), it is more likely that the pixel classified as cirrus is, in fact, a cloud free pixel. Another reason of using a *witness* pixel is that, most of the time, it gives decisive information about the underlying surface.

For every *area of interest*, one pixel from within (the *target* pixel) and one pixel from outside the *area of interest* (the *witness* pixel) were chosen to have their parameters recorded.

Every *case* was recorded as a unique record in a table. Each record contains the *case* parameters:

- date, time (of satellite pass), satellite id
- region id (S for *cliwanet_south* on the *summer* dataset and for *sswe* for the *winter* dataset, N for *cliwanet_north* on the *summer* dataset and for *sswe* for the *winter* dataset)
- comments
- and the pixels parameters:
- CTI (cloud type as interpreted), CTM (cloud type as output of the model) for both *target* and *witness* pixels
- x,y, x*,y* : *target* and *witness* pixel coordinates

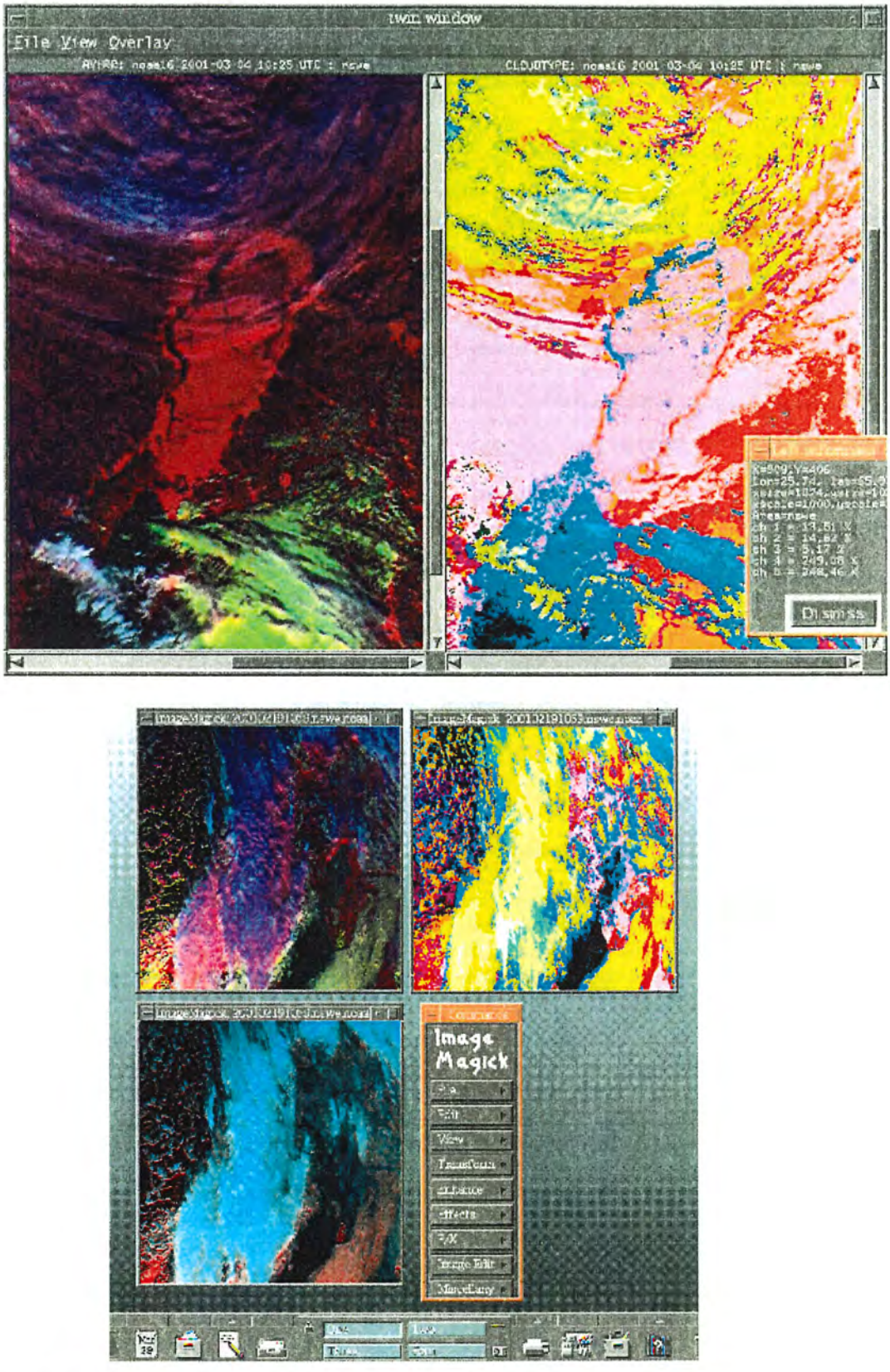
On completion of the analysis, in order to get more information on the recorded *cases* , a *python* program was used to retrieve file and pixel position information from the 2 tables, to read from the *hdf5* files the geographical coordinates, the values of the bi-directional reflectances and brightness temperatures (channels 1 to 5) and the *processing flags* for the pixels concerned and to write all the information gathered in a new table (*appendix C).*

Once the previous step has been accomplished, the tables were ordered after CTI and CTM which grouped the *cases* according to their *m* class. In every *m* class the classes are ordered after the *n* class number.

4.1 Software used:

ImageMagick™ was used to display the summer dataset in jpeg format. This preview of the dataset was necessary since the large number (~600 pairs) of images, the size of the hdf5 files and the computing environment would not have allowed to view every hdf5 format pair of images with the TwinWindow display software (see below). Since even the jpeg format files were too slow to load in ImageMagick, the images were shrinked to 40 % This was also necessary in order to be able to display 3 images at a time on the screen i.e., 2 AVHRR RGB images and one Cloud Type product image. The previewed images showing significant differences in the human interpretation as opposed to the model classifications will be further analysed using the hdf5 format images, in order to view additional pixel information like pixel values in the 5 channels, quality flags etc.

The **TwinWindow** display software was developed at SMHI specifically for this VS activity. It is designed to view 2 *hdf5* images at a time, side by side. This useful feature allows the comparison of the AVHRR images with the Cloud Type product images. Since the images are very big, another useful feature is the *sync scroll*, allowing the operator to have the same area of both the AVHRR image and the Cloud Type product displayed no matter which of the images is scrolled. Two small windows display the cursor position in the *x,y* , the *latitude, longitude*, the value of the pixel at the cursor position in the 5 AVHRR channels, calibrated in *bi-directional reflectances* and *brightness temperatures*, the *processing flags* and the cloud type *class*.



The ***Twin Window*** (above) and the ***ImageMagick™*** (below) display programs

CHAPTER 5 Case studies

5.1 Summer

In a first phase, more than 300 pairs of AVHRR images and Cloud Type product images in jpeg format were analyzed in order to rapidly track possible wrong classified cloud types and surface features. About 160 image pairs showing a significant difference between the model classification and the human interpretation were chosen for a more thorough analysis using the full resolution, hdf5 format AVHRR and cloud type product data. In the second phase, the analysis of 160 images pairs found 79 *cases* of misclassified cloud types and surface features.

Statistics derived from the *processing flags*:

50 / 79 cases over sea

29 / 79 cases over land

4 / 50 cases over sea are coast cases

37/ 79 cases with sunglint

63 / 79 daylight cases

15 / 79 twilight conditions

1 / 79 night-time case

8 / 79 low level inversions

3 / 79 low quality

The 79 cases were first grouped accordingly to the interpreted cloud type into 8 (out of the 20 possible) classes (cloud free sea, very low, low and medium stratus, very thin cirrus, thin cirrus, cirrus superimposed an low clouds and fractional clouds). In each of the 8 classes, cases were grouped accordingly to their classification as given by the model (Table 3). Each class contains one or more sub-classes.

Cloud Type Interpreted	Total Cases	Cloud Type Model	Cases
Cloud free sea	27	very thin cirrus	15
		very low clouds	11
		low clouds	1
Very low clouds	7	cloud free land	3
		cloud free sea	4
Low clouds	3	cloud free land	2
		cloud free sea	1
Medium clouds	2	cloud free sea	1
		thin cirrus	1
Very thin cirrus	24	cloud free land	4
		cloud free sea	7
		very low clouds	1
		low clouds	1
		medium clouds	8
		high opaque clouds	1
		very high opaque clouds	1
		fractional clouds	1
Thin cirrus	7	cloud free land	3
		low clouds	1
		medium clouds	3
Cirrus sup on low clouds		low clouds	1
		medium clouds	4
		high opaque clouds	1
		very high opaque clouds	1
		very thin cirrus	1
Fractional clouds	1	cloud free land	1

Table 3 : Misclassified Cloud Classes - Summer

Further on, an important statistic can be derived from the above table and concerns the distinction we can made between classification failures due the CMa respectively to the CT. Such a distinction is easy to make if we remember that the discrimination between cloudy (whatever the cloud type) and cloud free pixels on one side and snow / ice contaminated land (sea) on the other side is made when the CMa is calculated and that the CT uses the CMa as input. Counting the number of cases either CTI or CTM refers to one of the values 1,2,3 or 4, we find that for the *summer* dataset, the CMa was responsible for 67 % (53/79) of the misinterpreted classes. From the remaining 33 %, the separation of opaque clouds from semi-transparent and fractional clouds seems to have not performed very well

5.1.1 Cloud free sea

Out of the 27 *cloud free sea* cases analyzed the model classified 15 as *very thin cirrus*, 11 as *very low stratus* and 1 as *low level stratus*. In 25 of the cases, *sunglint* was detected by both the visual inspection and the model and should be made responsible for the failure of the model. The difference between the channel 4 actual pixel and "witness" pixel

brightness temperatures is zero or less than 0.02 C in 78 % of the cases while the remaining 22 % show differences of 2 to 4 C.

5.1.1.1 Very Low Stratus

All of the 11 cases occurred in areas with very strong sunglint and the channel 4 differences in all of them are zero or of the order of 2×10^{-2}.

5.1.1.2 Low Stratus

In just one case, also in a very strong sunglint area, the model classified as *low stratus* an area whose channel 4 brightness temperature was *higher* than of the neighboring zone, correctly classified as *cloud free sea*.

5.1.1.3 Very Thin Cirrus

In the majority of cases (13 out of 15) this category of misclassification was observed to occur in areas with very strong sunglint. Besides the visual interpretation, a comparison of the brightness temperatures of the areas classified by the model as *very thin cirrus* and a neighboring area classified as *cloud free sea* shows no differences at all or in the order of 10^{-2} in all of the 8 out of 13 cases and of 2 to 4 K in the remaining 5 observed in *sunglint* areas.

5.1.2 Very Low Stratus

Out of a total of 7 cases, the model classified *very low stratus* as *cloud free land (3)*, and cloud free sea *(4)*.

5.1.2.1 Cloud Free Land

All of the 3 cases occurred above *land*, 2 occurred in *twilight* and 1 in *night* conditions and *low level inversion* was the condition for 1 *twiligt* and 1 *night* cases.

5.1.2.2 Cloud Free Sea

Out of the 4 cases, 3 occurred above *sea* and 1 above *land*. One of the *sea* cases occurred in *twilight* and the other two in *sunglint*.

5.1.3 Low Stratus

Out of a total of 3 cases, the model classified *low stratus* as *cloud free land* (2) and as *cloud free sea* (1).All 3 cases occurred in *twilight* conditions.

5.1.4 Medium Level Stratus

Out of a total of 2 cases the model classified *medium stratus* as *cloud free sea* (1) and *thin cirrus* (1)

5.1.4.1 Cloud Free Sea

This case occurred in *sunglint* conditions

5.1.4.2 Thin Cirrus

The case occurred in *twilight* and *low level inversion* conditions

5.1.5 Very Thin Cirrus

In a number of 24 cases very thin cirrus were classified as cloud free land(4), cloud free sea(7), very low stratiform clouds(1), low stratiform clouds(1), medium stratiform clouds(8), very high opaque stratiform clouds(1), very high opaque cumuliform clouds(1).

5.1.5.1 Cloud Free Land

Out of the 4 cases, 2 occurred during twilight and low level inversion and 2 during day.

5.1.5.2 Cloud Free Sea

All of the 7 cases occurred in sunglint conditions.

5.1.5.3 Very Low Stratiform Clouds

This case occurred in twilight and low level inversion conditions, over land.

5.1.5.4 Low Stratiform Clouds

This case occurred during day and over land.

5.1.5.5 Medium Stratiform Clouds

Out of the total of 8 cases, 4 occurred above the sea and in sunglint (3) and twilight (1) conditions and 4 above the land during day.

5.1.5.6 Very High Opaque Stratiform Clouds

This case occurred above coast.

5.1.5.7 Fractional Clouds

This case occurred above land in twilight and low level inversion.

5.1.6 Thin Cirrus

In a number of 7 cases, the model classified *thin cirrus* as *cloud free land*(3), *low stratiform clouds*(1) and *medium level stratiform clouds*(3). All the cases occurred above *land* and during *day*.

5.1.6.1 Cloud Free Land

All the 3 cases occurred during in *daylight conditions* and none of the processing flags was set, except for the *nwp* flag.

5.1.6.2 Low Stratiform Clouds

This case occurred during *daytime* and none of the quality flags was set, except for the *nwp* flag.

5.1.6.3 Medium Level Stratiform Clouds

Out of these 3 cases 1 occurred in *twilight* conditions.

5.1.7 Cirrus superimposed on Low Clouds

In a number of 8 cases, the model classified thin cirrus superimposed on low clouds, as low clouds(1), medium level clouds(4),high opaque stratiform(1), very high opaque stratiform(1) and very thin cirrus(1). In all but one of the cases, nwp data was used.

5.1.7.1 Low Clouds

This case occurred during day above land.

5.1.7.2 Medium Level Clouds

Out of these 4 cases, 1 occurred above land and 3 above sea. The case above land occurred in low level inversion and twiligh conditions and one above sea in twilight conditions. The two other sea cases occurred in sunglint conditions

5.1.7.3 High Opaque Stratiform

This case occurred above coast and during day

5.1.7.3 Very High Opaque Stratiform

This case occurred above coast and during day

5.1.7.4 Very Thin Cirrus

This case occurred above land and during day

5.1.8 Fractional Clouds

In one case, the model classified *fractional clouds* as *cloud free land.*

5.1.8.1 Cloud Free Land

This case occurred during *day,* and had the *low quality* flag set.

5.2 Winter

For the period 18 February - 08 March 2001, only passes from one satellite (NOAA 16) covering most of Scandinavia (nswe & sswe regions) were chosen. A total 118 full resolution AVHRR and Cloud Type images in hdf5 format were carefully analyzed resulting in 65 cases of misclassification. However, since the model do not yet classify snow / ice during night, the true number should be 61.

Statistics derived from the *processing flags*:

24 / 65 cases over sea

20 / 65 cases over land

21 / 65 cases over sea are coast cases

32 / 65 daylight cases

3 / 65 twilight conditions

33 / 65 night-time case

6 / 65 low level inversions

8 / 65 low quality

The 65 cases were first grouped accordingly to the interpreted cloud type into 11 (out of the 20 possible) classes. In each of the 11 classes, cases were grouped accordingly to their classification as given by the model (Table 4). Each class contains one or more sub-classes

Cloud Type Interpreted	Total Cases	Cloud Type Model	Cases
Snow contaminated land	2	very low clouds	1
		medium level clouds	1
Snow / Ice contaminated sea	5	cloud free sea	4
		low clouds	1
Very low clouds	1	cloud free sea	1
Low clouds	5	cloud free land	4
		cloud free sea	1
Medium clouds	11	cloud free land	8
		cloud free sea	1
		snow / ice contaminated sea	1
		very thin cirrus	1
High opaque clouds	1	cloud free land	1
Very high opaque clouds	1	cloud free land	1
Very thin cirrus	27	cloud free land	1
		cloud free sea	1
		very low clouds	2
		low clouds	3
		medium clouds	16
		high opaque clouds	1
		thick cirrus	3
Thin cirrus	3	cloud free land	1
		medium level clouds	2
Cirrus sup on low clouds	8	cloud free land	2
		very low clouds	1
		medium level clouds	4
		very high opaque clouds	1
Fractional clouds	1	cloud free land	1

Table 4: Misclassified Cloud Classes - Winter

5.2.1 Snow contaminated land

Out of a total of 2 cases, the model classified *snow contaminated land* as *very low clouds(1)*, and *medium level clouds(1)*.

5.2.1.1 Very low clouds

Although a daylight pass and no low level inversion present, the model could not classify this area of snow contaminated land. The reason should be the fact the area is covered by forest.

5.2.1.1 Medium level clouds

This is a night pass and the model do not yet classify snow / ice during night.

5.2.2 Snow / Ice contaminated sea

Out of a total of 5 cases, the model classified sea / ice contaminated sea as cloud free sea (4) and low clouds (1)

5.2.3.1 Cloud free sea

All of the 4 cases were night passes when the model do not classify snow/ice on sea

5.2.3.2 Low clouds

In this case, ice covering a lake was classified as low stratus. The same lake was correctly classified in other occassions. No low level inversion observed, daylight, nswe.

5.2.3 Vey low clouds

5.2.3.1 Cloud free sea.

In this case, the very low stratus was classified as cloud free sea.Night pass, no low level inversion observed, probably because of the small contrast between the cloud and sea surface (3 C).

5.2.4 Low clouds

Out of a total of 5 cases, the model classified *low clouds* as *cloud free land (4)* and *cloud free sea(1).*

5.2.4.1 Cloud free land

All four cases were identified on night-time scenes. In one of the cases, the witness pixel is cloud free land and d4 is quite large (5.3 C).

For three cases, the witness pixel is part of the same cloud and is correctly classified, the d4 values range from 0.5 C to 3 C. No *low level inversion* present.

5.2.4.2 Cloud free sea

The case was identified on a night-time scene. The witness pixel is cloud free sea and d4 is very large, 18 C. The *low quality* flag is set.

5.2.5 Medium level clouds

Out of a total of 11 cases, the medium level clouds were classified as cloud free land(8), cloud free sea(1) and very thin cirrus(1).

5.2.5.1 Cloud free land

All the 8 cases were identified on night-time scenes and had the nwp flag set. In 3 cases the undelying surface was low terrain, in 4 cases high terrain and in 1 case, coast. Also, 3 cases had the inversion flag set

5.2.5.2 Cloud free sea

This case was identified on a night-time scene.The low quality flag was set. The medium stratus cloud for which the target pixel belongs, continues on the land, where it is correctly classified as medium level cloud.

5.2.5.3 Very thin cirrus

This case was identified on a night-time scene and low level inversion. The low quality flag was not set.

5.2.6 High opaque clouds

5.2.6.1 Cloud free land

There were no pixel size holes in the cloud and the *witness* pixel belonging to the same cloud system and correctly classified as *high opaque cloud* shows a very similar t4 temperature (d4 ~0.23 C). *Coast* flags set.

5.2.7 Very high opaque clouds

5.2.7.1 Cloud free land

No pixel size breakthroughs could be observed and the *witness* pixel belonging to the same cloud system and correctly classified as very *high opaque cloud* shows almost the same t4 temperature (d4 ~0.01 C). *Coast* flags set.

5.2.8 Very thin cirrus

Out of a total of 27 cases, the model classified the *very thin cirrus* as *cloud free land*(1 case), *cloud free sea*(1 case), *very low clouds* (2 cases), *low clouds*(3 cases), *medium clouds* (16 cases), *high opaque clouds* (1 case), *thick cirrus* (3 cases).

From the total of 27 cases, 25 were identified on daylight scenes. Also, in the majority of the cases, the underlying surface was *snow / ice contaminated sea or land.* This was quite easy to separate since the cirrus were transparent, and in many cases over the sea, the cracks in the ice showing higher brightness temperature were very helpful.

5.2.8.1 Cloud free land

This case was identified on a night-time scene, the underlying surface is *snow contaminated land* (identified on a previous daylight scene).

5.2.8.2 Cloud free sea

This case was also identified on a night-time scene. It is a *very thin cirrus*, superimposed on a *low stratiform cloud.* Witness is on the same low stratiform cloud. The *low quality* flag is set.

5.2.8.3 Very low clouds

This two cases were identified on daylight scenes, over *high terrain* covered by snow, the *witness* pixels were correctly classified as *very thin cirrus*, respectively *snow contaminated land.*

5.2.8.4 Low clouds

The 3 cases were identified on daylight scenes, *over snow/ice contaminated sea (1) and snow contaminated land (coast, 2).* No *low level inversion* or *low quality* flags set.

5.2.8.5 Medium clouds

In the majority of cases (16), the *very thin cirrus* clouds were classified as *medium clouds.* Out of the 16 cases, the underlying surface is *coast*(6), *sea*(4) and *land*(6). No *low level inversion* or *low quality* flags set.

5.2.8.6 High opaque clouds

This case was identified on a daylight scene. The *very thin cirrus* is above *low stratiform clouds.*

5.2.8.7 Thick cirrus

Three cases of *very thin cirrus* clouds above *snow contaminated* land (1) and coast (2) classified as *thick cirrus.* The underlying surface is easy to identify due to the high transparency of the cirrus.

5.2.9 Thin Cirrus

Out of the 3 cases, the *thin cirrus* was classified as *cloud free land*(1) and *medium level cloud*(2).

5.2.9.1 Cloud free land

This case was identified on a night-time scene. *Low level inversion* was present.

5.2.9.2 Medium level cloud

Both cases were identified on daylight scenes. The underlying surfaces were snow contaminated *land* and *coast*. No *low quality* or *low level inversion* flags were set.

5.2.10 Cirrus superimposed on low clouds

Out of the 8 cases the cirrus superimposed on low clouds were classified as cloud free sea(2), very low clouds(1), medium level clouds(4) and high opaque clouds.

5.2.10.1 Cloud free sea

In both cases, identified on night-time scenes, the very thin cirrus and the cirrus were superimposed on low stratus. The low level inversion was set in the first case and the underlying surface were coast and land.

5.2.10.2 Very low clouds

The case was identified on a night-time scene. The cirrus are superimposed on low clouds. The category is correctly classified over the sea (the same cloud system). The low level inversion flag was set, the coast flag as well.

5.2.10.3 Medium level clouds

In 3 out of 4 , the cases were identified on night-time scenes. In all cases the thin cirrus was superimposed on low clouds. In 2 cases, the underlying surface was sea, in one case land and in one case coast when the low quality flag was also set.

5.2.10.4 High opaque clouds

The case was identified on a daytime scene. The thin cirrus above low clouds was classified as high opaque cloud. The coast flags is set.

5.2.11 Fractional clouds

5.2.11.1 Cloud free land

The case was identified on a night-time scene. The *fractional cloud* over *snow / ice contaminated land* in *low level inversion* conditions was classified as *cloud free land.*

CHAPTER 6 Summary and Conclusion

On a whole, comparing the ratio of *cases* found to the number of analyzed images in the *summer* and *winter* datasets, we have found that the average number of erroneously classified sub-areas (assuming the subjective analysis to be correct of course) grows from 26% in summer to 55% in winter. This is of course highly variable and dependent on the weather situation, as there were images where we could not find any *cases* while on others we could find 2 or more. Though variable in size and shape, the found *cases* are on average 60-80 pixels large along both x and y. This means that roughly between 0.05% and 0.09% of the pixels in a scene is erroneously classified during summertime, and roughly between 0.2% and 0.3% in wintertime.

This is, of course only a rough approximation, and shall only be used as such. As it is impossible to guarantee that we have found all erroneously classified cases in the scenes these numbers shall rather be seen as a lower limit. But in general, we can say that both Cloud Mask and Cloud Type algorithms perform better during summertime than in wintertime.

Since the Cloud Mask is utilized by the Cloud Type algorithm, the Cloud Type product analysis can reveal the causes of both Cloud Mask and Cloud Type failures. We can then firstly categorize the results obtained in two main categories: Cloud Mask errors and Cloud Type errors.

Since the separation, cloud free - cloudy area, is made by the Cloud Mask algorithm, adding up the *cases* when either a cloudy scene (regardless the cloud type) was classified as cloud free or a cloud free scene as cloudy we found that in the 53 out of the total number of 79 summer *cases* (67 %), we can talk about a CMa error and in the remaining 26 (33)% about a CT error. In 25 out of the 26 *cases* the problems occurred at the separation stage between semi-transparent/fractional clouds and opaque clouds. Just 1 *case* out of 26, concerned the separation stage between semi-transparent and fractional clouds. No *cases* of erroneous separation of the opaque clouds were found.

For the winter dataset, the errors separating cloudy pixels from cloud free pixels accounted for 45 % of the total number of *cases* while CT can be held responsible for the incorrect separation of opaque clouds from semi-transparent and fractional clouds in about the rest of the *cases.*

With respect to the *conditions* under which the misclassifications occurred, for the winter data set, misclassifications were almost equally distributed between *land, coast* and *sea*, between *night* and *day*, 10% in *low level inversion*, about 5% in *twilight* and in 12 % of the *cases* the *low quality* bit was set.

For the summer data set, 2/3 occurred over *sea* and 1/3 over *land*, approximately one half in *sunglint* conditions and 1/5 during *twilight*. Only 1 *night* compared the 78 *daylight* cases and 1/10 of *low level inversions*. In just 3 *cases*, the *low quality* bit was set.

The *cases* which occurred in *sun-glint* conditions need special attention. Even if *sun-glint* is relatively easy to identify for the human operator, to decide whether or not the area is absolutely cloud free is not always possible. That's why, for the *sun-glint* cases, it is fair to associate a confidence rate of about 60-70%.

To conclude, the Cloud Mask and Cloud Type schemes were found to perform better during summer than during winter. It is quite likely that the schemes will perform better (at least during winter) at lower latitudes due to the higher thermal contrast between the surface and the clouds. The quality of the classification is especially influenced *by sun-glint* and *twilight* conditions but the information contained in the *processing flags* is very helpful in these cases since it is possible to attach a *confidence interval* to the classification.

References

Dybbroe, A., K.-G. Karlsson, M. Moberg, A. Thoss, *Scientific Report for the SAFNWC Mid Term Review*, issue 1.1,SMHI, september 2000

Dybbroe, A., A. Thoss, and K.-G. Karlsson, *The avhrr cloud mask scheme of the safnwc*, Proceedings of the 1999 EUMETSAT Satellite Data Users Conference.

K.-G. Karlsson, *An introduction to Remote Sensing in Meteorology*, SMHI, september 1997

Karlsson.-K.G., A. Thoss, and A.Dybbroe, *High Resolution Cloud Products from NOAA / AVHRR and AMSU*, EUMETSAT Proceedings of the SAF Training Workshop - Nowcasting and very short range forecasting, ISBN 92-9110-030-7, 180-190,1999

Arnout J. Feijt, *Quantitative Cloud Analysis using Meteorological Satellites*, 2000, KNMI, ISBN 90-5808-315-2

Notations and Conventions

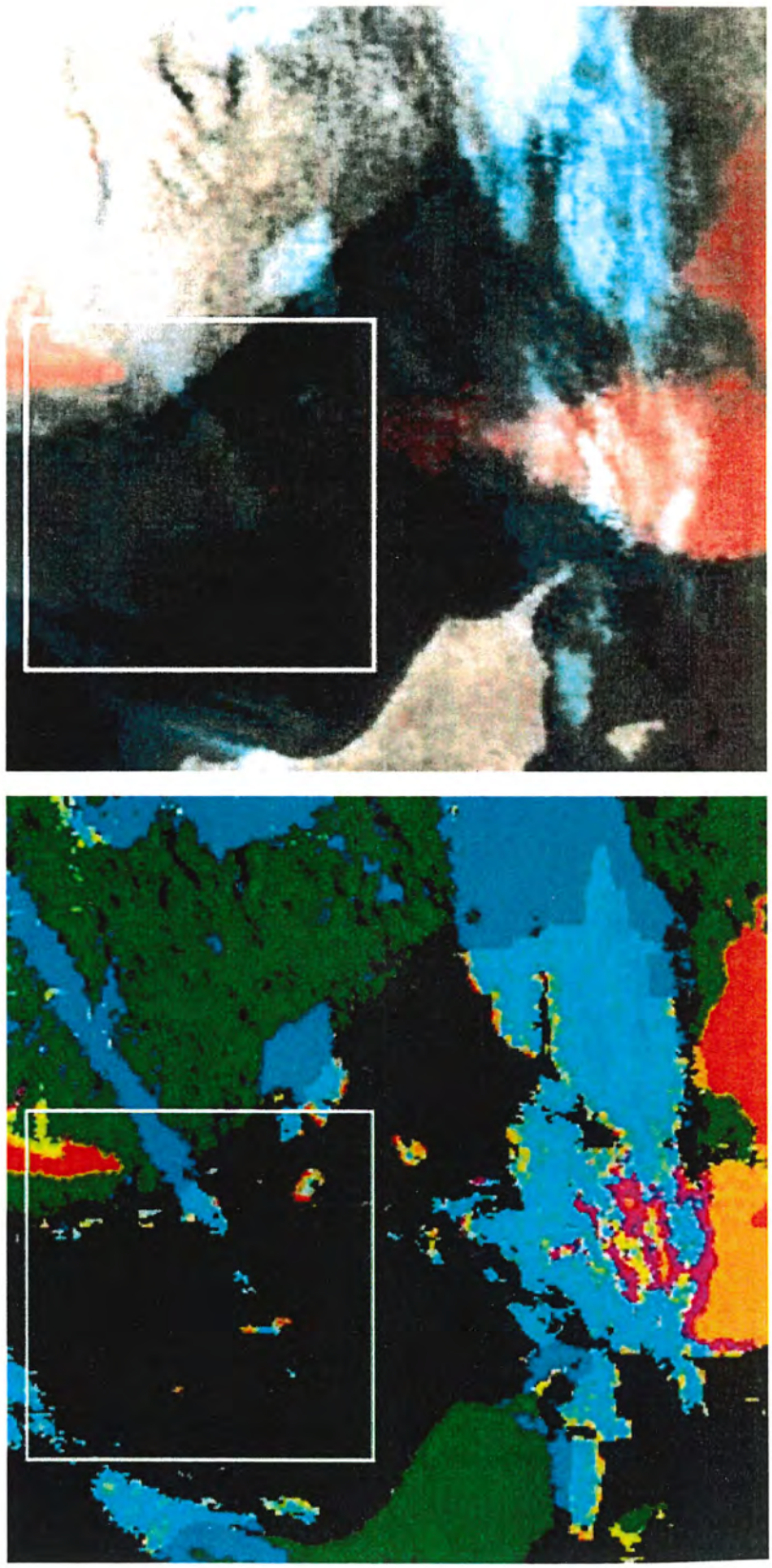
Notation:

d4 = T4*-T4,

where T4* and T4 are *the witness* pixel and *target pixel* AVHRR channel 4 brightness temperatures.

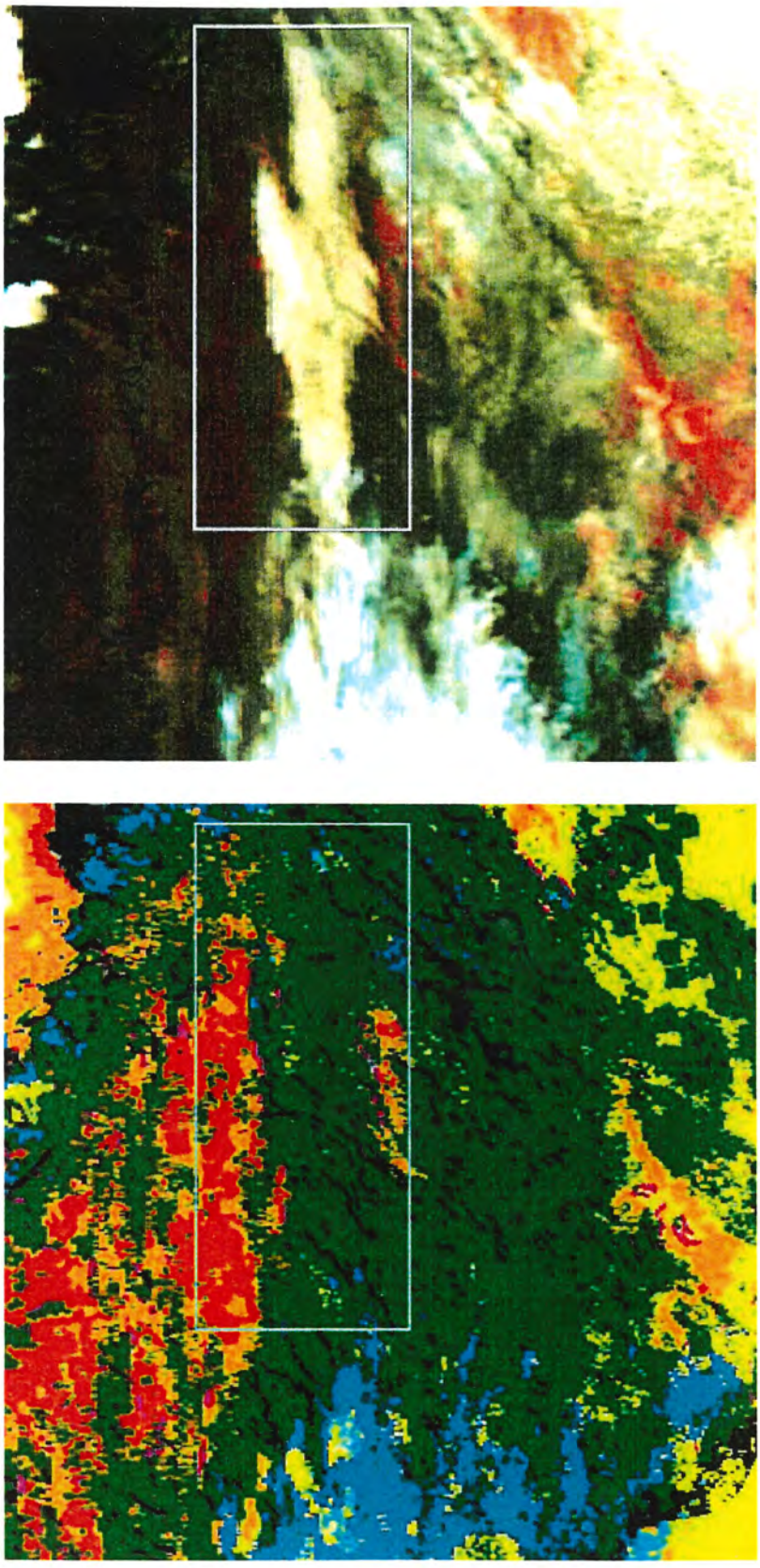
Conventions:

In section 5, regarding the *sun glint*, *twilight* and *low level inversion* processing flags, the default is value is 0, i.e., if the text do not refers to them, their value is zero. However, it might happen that some time they are referred as not being set.



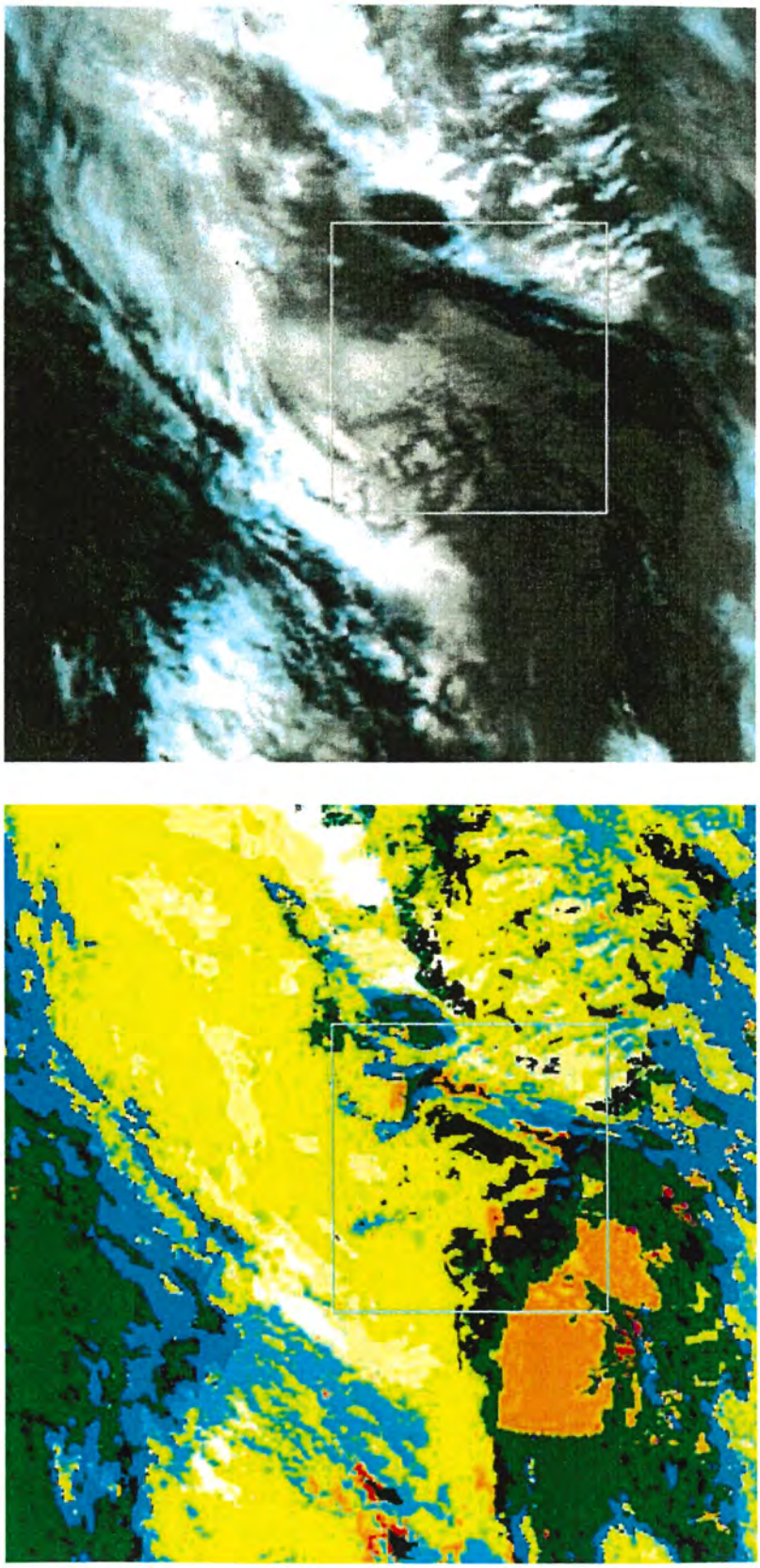
07 MARCH 2001 01:41 SSWE 5/2

Very low stratus over the sea, small contrast between clouds and sea (~3 K)



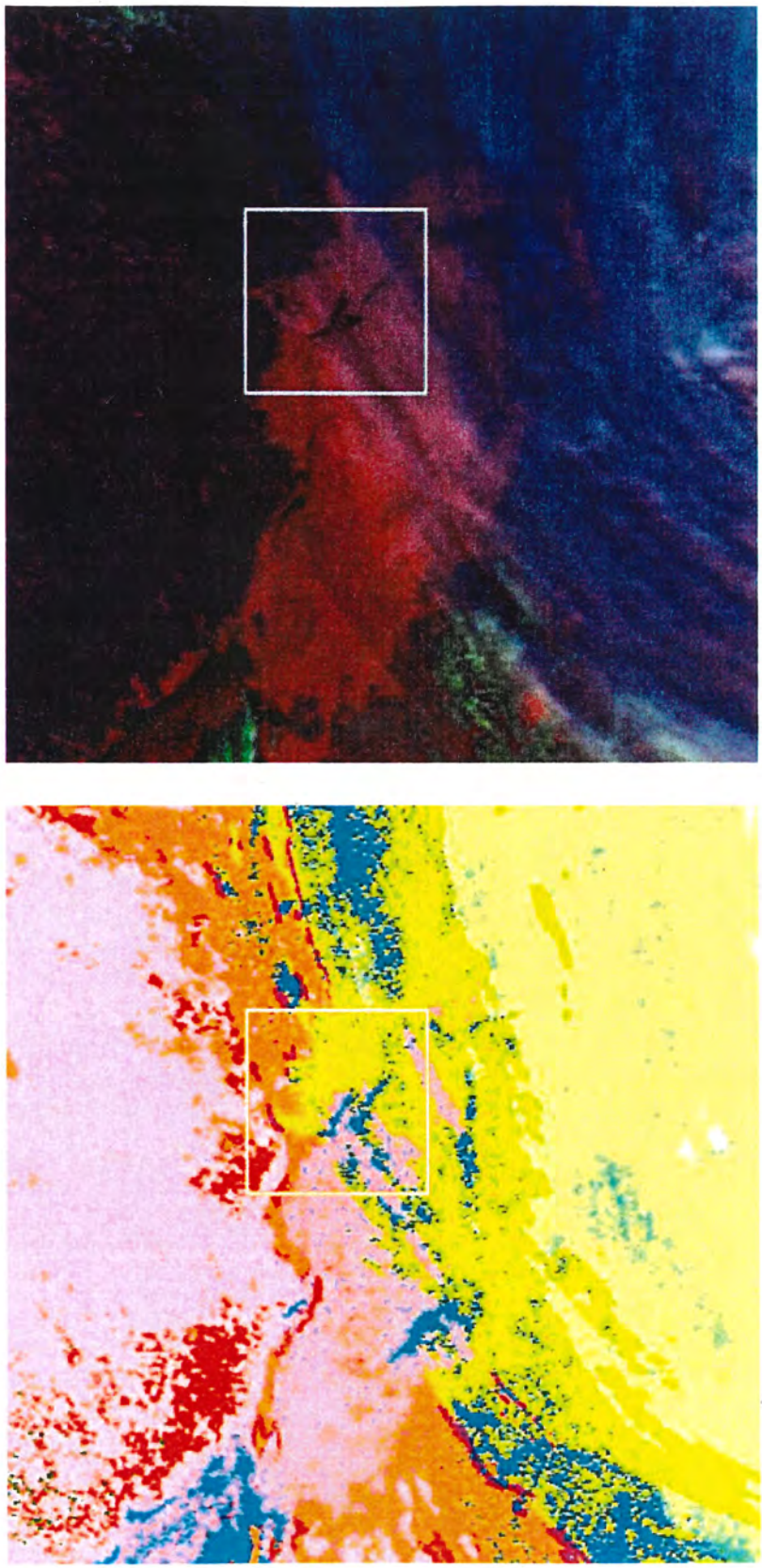
22 FEBRUARY 2001 00:34 NSWE 7/1

Low stratus above land, small thermal contrast (~5 K)



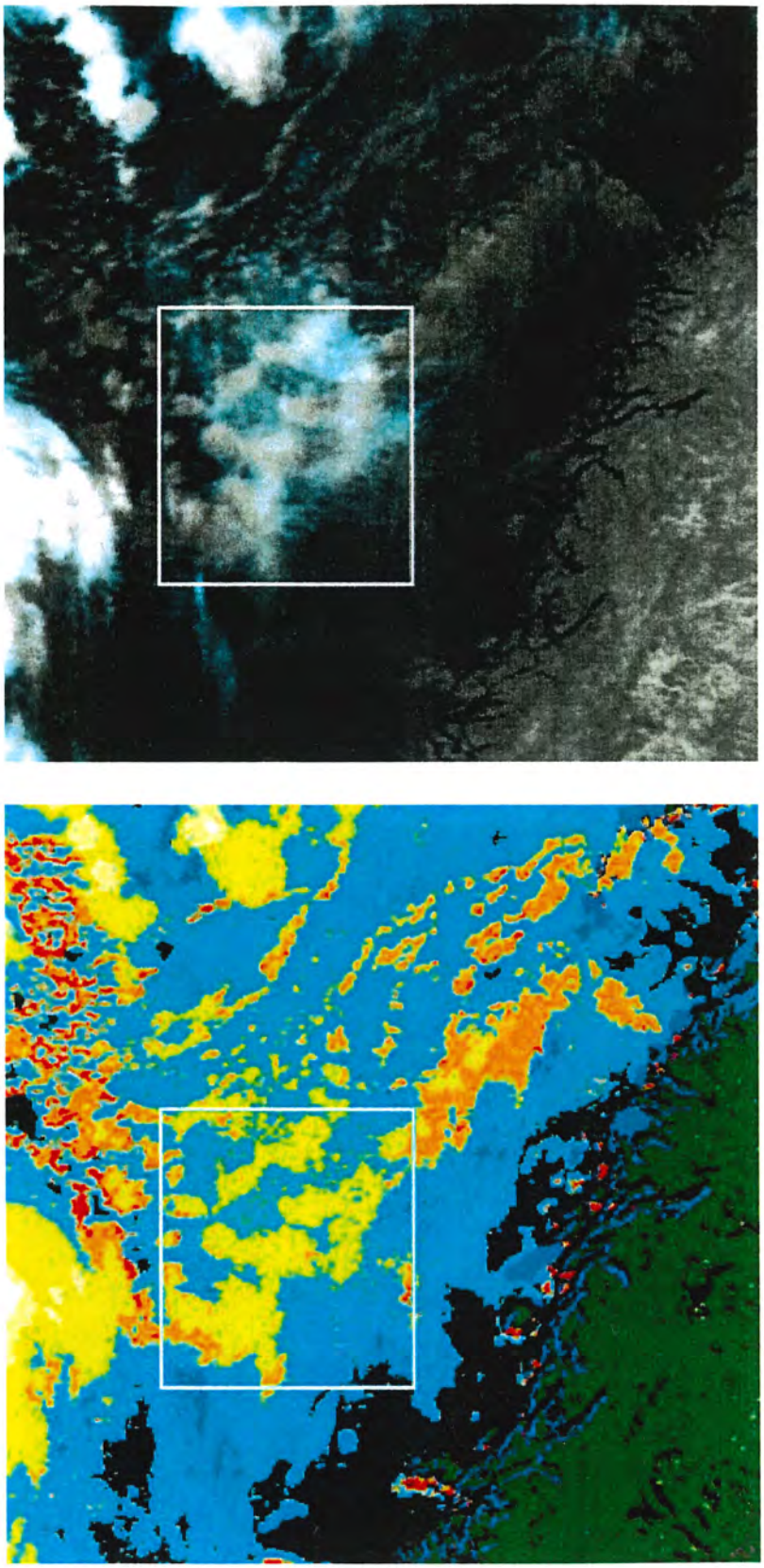
21 FEBRUARY 2001 00:44 NSWE 7/2

Low stratus above sea, large thermal contrast (~18 K)



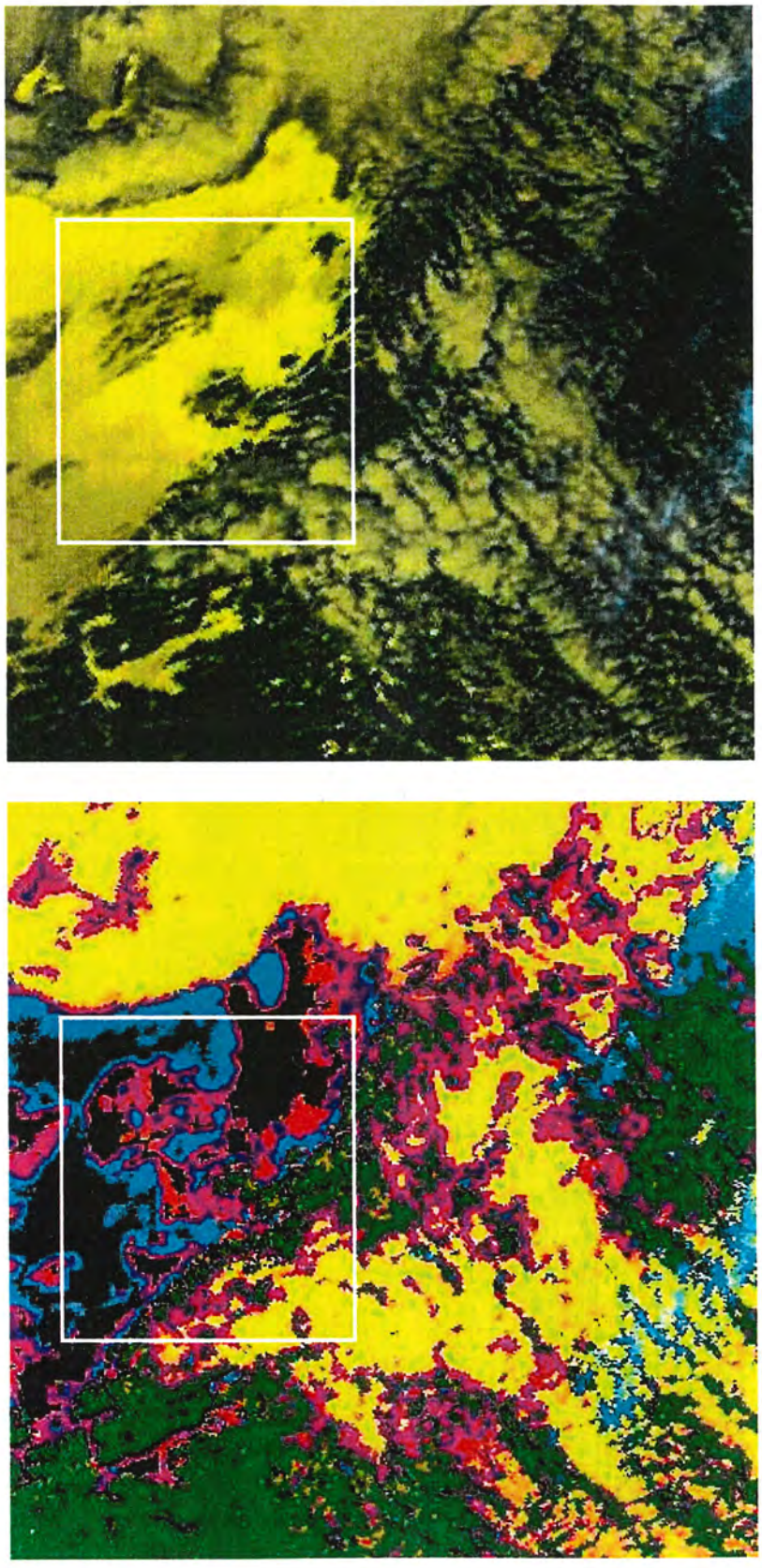
03 MARCH 2001 12:15 NSWE 15/9

Very thin cirrus classified as medium level clouds



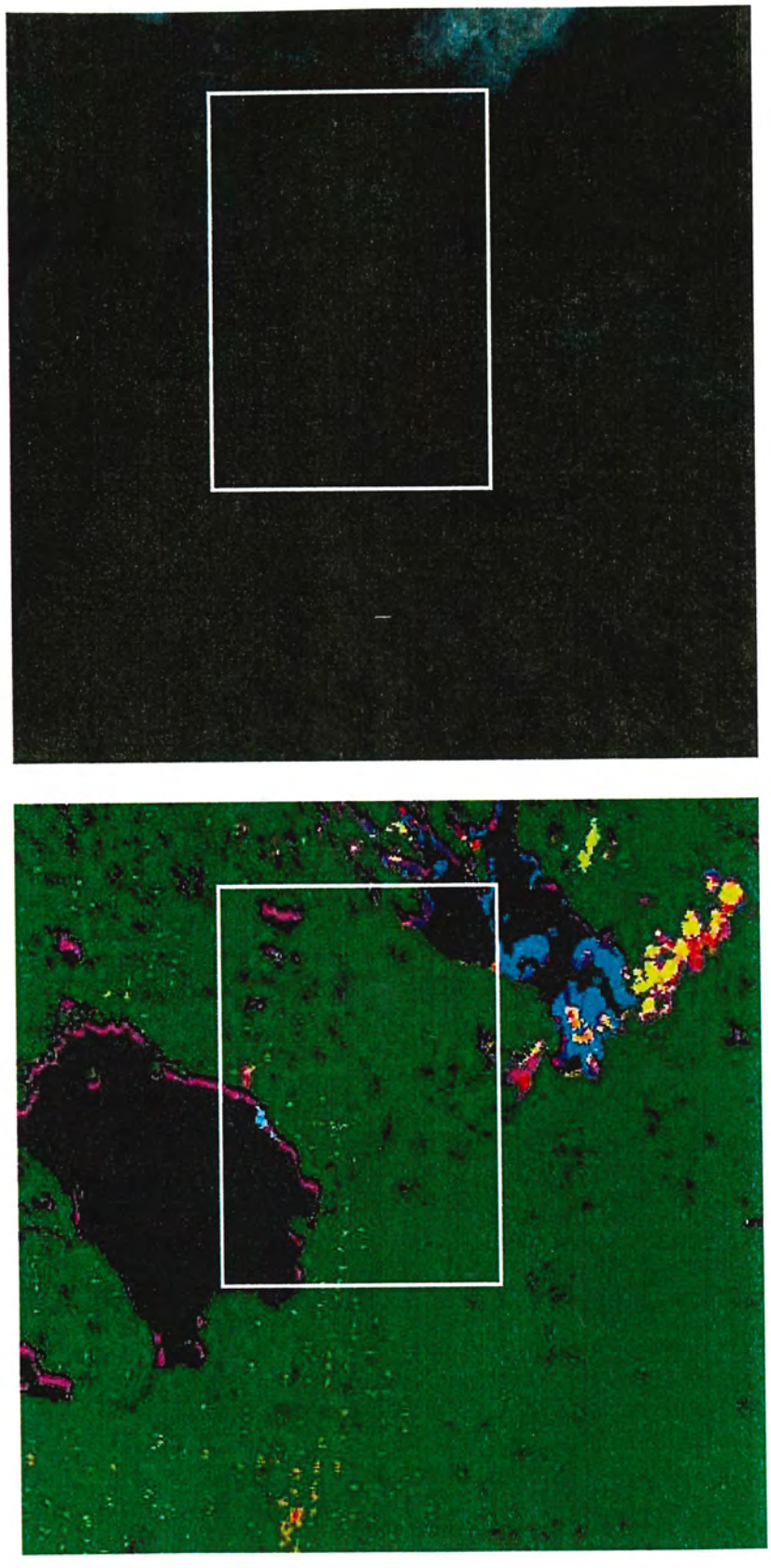
27 FEBRUARY 2001 01:23 NSWE 18/9

Cirrus superimposed on low clowd classified as medium level clouds



10 AUGUST 2000 13:31 CLIWANET NORTH 2 / 5

Cloud free sea in SUN GLINT conditions, classified as low stratus



27 AUGUST 2000 03:56 NSWE 5 / 1

Very low clouds classified as cloud free land

Notations & Symbols

R - region : S = sswe (winter) or cliwanet_south (summer)

N = nswe (winter) or cliwanet_north (summer)

CTI : cloud type interpreted by the operator

CTM: cloud type model

X,Y : pixel coordinates

LA, LO : pixel latitude, longitude

C1-C5 : AVHRR channel 1 to 5 pixel values calibrated in bi-directional albedo and brightness temperature

the notations following refers to the *quality flags*:

LA : land, CO : coast, TW : twilight, SU : sun glint, HI : high terrain, IN : low level inversion, NW : nwp data

MI : AVHRR channel data missing, LO : low quality, RE : reclassification, ST : stratus - stratocumulus distinction performed

1. The notations followed by a * (star) symbol refer to the "witness" pixel, the notations without a star to the "target" pixel

2. Tables are spread on multiple pages, to keep track of particular record, the record number (NR) should be used

WINTER DATA : February-March 2001, "Target pixel" information

NR	DATE	TIME	R	CTI	CTM	X	Y	LO	LA	C1	C2	C3	C4	C5	LA	CO	NI	TW	SU	HI	IN	NW	MI	LO	RE	ST
1	2001-03-03	10:36	N	3	5	831	856	22.49	62.05	14.61	15.55	5.05	260.76	260.53	1	0	0	0	0	0	0	1	0	0	0	0
2	2001-02-22	02:15	N	3	9	700	341	21.24	66.87	0.02	0.1	239.95	239.48	239.54	1	0	1	0	0	0	0	1	0	0	0	0
3	2001-02-22	00:34	N	4	2	823	550	23.3	64.81	0.02	0.05	258.17	257.55	256.76	0	0	1	0	0	0	0	1	0	1	0	0
4	2001-02-22	02:15	N	4	2	809	527	23.08	65.04	0.02	0.05	259.27	258.49	257.53	0	0	1	0	0	0	0	1	0	1	0	0
5	2001-03-01	02:43	N	4	2	829	522	23.52	65.05	0.02	0.1	256.39	255.25	254.45	0	0	1	0	0	0	0	1	0	1	0	0
6	2001-03-05	02:02	N	4	2	758	561	21.88	64.8	0.02	0.05	259.22	259.61	259.13	0	0	1	0	0	0	0	1	0	1	0	0
7	2001-02-23	10:17	N	4	7	1011	565	27.16	64.34	16.86	17.08	1.98	251.01	250.37	0	1	0	0	0	0	0	1	0	0	0	0
8	2001-03-07	01:41	S	5	2	101	500	7.56	65.44	0.02	0.05	261.84	261.33	260.86	0	0	1	0	0	0	0	1	0	0	0	0
9	2001-02-22	00:34	N	7	1	488	453	16.16	66.01	0.02	0.05	248.46	248.5	248.3	1	0	1	0	0	1	0	1	0	0	0	0
10	2001-03-07	01:41	N	7	1	169	782	9.54	62.93	0.02	0.1	261.81	262.87	262.7	1	0	1	0	0	1	0	1	0	0	0	0
11	2001-02-19	01:05	S	7	1	865	671	23.75	63.66	0.02	0.1	254.24	249.58	248.84	1	0	1	0	0	0	1	1	0	0	0	0
12	2001-02-22	00:34	S	7	1	527	497	16.99	65.59	0.02	0.05	250.27	252.73	252.29	0	1	1	0	0	0	0	1	0	0	0	0
13	2001-02-21	00:44	N	7	2	747	662	21.37	63.9	0.02	0.1	249.6	249.93	249.87	0	0	1	0	0	0	0	1	0	1	0	0
14	2001-02-22	00:34	N	9	1	463	468	15.59	65.88	-320.01	0.05	245.67	245.94	245.43	1	0	1	0	0	1	0	1	0	0	0	0
15	2001-03-02	00:52	N	9	1	373	677	13.6	63.97	0.02	0.1	237.11	237.83	237.56	1	0	1	0	0	1	0	1	0	0	0	0
16	2001-03-08	03:11	N	9	1	64	919	7.76	61.61	0.02	0.05	255.63	256.75	256.61	1	0	1	0	0	1	0	1	0	0	0	0
17	2001-02-19	02:46	S	9	1	581	301	18.53	67.35	0.02	0.1	245.41	242.88	241.28	1	0	1	0	0	1	0	1	0	0	0	0
18	2001-02-20	02:36	S	9	1	992	749	25.96	62.74	0.02	0.05	244.28	241.68	240.7	0	1	1	0	0	0	0	1	0	0	0	0
19	2001-02-27	01:23	S	9	1	165	206	8.33	68.2	0.02	0.05	260.0	256.07	254.13	0	0	1	0	0	0	0	1	0	0	0	0
20	2001-03-06	01:52	S	9	1	895	148	26.71	68.32	0.02	0.1	247.4	246.87	246.89	1	0	1	0	0	0	1	1	0	0	0	0
21	2001-03-08	03:11	S	9	1	406	235	14.34	68.03	-320.01	0.05	271.14	268.17	267.0	0	0	1	0	0	0	0	1	0	0	0	0
22	2001-02-21	02:25	N	9	2	785	661	22.15	63.86	0.02	0.1	250.41	250.97	250.74	0	0	1	0	0	0	0	1	0	1	0	0
23	2001-03-07	11:33	N	9	4	837	523	23.69	65.03	20.1	19.24	2.36	265.46	264.67	0	0	0	0	0	0	0	1	0	0	0	0
24	2001-02-28	02:54	N	9	15	829	789	22.65	62.65	0.02	0.1	242.89	238.26	236.33	1	0	1	0	0	0	1	1	0	0	0	0

25	2001-03-05	02:02	S	11	1	390	199	13.94	68.37	0.02	0.05	272.95	269.6	268.03	0	1	1	0	0	0	0	1	0	0	0	0
26	2001-03-06	01:52	S	13	1	513	190	17.04	68.42	0.02	0.05	260.9	259.94	259.91	0	1	1	0	0	0	0	1	0	0	0	0
27	2001-02-21	00:44	N	15	1	973	493	26.71	65.06	0.02	0.05	258.11	257.7	257.22	1	0	1	0	0	0	0	1	0	0	0	0
28	2001-03-03	00:42	N	15	2	698	784	20.09	62.85	-320.01	0.05	252.74	254.27	252.83	0	0	1	0	0	0	0	1	0	1	0	0
29	2001-02-26	11:26	N	15	5	46	917	7.41	61.61	21.15	20.83	11.76	252.25	251.94	1	0	0	0	0	1	0	1	0	0	0	0
31	2001-02-18	11:08	N	15	7	872	454	24.71	65.6	12.57	11.8	3.09	257.26	256.41	0	1	0	0	0	0	0	1	0	0	0	0
32	2001-02-18	12:49	N	15	7	890	701	24.14	63.35	7.6	8.83	3.41	262.46	261.61	1	0	0	0	0	0	0	1	0	0	0	0
33	2001-02-20	10:49	N	15	7	837	445	23.98	65.74	11.16	10.21	2.18	258.4	257.84	0	1	0	0	0	0	0	1	0	0	0	0
34	2001-02-24	10:09	S	15	7	923	139	27.44	68.34	8.18	8.16	2.18	249.6	248.8	1	0	0	0	0	0	0	1	0	0	0	0
35	2001-02-18	12:49	N	15	9	815	440	23.52	65.82	8.81	9.24	3.3	252.42	251.25	0	1	0	1	0	0	0	1	0	0	0	0
36	2001-02-18	12:49	N	15	9	914	653	24.8	63.74	7.6	9.29	4.56	254.65	253.61	1	0	0	1	0	0	0	1	0	0	0	0
37	2001-02-20	12:28	N	15	9	833	451	23.87	65.69	12.47	13.08	4.73	252.59	251.42	0	1	0	0	0	0	0	1	0	0	0	0
38	2001-02-23	11:58	N	15	9	287	974	12.03	61.26	11.63	13.03	8.69	248.54	248.28	1	0	0	0	0	1	0	1	0	0	0	0
39	2001-02-24	10:09	N	15	9	953	804	25.0	62.32	8.18	9.44	3.24	249.05	248.44	1	0	0	0	0	0	0	1	0	0	0	0
40	2001-02-27	11:15	N	15	9	999	718	26.23	63.0	12.47	13.54	4.67	245.42	244.88	0	1	0	0	0	0	0	1	0	0	0	0
41	2001-03-01	10:57	N	15	9	506	242	16.8	67.94	12.31	12.26	2.65	244.25	244.5	0	1	0	0	0	1	0	0	0	0	0	0
42	2001-03-02	12:25	N	15	9	814	545	23.12	64.87	14.51	14.78	5.46	241.13	240.5	0	0	0	0	0	0	0	1	0	0	0	0
43	2001-03-02	10:46	N	15	9	924	402	26.09	65.97	13.56	14.37	5.0	239.09	238.35	1	0	0	0	0	0	0	1	0	0	0	0
44	2001-03-03	10:36	N	15	9	851	443	24.3	65.73	17.38	16.57	4.23	249.8	248.99	0	1	0	0	0	0	0	1	0	0	0	0
45	2001-03-03	12:15	N	15	9	791	503	22.77	65.28	16.02	16.37	5.05	246.71	245.96	0	0	0	0	0	0	0	1	0	0	0	0
46	2001-03-04	10:25	N	15	9	814	463	23.41	65.61	20.26	19.96	6.67	247.99	247.23	0	0	0	0	0	0	0	1	0	0	0	0
47	2001-03-04	12:04	N	15	9	447	336	15.3	67.09	10.69	11.34	4.06	248.0	247.42	0	1	0	0	0	0	0	1	0	0	0	0
48	2001-02-27	11:15	S	15	9	56	208	5.64	68.06	15.92	17.7	4.17	229.15	229.03	0	0	0	0	0	0	0	1	0	0	0	0
49	2001-02-28	12:46	S	15	9	48	232	5.53	67.83	3.63	3.03	1.8	270.51	269.48	0	0	0	0	0	0	0	1	0	0	0	0
50	2001-03-04	10:25	S	15	9	978	610	26.28	64.01	8.96	10.16	4.2	258.87	258.16	0	1	0	0	0	0	0	1	0	0	0	0
51	2001-03-02	12:25	N	15	11	953	938	24.52	61.13	17.7	18.67	7.69	233.09	232.35	0	1	0	0	0	0	0	1	0	0	0	0

52	2001-02-18	12:49	N	15	17	109	987	8.72	61.04	16.39	14.83	5.02	248.19	244.12	0	1	0	0	0	1	0	0	0	0	0	0
53	2001-02-18	11:08	S	15	17	134	610	8.52	64.47	9.28	8.72	4.88	267.5	267.41	0	0	0	0	0	0	0	1	0	0	0	0
54	2001-02-18	12:49	S	15	17	134	221	7.6	68.03	7.6	7.23	4.56	267.39	267.13	0	0	0	1	0	0	0	1	0	0	0	0
55	2001-03-03	00:42	S	16	1	81	729	7.68	63.34	0.02	0.05	272.68	271.3	268.89	0	0	1	0	0	0	0	0	0	0	0	0
56	2001-02-19	12:39	N	16	9	254	800	11.25	62.82	14.92	15.13	5.17	244.48	243.94	1	0	0	0	0	1	0	1	0	0	0	0
57	2001-02-21	10:38	N	16	9	462	512	15.54	65.47	13.93	14.06	6.72	243.86	242.99	0	1	0	0	0	1	0	0	0	0	0	0
58	2001-03-06	01:52	N	18	1	806	883	21.95	61.84	0.02	0.05	253.65	254.92	254.14	0	1	1	0	0	0	1	1	0	0	0	0
59	2001-02-23	02:05	S	18	1	142	329	8.07	67.05	0.02	0.05	278.76	278.6	277.65	0	0	1	0	0	0	0	0	0	0	0	0
60	2001-03-05	02:02	S	18	5	435	363	15.0	66.85	0.02	0.05	258.14	259.14	258.66	1	0	1	0	0	1	0	1	0	0	0	0
61	2001-02-27	01:23	N	18	9	182	436	9.22	66.1	0.02	0.1	239.95	239.27	238.75	0	0	1	0	0	0	0	1	0	0	0	0
62	2001-03-06	01:52	N	18	9	154	165	7.94	68.57	0.02	0.1	252.87	250.84	250.58	0	0	1	0	0	0	0	1	0	0	0	0
63	2001-02-23	10:17	S	18	9	901	854	23.83	61.96	10.9	12.72	1.92	253.43	253.08	0	1	0	0	0	0	0	1	0	0	0	0
64	2001-03-01	02:43	S	18	9	929	370	26.35	66.25	0.07	0.1	242.84	242.51	242.82	0	1	1	0	0	0	1	1	0	0	0	0
65	2001-02-20	10:49	S	18	11	155	959	9.54	61.33	20.1	20.21	12.58	237.03	235.51	0	1	0	0	0	1	0	0	0	0	0	0
66	2001-02-27	01:23	N	19	1	288	1000	12.06	61.02	0.02	0.1	247.5	246.67	245.23	1	0	1	0	0	0	1	1	0	1	0	0

WINTER DATA : February-March 2001, "Witness pixel" information

NR	DATE	TIME	R	CTI*	CTM*	X*	Y*	LO*	LA*	C1*	C2*	C3*	C4*	C5*	LA*	CO*	NI*	TW*	SU*	HI*	IN*	NW*	MI*	LO*	RE*	ST*
1	2001-03-03	10:36	N	3	3	835	871	22.53	61.91	13.72	14.06	3.53	260.91	260.83	1	0	0	0	0	0	0	1	0	0	0	0
2	2001-02-22	02:15	N	1	1	670	340	20.54	66.92	0.02	0.1	244.1	244.03	243.74	0	1	1	0	0	0	0	1	0	0	0	0
3	2001-02-22	00:34	N	2	2	801	570	22.76	64.66	0.02	0.05	270.53	270.32	269.02	0	0	1	0	0	0	0	0	0	0	0	0
4	2001-02-22	02:15	N	2	2	793	573	22.59	64.65	0.02	0.05	271.45	271.26	270.28	0	0	1	0	0	0	0	0	0	0	0	0
5	2001-03-01	02:43	N	2	2	856	480	24.26	65.39	0.02	0.05	264.57	263.92	262.36	0	0	1	0	0	0	0	1	0	1	0	0
6	2001-03-05	02:02	N	2	2	741	557	21.53	64.86	0.02	0.05	268.85	268.46	266.71	0	0	1	0	0	0	0	0	0	0	0	0
7	2001-02-23	10:17	N	3	3	1012	552	27.24	64.45	6.56	8.47	1.16	251.88	251.9	0	1	0	0	0	0	0	1	0	0	0	0
8	2001-03-07	01:41	S	2	2	123	516	8.08	65.32	0.02	0.1	264.99	262.11	260.72	0	0	1	0	0	0	0	1	0	0	0	0
9	2001-02-22	00:34	N	1	1	510	443	16.67	66.09	0.02	0.05	252.85	253.92	253.79	1	0	1	0	0	1	0	1	0	0	0	0
10	2001-03-07	01:41	N	7	7	125	738	8.58	63.3	0.02	0.1	265.0	265.56	265.23	0	1	1	0	0	0	0	1	0	1	0	0
11	2001-02-19	01:05	S	7	7	844	707	23.2	63.36	0.02	0.1	253.6	247.41	246.14	0	1	1	0	0	0	1	1	0	0	0	0
12	2001-02-22	00:34	S	7	7	606	556	18.63	65.0	0.02	0.1	252.1	251.35	250.76	1	0	1	0	0	0	0	1	0	0	0	0
13	2001-02-21	00:44	N	2	2	797	668	22.37	63.78	0.01	0.05	268.06	268.04	267.44	0	0	1	0	0	0	0	0	0	0	0	0
14	2001-02-22	00:34	N	5	5	443	458	15.14	65.97	0.02	0.05	253.47	256.56	256.24	1	0	1	0	0	1	0	1	0	0	0	0
15	2001-03-02	00:52	N	15	15	365	673	13.43	64.0	0.02	0.1	246.72	244.43	243.94	1	0	1	0	0	1	0	1	0	1	0	0
16	2001-03-08	03:11	N	9	9	21	786	6.62	62.76	0.02	0.1	257.6	257.69	257.39	0	1	1	0	0	0	0	1	0	0	0	0
17	2001-02-19	02:46	S	9	9	615	284	19.38	67.48	0.02	0.05	267.37	266.73	266.23	1	0	1	0	0	1	0	1	0	0	0	0
18	2001-02-20	02:36	S	9	9	1017	825	26.13	62.02	0.02	0.1	249.64	248.7	248.27	0	1	1	0	0	0	1	1	0	0	0	0
19	2001-02-27	01:23	S	9	9	165	219	8.36	68.08	0.02	0.1	267.06	257.04	254.96	0	0	1	0	0	0	0	1	0	0	0	0
20	2001-03-06	01:52	S	3	1	984	155	28.82	68.06	0.02	0.1	249.52	249.06	249.2	1	0	1	0	0	0	0	1	0	0	0	0
21	2001-03-08	03:11	S	9	9	382	230	13.74	68.08	0.02	0.05	269.9	267.3	266.28	0	1	1	0	0	0	0	1	0	0	0	0
22	2001-02-21	02:25	N	9	9	800	652	22.48	63.92	0.02	0.1	250.48	250.65	250.39	0	0	1	0	0	0	0	0	0	0	0	0
23	2001-03-07	11:33	N	4	4	893	480	25.06	65.33	20.47	18.93	1.36	263.83	263.15	0	0	0	0	0	0	0	1	0	0	0	0

24	2001-02-28	02:54	N	1	1	847	796	22.98	62.56	0.07	0.1	254.28	253.07	252.27	1	0	1	0	0	0	1	1	0	1	0	0
25	2001-03-05	02:02	S	11	11	388	202	13.89	68.34	0.02	0.1	268.53	262.1	259.62	0	1	1	0	0	0	0	1	0	0	0	0
26	2001-03-06	01:52	S	13	13	527	195	17.39	68.37	0.02	0.05	266.65	265.42	264.93	0	1	1	0	0	0	0	1	0	0	0	0
27	2001-02-21	00:44	N	1	1	984	535	26.74	64.66	0.02	0.05	259.24	258.35	257.84	1	0	1	0	0	0	0	1	0	0	0	0
28	2001-03-03	00:42	N	7	7	681	808	19.71	62.65	0.02	0.1	252.89	257.08	256.93	0	0	1	0	0	0	0	1	0	0	0	0
29	2001-02-26	11:26	N	15	15	33	931	7.2	61.47	13.72	14.67	10.42	256.12	254.46	0	1	0	0	0	1	0	0	0	0	0	0
31	2001-02-18	11:08	N	4	4	894	458	25.18	65.52	14.72	13.85	2.86	262.91	262.21	0	1	0	0	0	0	0	1	0	0	0	0
32	2001-02-18	12:49	N	4	4	868	719	23.64	63.22	10.37	10.16	2.91	265.02	263.6	0	1	0	0	0	0	0	1	0	0	0	0
33	2001-02-20	10:49	N	4	4	802	452	23.19	65.73	17.28	15.85	1.1	264.43	263.72	0	1	0	0	0	0	0	1	0	0	0	0
34	2001-02-24	10:09	S	3	3	903	150	26.89	68.29	8.54	9.7	1.89	250.11	249.85	1	0	0	0	0	0	0	1	0	0	0	0
35	2001-02-18	12:49	N	15	15	813	430	23.51	65.91	6.61	7.39	3.3	253.81	252.62	0	1	0	1	0	0	1	0	0	0	0	0
36	2001-02-18	12:49	N	1	1	927	664	25.02	63.62	5.3	6.52	3.06	261.56	260.68	0	1	0	0	0	0	0	1	0	1	0	0
37	2001-02-20	12:28	N	15	15	842	459	24.04	65.6	8.02	8.62	4.82	252.25	250.56	0	0	0	0	0	0	0	1	0	0	0	0
38	2001-02-23	11:58	N	3	3	304	1001	12.36	61.02	3.89	3.95	0.48	257.59	257.2	0	1	0	0	0	0	0	1	0	0	0	0
39	2001-02-24	10:09	N	3	3	940	784	24.82	62.52	7.34	8.57	1.22	253.07	252.91	1	0	0	0	0	0	0	1	0	0	0	0
40	2001-02-27	11:15	N	3	3	998	706	26.26	63.11	4.36	4.05	0.31	254.97	254.79	0	1	0	0	0	0	0	1	0	0	0	0
41	2001-03-01	10:57	N	3	3	489	244	16.38	67.93	21.72	24.0	3.35	255.79	255.12	0	1	0	0	0	0	0	1	0	0	0	0
42	2001-03-02	12:25	N	15	15	794	569	22.62	64.68	14.56	14.62	5.96	241.93	240.52	0	0	0	0	0	0	0	1	0	0	0	0
43	2001-03-02	10:46	N	15	15	917	396	25.96	66.04	12.36	13.29	5.02	238.68	237.34	1	0	0	0	0	0	0	1	0	0	0	0
44	2001-03-03	10:36	N	15	15	850	469	24.17	65.5	10.48	9.49	3.68	252.59	250.93	0	0	0	0	0	0	0	1	0	0	0	0
45	2001-03-03	12:15	N	15	15	786	495	22.69	65.36	12.05	11.7	4.32	250.85	249.53	0	0	0	0	0	0	0	1	0	0	0	0
46	2001-03-04	10:25	N	15	15	787	482	22.75	65.48	12.15	11.9	5.38	256.77	256.08	0	0	0	0	0	0	0	1	0	0	0	0
47	2001-03-04	12:04	N	15	15	404	306	14.28	67.38	6.14	6.16	3.15	258.23	256.92	0	1	0	0	0	0	0	1	0	0	0	0
48	2001-02-27	11:15	S	3	3	25	209	4.89	68.0	9.17	9.8	4.15	232.42	232.15	0	0	0	0	0	0	0	1	0	0	0	0
49	2001-02-28	12:46	S	3	3	44	246	5.49	67.69	4.73	4.57	3.91	266.81	265.55	0	0	0	0	0	0	0	1	0	0	0	0
50	2001-03-04	10:25	S	3	3	970	576	26.27	64.32	8.6	9.59	2.56	257.75	257.68	1	0	0	0	0	0	0	1	0	0	0	0

51	2001-03-02	12:25	N	15	15	849	968	22.52	61.02	18.95	20.06	11.38	245.97	244.31	1	0	0	0	0	0	0	1	0	0	0	0
52	2001-02-18	12:49	N	17	17	76	970	8.08	61.16	18.59	17.8	12.0	237.86	233.62	0	1	0	0	0	1	0	0	0	0	0	0
53	2001-02-18	11:08	S	1	1	98	617	7.78	64.37	6.29	5.8	6.43	272.44	271.4	0	0	0	0	0	0	0	1	0	0	0	0
54	2001-02-18	12:49	S	3	3	148	223	7.95	68.03	6.03	5.75	3.3	269.53	269.01	0	0	0	1	0	0	0	1	0	0	0	0
55	2001-03-03	00:42	S	1	1	54	717	7.11	63.42	0.02	0.1	272.11	270.73	268.46	0	0	1	0	0	0	0	0	0	0	0	0
56	2001-02-19	12:39	N	3	3	174	828	9.71	62.52	12.94	11.18	3.76	263.69	263.3	1	0	0	0	0	1	0	1	0	0	0	0
57	2001-02-21	10:38	N	15	15	456	516	15.41	65.44	13.62	14.06	8.72	244.44	243.18	0	1	0	0	0	1	0	0	0	0	0	0
58	2001-03-06	01:52	N	5	5	870	881	23.16	61.77	0.02	0.05	256.33	258.68	259.15	0	1	1	0	0	0	1	1	0	0	0	0
59	2001-02-23	02:05	S	7	7	100	367	7.19	66.65	0.02	0.05	275.21	272.8	271.26	0	0	1	0	0	0	0	1	0	0	0	0
60	2001-03-05	02:02	S	17	17	377	398	13.65	66.53	0.02	0.05	256.1	253.23	252.45	0	1	1	0	0	0	1	1	0	0	0	0
61	2001-02-27	01:23	N	15	15	160	434	8.72	66.1	0.02	0.1	257.52	247.03	245.6	0	0	1	0	0	0	0	1	0	0	0	0
62	2001-03-06	01:52	N	5	5	191	158	8.86	68.66	0.02	0.1	256.25	256.09	255.62	0	0	1	0	0	0	0	1	0	0	0	0
63	2001-02-23	10:17	S	7	7	943	898	24.47	61.5	4.83	6.72	1.07	254.27	254.28	0	1	0	0	0	0	0	1	0	0	0	0
64	2001-03-01	02:43	S	7	7	894	444	25.24	65.65	0.07	0.1	247.44	248.68	249.34	1	0	1	0	0	0	1	1	0	0	0	0
65	2001-02-20	10:49	S	15	15	223	895	10.74	61.94	20.31	21.8	17.13	231.48	229.47	1	0	0	0	0	1	0	1	0	0	0	0
66	2001-02-27	01:23	N	3	1	336	975	12.94	61.26	0.02	0.05	242.96	241.09	241.3	1	0	1	0	0	1	0	1	0	0	0	0

WINTER DATA : February-March 2001, "Comments" information

DATE	COMMENTS
2001-03-03	snow contaminated land over a very large area;land;witness is snow / ice contaminated land, d4 ~ 0.15 C ;land
2001-02-22	snow contaminated land over a very large area (checked with 10:27 image);land;witness is snow / ice contaminated land, d4 ~ 4C ;coast
2001-02-22	ice on sea(checked with 10:27 image), low; witness is cloud free sea, d4 is 18 C, could not have such a temperature gradient, d4-d5 ~ 0.2;
2001-02-22	ice on sea (checked with 10:27 image);low;witness is cloud free sea, d4 is 13 C, could not have such a temperature gradient, d4-d5 ~ 1C;
2001-03-01	ice on sea;,low;witness is cloud free sea, d4 ~ 9 C;sea,low;
2001-03-05	ice / snow contaminated sea;,low;witness is cloud free sea,d4~7C, t4-t5~0.5;sea;
2001-02-23	ice on a lake;coast;witness is snow /ice contaminated land, d4 < 1C;coast;
2001-03-07	very low stratus;sea;witness is cloud free sea, d4 ~3C, t4-t5~0.5C;sea;
2001-02-22	low stratiform cloud over the land, high so most probably snow /ice covered;high;witness is cloud free land, d4=5.3 C,d4-d5 < 0.2;land,high
2001-03-07	low stratus;land,high;witness is low stratus (same), d4~3C, d4-d5=0.03C;coast,low;
2001-02-19	low stratus;land,,low;witness is low stratus (same), d4~0.5C, d4-d5=0.3C;
2001-02-22	low stratus;coast;witness is low stratus (same cloud),d4 ~0.5C,t4-t5~0.5C; sea;
2001-02-21	low stratiform clouds over the sea;low;witness is cloud free sea, not low, T4 is 18 C warmer then target;sea
2001-02-22	medium stratiform over land and low stratiform, high so most probably snow / ice covered;high;witness is very low stratus, d4 ~11 C;high;
2001-03-02	medium level over land;,high;witness is very thin cirrus, d4~7 C, t4-t5 ~ 0.3 C;land,high,low;
2001-03-08	medium stratus;land,high;d4 < 1C, t4-t5=0.06;coast;
2001-02-19	low stratus;land,inv;witness is the same medium stratus, d4 ~0.3 C, t4-t5~0.2;coast,inv;
2001-02-20	medium stratus;land,inv;d4 < 0.6C, t4-t5=0.14;land,inv;
2001-02-27	medium stratus;high,land;witness is medium stratus,d4~0.4, t4-t5~0.3;inv,,coast;
2001-03-06	medium stratus;land,inv;d4 < 3C, t4-t5<0.4;coast,inv;
2001-03-08	medium stratus;coast,nw;witness is same medium stratus cloud, d4=0.01C, t4-t5=0.27;land;
2001-02-21	medium stratiform over sea, the wide stratiform band continues on land;,low;witness is medium stratiform and d4,d5 ~ 0.2-0.3, sea surface temperature could not be 250 K(when t4-t5=0.26);
2001-03-07	very thin cirrus above ice on sea(transparent);,sea;witness is snow/ice contaminated sea, d4~5C,t4-t5=0.35;sea;
2001-02-28	medium level over land;,inv;witness is cloud free land, d4~17 C, t4-t5 ~ 2 C;land,inv,low;

2001-03-05	high opaque stratus, no visible holes in the cloud;coast;witness is same high opaque cloud, d4=0.23C, t4-t5=0.40C;coast;
2001-03-06	very high stratus with no visible breakthroughs (the cloud free classification shows the same t4);coast;withness is same very high stratus,d4=0.01C, t4-t5=0.85C;land;
2001-02-21	very thin cirrus over snow / ice land (snow / ice was assumed since on the daylight image was snow /ice);land;witness is cloud free;land,
2001-03-03	very thin cirrus over low stratiform clouds (transparent);,sea,low;witness is the same low level stratiform, d4 < 3 C, t4-t5 < 0.2;,sea;
2001-02-26	very thin cirrus over mountains covered by snow / ice, transparent, can see valey and snow / ice;witness is a valley covered by the same very thin cirrus layer and classified OK, d4 = 4.18 C,coast, high;
2001-02-18	very thin cirrus over snow/ice sea (you can see the through them) taken as low stratus;coast,
2001-02-18	very thin cirrus over snow / ice land (you can see the ice through);land, ; witness is cloud free land;coast;
2001-02-20	very thin cirrus over snow / ice coast (you can see the ice through);coast;witness is cloud free coast; coast,
2001-02-24	very thin cirrus superimposed on ice / snow contaminated land(transparent);coast;witness is snow / ice contaminated land, d4 ~4C,t4-t5~1C;land;
2001-02-18	very thin cirrus over snow /ice sea (you can see through);coast, twil; witness is also thin cirrus but above much less snow / ice is correctly interpreted;Coast, Twil, Inv; d4 = 1 C, d1 = 2
2001-02-18	thin cirrus over snow / ice land;land, ; witness is cloud free land;coast,,low;
2001-02-20	very thin cirrus over snow / ice coast (you can see the ice through);coast;witness is very thin cirrus; coast;
2001-02-23	very thin cirrus overv snow / ice contaminated land(transparent);,high;witness is land contaminated ice/snow, d4 ~9 C;,coast
2001-02-24	very thin cirrus overv snow / ice contaminated land(transparent);;witness is land contaminated ice/snow, d4 ~5 C;;
2001-02-27	very thin cirrus over land contaminated snow / ice (transparent);, coast;witness is land contaminated snow /ice, d4 ~ 9 C;,coast
2001-03-01	very thin cirrus over snow / ice contaminated land;coast;witness is snow /ice contaminated land, d4~1.5 C;, coast;
2001-03-02	very thin cirrus above sea ice (transparent, can see navigation "channels");,sea;witness is very thin cirrus, d4 ~ 0.17 C, t4-t5 ~ 0.4 C;,sea;
2001-03-02	very thin cirrus over land contaminated snow / ice (transparent);;witness is very thin cirrus, d4 ~ 0.41 C;,land
2001-03-03	very thin cirrus (same) over snow / ice (coast), transparent;coast;witness is very thin cirrus over ice / snow contaminated sea;d4 ~ 2 C, t4-t5 ~ 1.5 C;sea;
2001-03-03	very thin cirrus over ice / snow contaminated sea (transparent);sea;witness is same very thin cirrus, correctly classif (higher contrast with the underlying surface wich is "canal" in the ice, d4~4C, t4-t5 ~ 1C;sea;
2001-03-04	very thin cirrus over ice / snow contaminated sea (transparent);sea;witness is same very thin cirrus, correctly classif. (higher contrast with the underlying surface wich is "canal" in the ice), d4~10C, t4-t5 ~ 0.5C;sea;
2001-03-04	very thin cirrus over ice / snow contaminated land (transparent);,coast;witness is very thin cirrus over sea, d4 10C, t4-t5 ~0.5;, coast
2001-02-27	very thinn cirrus over snow contaminated land;coast,high;witness is snow contaminated land,d4~4C, c4-c5~0.2;coast,high;
2001-02-28	very thinn cirrus over snow contaminated land;coast,high;witness is snow contaminated land,d4~7C, c4-c5~0.4;coast,high;
2001-03-04	very thin cirrus over snow contaminated land(transparent);land;witness is snow contaminated land,d4~13C,t4-t5~0.5;land;
2001-03-02	very thin cirrus above low stratiform cloudsor low clouds ;,coast;witness is thin cirrus;d4 < 1 C;,coast

2001-02-18	very thin cirrus over snow/ice land (you can see the through them) taken as thik cirrus, witness is really thick ciirus ;coast, high
2001-02-18	very thin cirrus above land;coast;witness is very thin cirrus,d4~9C,t4-t5~6C;coast;
2001-02-18	very thin cirrus superimposed on snow / ice contaminated land (transparent);coast,high;witness is ice / snow contaminated land, d4~9C, t4-t5~3C;high,land;
2001-03-03	thin cirrus;land,inv;witness is cloud free land, d4~4C, t4-t5~0.15C;inv,,land;
2001-02-19	very thin cirrus over snow / ice land (you can almost see the ice through);land, ; witness is cloud free snow / ice land;land, high;
2001-02-21	thin cirrus over most probably snow / ice coast;coast, high; witness is very thin cirrus, d4,d5 ~0.5 ;coast,high;
2001-03-06	very thin cirrus over very low stratus(can see the stratus through the cirrus);inv,coast;witness is very low stratus d4~4C, t4-t5~0.7C;inv,coast;
2001-02-23	cirrus superimposed on low stratus;high,,land;witness is medium stratus,d4 ~2.5C,t4-t5=0.18;land,high;
2001-03-05	cirrus superimposed on low clouds, correctly classified over the sea (same cloud);inv,coast;witness is cirrus over sea, d4 ~2C, t4-t5=0.01C;,sea;
2001-02-27	very thin cirrus above low stratiform clouds (you can see through);,sea;witness is thick cirrus over sea;d4 ~ 8 C, t4-t5 = 0.5;
2001-03-06	cirrus superimposed on low clouds;,sea;witness is low stratus, d4 ~6C,t4-t5~0.3C;,sea;
2001-02-23	very thin cirrus superimposed on low clouds;land;witness is low stratus, d4 ~7C, t4-t5~0.5;land,
2001-03-01	cirrus superimposed on low clouds(transparent);,low;witness is low stratus;d4~19C,c4-c5~1.2C;coast;
2001-02-20	thin cirrus superimposed on low clouds;land;witness is very thin cirrus over sea, d4~7C, t4-t5~1.5C;coast;
2001-02-27	medium stratiform cloud over snow / ice contaminated land ;inv,low;witness is snow / ice contaminated land, d4 ~4 C;high;

SUMMER DATA : August 200, "target" pixel information

DATE	TIME	SA	CTI	CTM	X	Y	LON	LAT	C1	C2	C3	C4	C5	CO	NI	TW	SU	HI	IN	NW	LO	MI	RE	ST
2000-08-10	13:31	12	2	5	338	433	11.64	65.29	61.62	47.33	322.56	280.22	279.5	0	0	0	1	0	0	0	0	0	0	0
2000-08-14	13:41	12	2	5	724	978	19.95	60.62	61.31	47.74	322.57	284.07	283.32	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	12	2	5	721	43	19.9	58.83	73.19	56.97	322.37	286.42	284.32	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	12	2	5	934	176	23.48	57.58	59.75	46.72	322.5	286.43	284.68	0	0	0	1	0	0	0	0	0	0	0
2000-08-09	13:56	12	2	5	401	365	14.79	55.82	38.59	29.58	322.44	284.08	282.27	0	0	0	1	0	0	0	0	0	0	0
2000-08-13	14:05	12	2	5	371	493	14.48	54.65	54.85	42.06	322.58	286.53	284.77	0	0	0	1	0	0	0	0	0	0	0
2000-08-13	14:05	12	2	5	436	494	15.49	54.68	93.83	99.78	322.52	286.54	284.55	0	0	0	1	0	0	0	0	0	0	0
2000-08-14	13:41	12	2	5	680	319	19.25	56.34	91.43	97.14	322.49	286.52	285.15	0	0	0	1	0	0	0	0	0	0	0
2000-08-27	13:45	12	2	5	730	266	20.06	56.82	101.65	84.15	322.31	286.54	285.48	0	0	0	1	0	0	0	0	0	0	0
2000-08-27	13:45	12	2	5	599	112	17.83	58.19	53.6	42.87	322.51	286.52	284.77	0	0	0	1	0	0	0	0	0	0	0
2000-08-30	14:18	12	2	5	385	548	14.76	54.16	63.6	51.69	322.59	286.58	284.93	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	12	2	7	379	626	12.97	63.61	94.87	99.27	322.31	282.66	281.11	0	0	0	1	0	0	1	0	0	0	0
2000-08-04	14:10	12	2	15	313	1045	12.6	59.81	91.95	88.82	322.46	289.99	286.31	1	0	0	0	0	0	1	0	0	0	0
2000-08-01	13:36	12	2	15	144	387	7.36	65.42	67.15	51.19	322.41	282.63	280.22	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	12	2	15	360	620	12.57	63.65	79.76	62.85	322.53	282.66	280.6	0	0	0	1	0	0	0	0	0	0	0
2000-08-04	14:10	12	2	15	375	1127	13.84	59.13	63.29	50.98	322.55	286.43	284.06	0	0	0	1	0	0	0	0	0	0	0
2000-08-05	13:46	12	2	15	643	947	18.46	60.89	48.8	38.3	322.29	286.45	284.16	0	0	0	1	0	0	0	0	0	0	0
2000-08-05	13:46	12	2	15	587	1103	17.53	59.47	60.79	46.32	322.38	284.06	280.76	0	0	0	1	0	0	1	0	0	0	0
2000-08-10	13:31	12	2	15	272	377	10.05	65.71	67.56	51.69	322.64	282.67	279.97	0	0	0	1	0	0	1	0	0	0	0
2000-08-12	14:28	12	2	15	150	1130	9.95	58.86	55.79	43.07	322.52	286.52	284.2	0	0	0	1	0	0	0	0	0	0	0
2000-08-14	13:41	12	2	15	247	512	9.98	64.47	53.49	41.35	322.53	282.73	280.1	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	12	2	15	668	35	18.98	58.89	56.2	44.19	322.17	286.41	283.83	0	0	0	1	0	0	0	0	0	0	0
2000-08-03	14:30	12	2	15	22	142	8.2	57.37	34.84	28.16	322.54	286.44	283.58	0	0	0	1	0	0	1	0	0	0	0

2000-08-04	14:10	12	2	15	330	468	13.81	54.84	27.65	21.06	322.37	286.5	283.24	0	0	0	1	0	0	1	0	0	0	0
2000-08-04	14:10	12	2	15	237	268	12.01	56.54	32.65	26.33	322.33	286.45	283.22	0	0	0	1	0	0	1	0	0	0	0
2000-08-04	14:10	12	2	15	344	34	13.37	58.74	91.95	88.62	322.39	290.01	287.26	0	0	0	1	0	0	0	0	0	0	0
2000-08-15	14:57	12	2	19	474	135	13.93	68.09	1.07	0.57	283.49	283.52	282.4	0	0	0	0	0	0	0	0	0	0	0
2000-08-27	03:56	12	5	1	1058	392	27.24	65.72	4.82	3.81	279.54	274.61	274.04	0	0	1	0	0	1	0	0	0	0	0
2000-08-17	02:53	14	5	1	661	745	19.03	52.51	0.56	0.79	275.24	275.33	274.61	0	1	0	0	0	1	1	0	0	0	0
2000-08-13	04:15	12	5	2	709	829	19.66	61.95	5.66	4.22	282.64	280.56	280.03	0	0	1	0	0	0	0	0	0	0	0
2000-08-04	04:20	12	5	2	952	317	23.65	56.31	7.84	6.04	287.17	282.67	281.86	0	0	0	0	0	0	1	0	0	0	0
2000-08-09	13:56	12	5	2	576	143	17.46	57.9	51.62	39.11	322.51	284.08	283.0	0	0	0	1	0	0	0	0	0	0	0
2000-08-12	14:28	12	5	2	111	466	10.43	54.63	57.45	46.32	322.36	286.56	284.71	0	0	0	1	0	0	0	0	0	0	0
2000-08-09	04:27	14	5	1	26	281	8.65	56.15	2.72	2.75	277.6	277.37	276.9	0	0	1	0	0	0	1	0	0	0	0
2000-08-09	04:27	14	7	1	40	395	9.17	55.16	2.51	2.53	276.46	276.29	275.5	0	0	1	0	0	0	1	0	0	0	0
2000-08-09	04:27	14	7	1	54	570	9.79	53.63	2.29	2.1	276.16	275.34	275.12	0	0	1	0	0	0	1	0	0	0	0
2000-08-13	04:15	12	7	2	667	976	18.91	60.63	5.34	3.91	280.4	279.72	279.27	0	0	1	0	0	0	0	0	0	0	0
2000-08-09	02:46	14	9	2	1504	354	32.35	55.38	2.08	1.99	266.31	264.88	264.21	0	0	1	0	0	1	0	0	0	0	0
2000-08-06	05:15	12	9	16	673	380	19.15	55.79	15.24	11.73	281.01	263.1	261.89	0	0	0	1	0	0	1	0	0	0	0
2000-08-27	03:56	12	15	1	1600	595	37.49	63.01	2.32	2.7	277.85	271.76	270.63	0	0	0	0	0	0	1	0	0	0	0
2000-08-27	12:29	14	15	1	1496	1058	33.59	59.19	4.45	7.11	290.3	281.4	279.26	0	0	0	0	0	0	1	1	0	0	0
2000-08-17	02:53	14	15	1	631	664	18.57	53.23	0.56	0.79	281.49	280.19	278.89	0	0	1	0	0	1	0	0	0	0	0
2000-08-21	03:47	14	15	1	1259	441	28.34	54.95	3.16	3.3	287.03	284.33	282.83	0	0	1	0	0	1	0	0	0	0	0
2000-08-03	14:30	12	15	2	247	381	9.53	65.64	3.99	2.8	291.06	280.21	278.62	0	0	0	1	0	0	0	0	0	0	0
2000-08-03	13:48	14	15	2	223	390	9.05	65.52	3.16	2.21	285.95	281.02	279.02	0	0	0	1	0	0	0	0	0	0	0
2000-08-19	13:26	12	15	2	75	449	6.19	64.75	35.98	27.65	322.51	280.27	277.75	0	0	0	1	0	0	0	0	0	0	0
2000-08-19	13:26	12	15	2	165	512	8.29	64.35	38.69	29.88	322.43	280.3	279.5	0	0	0	1	0	0	0	0	0	0	0
2000-08-09	13:56	12	15	2	578	133	17.48	57.99	51.72	38.91	322.48	284.08	280.92	0	0	0	1	0	0	1	0	0	0	0
2000-08-12	14:28	12	15	2	206	496	11.94	54.47	55.06	45.91	322.49	286.57	284.1	0	0	0	1	0	0	0	0	0	0	0

2000-08-12	14:28	12	15	2	79	43	8.87	58.34	56.31	42.87	322.41	286.52	284.2	0	0	0	1	0	0	0	0	0	0	0
2000-08-31	03:31	14	15	5	1378	308	34.48	65.99	2.72	3.3	277.89	272.04	271.01	0	0	1	0	0	1	0	0	0	0	0
2000-08-01	12:31	14	15	7	1607	290	39.43	65.61	8.02	6.13	274.96	258.35	257.92	0	0	0	0	0	0	1	0	0	0	0
2000-08-03	14:30	12	15	9	841	225	22.66	67.37	16.08	12.64	285.89	266.61	265.09	0	0	0	0	0	0	1	0	0	0	0
2000-08-03	16:11	12	15	9	821	251	22.18	67.14	12.01	9.6	290.82	267.2	265.98	0	0	0	0	0	0	1	0	0	0	0
2000-08-31	04:05	12	15	9	1371	314	34.3	65.95	2.84	3.1	274.13	265.87	264.42	0	0	0	0	0	0	1	0	0	0	0
2000-08-05	05:13	14	15	9	34	440	9.18	54.75	13.75	12.34	289.35	258.71	257.81	0	0	0	0	0	0	1	0	0	0	0
2000-08-12	03:52	14	15	9	373	378	14.37	55.68	2.72	2.75	273.0	268.18	267.78	0	0	1	0	0	0	1	0	0	0	0
2000-08-05	13:26	14	15	9	394	280	12.44	66.72	24.88	20.52	283.82	261.62	261.41	0	0	0	1	0	0	1	0	0	0	0
2000-08-07	13:04	14	15	9	145	224	6.64	66.86	30.83	24.66	283.52	252.92	251.88	0	0	0	1	0	0	1	0	0	0	0
2000-08-15	14:57	12	15	9	181	1114	10.44	59.04	9.09	8.48	281.96	271.22	269.82	0	0	0	1	0	0	1	0	0	0	0
2000-08-27	14:11	14	15	13	158	604	8.49	63.53	6.29	7.66	292.25	280.18	276.95	1	0	0	0	0	0	1	0	0	0	0
2000-08-11	13:55	14	15	14	158	754	11.68	52.11	40.45	33.71	280.9	251.74	250.65	0	0	0	0	0	0	1	0	0	0	0
2000-08-13	03:40	14	15	19	112	260	9.98	56.46	0.99	1.44	273.43	271.62	271.12	0	0	1	0	0	1	0	0	0	0	0
2000-08-27	03:56	12	16	1	1517	814	34.91	61.28	1.59	2.29	277.3	274.23	273.78	0	0	0	0	0	0	1	0	0	0	0
2000-08-27	14:11	14	16	1	1285	709	30.95	62.61	6.18	7.87	284.26	269.55	266.89	0	0	0	0	0	0	1	0	0	0	0
2000-08-29	05:35	14	16	1	938	925	23.92	61.04	9.32	8.96	283.26	271.78	271.02	0	0	0	0	0	0	1	0	0	0	0
2000-08-06	13:15	14	16	7	314	307	13.32	56.27	34.83	28.37	302.26	276.23	274.91	0	0	0	0	0	0	1	0	0	0	0
2000-08-29	05:35	14	16	9	771	470	20.95	65.18	10.83	11.14	281.91	268.37	267.26	0	0	0	0	0	0	1	0	0	0	0
2000-08-06	13:15	14	16	9	80	246	9.43	56.54	48.45	37.96	296.82	261.09	258.8	0	0	0	0	0	0	1	0	0	0	0
2000-08-27	04:18	14	16	9	355	675	14.46	53.0	1.75	2.32	280.95	273.4	271.68	0	0	1	0	0	0	1	0	0	0	0
2000-08-16	14:34	12	18	7	767	585	20.62	53.95	7.84	9.39	292.21	279.65	276.54	0	0	0	0	0	0	1	0	0	0	0
2000-08-13	04:15	12	18	9	505	949	15.92	60.81	6.8	5.54	276.12	271.64	271.05	0	0	1	0	0	1	0	1	0	0	0
2000-08-31	03:31	14	18	9	204	338	8.44	65.95	0.67	0.9	264.65	262.42	261.46	0	0	1	0	0	0	1	0	0	0	0
2000-08-12	14:28	12	18	9	309	231	10.37	67.05	24.62	18.52	286.38	266.38	266.33	0	0	0	1	0	0	1	0	0	0	0
2000-08-22	13:28	14	18	9	428	132	12.83	68.08	21.21	16.59	272.57	263.05	262.33	0	0	0	1	0	0	1	0	0	0	0

2000-08-15	14:57	12	18	11	283	661	11.14	63.2	25.56	19.64	262.74	247.85	247.03	1	0	0	0	0	0	1	0	0	0	0
2000-08-07	14:39	12	18	13	274	548	10.64	64.19	31.82	25.22	268.41	238.7	237.64	1	0	0	0	0	0	1	0	0	0	0
2000-08-27	14:11	14	18	15	169	599	8.69	63.59	9.32	10.49	283.97	265.54	262.49	0	0	0	0	0	0	1	0	0	0	0
2000-08-28	05:13	12	19	1	659	151	18.86	57.85	5.86	5.84	292.88	280.37	278.75	0	0	0	0	0	0	1	1	0	0	0

SUMMER DATA : August 200, "witness" pixel information

DATE	TIME	CTI*	CTM*	X*	Y*	LON*	LAT*	C1*	C2*	C3*	C4*	C5*	LA*	CO*	NI*	TW*	SU*	HI*	IN*	NW*	LO*	MI*	RE*	ST*
2000-08-10	13:31	2	2	333	424	11.51	65.37	39.53	30.09	322.53	280.22	279.01	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-14	13:41	2	2	741	973	20.26	60.66	29.31	22.68	322.61	284.07	282.83	0	0	0	0	1	0	0	1	0	0	0	0
2000-08-01	13:36	2	2	734	60	20.13	58.67	44.95	34.85	322.45	286.42	283.73	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	2	2	942	174	23.61	57.6	43.38	33.74	322.48	286.43	284.69	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-09	13:56	2	2	410	374	14.95	55.74	33.17	25.22	322.43	284.09	283.11	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-13	14:05	2	2	381	491	14.63	54.67	17.02	11.73	319.64	286.76	284.89	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-13	14:05	2	2	407	487	15.03	54.73	22.85	17.41	322.47	286.53	285.01	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-14	13:41	2	2	663	332	18.97	56.22	24.94	18.72	322.49	286.53	284.19	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-27	13:45	2	2	684	253	19.3	56.94	47.55	38.0	322.43	286.53	285.24	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-27	13:45	2	2	585	98	17.58	58.31	46.51	36.48	322.44	286.52	284.51	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-30	14:18	2	2	406	533	15.07	54.31	44.53	36.98	322.41	286.57	285.28	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	2	2	374	626	12.87	63.61	2.95	7.36	290.79	285.88	284.38	1	0	0	0	0	1	0	1	0	0	0	0
2000-08-04	14:10	1	1	321	1049	12.75	59.78	6.18	7.87	300.67	287.31	285.25	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-01	13:36	2	2	141	432	7.48	65.02	42.55	32.01	322.38	282.64	280.46	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	1	1	368	622	12.74	63.64	6.18	9.9	304.36	287.46	286.28	0	1	0	0	0	1	0	0	0	0	0	0
2000-08-04	14:10	2	2	360	1123	13.57	59.15	35.26	27.85	322.54	286.44	283.96	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-05	13:46	2	2	627	959	18.17	60.77	43.28	33.84	322.38	282.78	280.39	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-05	13:46	2	2	590	1105	17.59	59.45	25.35	19.54	318.1	282.08	280.27	0	1	0	0	0	0	0	1	0	0	0	0
2000-08-10	13:31	2	2	265	389	9.94	65.59	45.26	34.35	322.57	282.69	280.37	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-12	14:28	2	2	143	1123	9.81	58.91	45.05	34.55	322.27	286.52	284.67	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-14	13:41	2	2	247	508	9.96	64.51	48.39	37.9	322.53	282.73	280.47	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-01	13:36	2	2	666	47	18.95	58.79	41.2	31.81	322.08	286.41	284.09	0	0	0	0	1	0	0	0	0	0	0	0

2000-08-03	14:30	2	2	11	140	8.02	57.37	35.57	28.26	322.58	286.44	284.06	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-04	14:10	2	2	323	452	13.68	54.98	26.6	20.15	322.43	284.09	283.24	0	0	0	0	1	0	0	1	0	0	0	0
2000-08-04	14:10	2	2	236	260	11.98	56.61	32.75	26.23	322.46	286.46	283.45	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-04	14:10	2	2	334	28	13.19	58.78	28.38	22.48	322.22	286.44	284.53	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-15	14:57	2	2	475	137	13.96	68.07	1.07	0.47	283.69	283.29	282.41	0	0	0	0	0	0	0	0	0	0	0	0
2000-08-27	03:56	1	1	1106	446	28.13	65.19	2.95	2.09	279.51	280.75	279.99	1	0	0	1	0	0	1	0	0	0	0	0
2000-08-17	02:53	1	1	665	759	19.1	52.38	0.56	0.79	283.97	284.06	282.9	1	0	1	0	0	0	1	1	0	0	0	0
2000-08-13	04:15	2	2	669	817	18.9	62.06	1.28	0.67	283.67	283.81	282.81	0	0	0	1	0	0	0	0	0	0	0	0
2000-08-04	04:20	2	2	950	301	23.63	56.45	2.11	2.49	286.86	285.18	284.15	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-09	13:56	2	2	584	147	17.59	57.87	43.28	32.72	322.52	284.08	283.25	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-12	14:28	2	2	97	456	10.19	54.7	40.15	31.0	322.55	286.56	284.59	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-09	04:27	1	1	26	273	8.63	56.22	1.43	1.55	281.94	281.81	280.98	1	0	0	1	0	0	0	1	0	0	0	0
2000-08-09	04:27	1	1	38	410	9.17	55.02	1.43	1.88	280.46	280.66	279.77	1	0	0	1	0	0	0	1	0	0	0	0
2000-08-09	04:27	1	1	46	584	9.7	53.49	1.21	1.55	280.45	280.44	279.64	1	0	0	1	0	0	0	1	0	0	0	0
2000-08-13	04:15	7	7	660	1000	18.79	60.41	5.03	3.81	283.39	278.88	278.41	0	0	0	1	0	0	0	1	0	0	0	0
2000-08-09	02:46	1	1	1516	428	32.33	54.71	1.43	2.21	278.74	276.92	276.04	1	0	0	1	0	0	1	0	0	0	0	0
2000-08-06	05:15	7	7	673	352	19.14	56.05	18.27	13.96	286.97	274.42	274.06	0	0	0	0	1	0	0	1	0	0	0	0
2000-08-27	03:56	1	1	1642	642	38.04	62.5	1.49	1.99	279.57	277.55	276.84	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-27	12:29	1	1	1503	1064	33.69	59.12	2.94	7.0	290.88	288.57	286.94	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-17	02:53	1	1	626	668	18.5	53.19	0.56	0.79	283.14	283.61	282.53	1	0	1	0	0	0	1	1	0	0	0	0
2000-08-21	03:47	1	1	1275	439	28.59	54.95	2.83	2.97	287.48	286.76	285.57	1	0	0	1	0	0	1	0	0	0	0	0
2000-08-03	14:30	2	2	244	364	9.4	65.78	2.84	1.99	289.75	283.14	281.73	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-03	13:48	15	15	213	393	8.85	65.48	3.7	2.75	288.94	281.71	279.88	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-19	13:26	2	2	71	488	6.28	64.4	42.45	32.12	322.56	280.26	278.62	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-19	13:26	2	2	162	514	8.24	64.33	40.26	31.2	322.43	280.3	279.38	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-09	13:56	2	2	590	133	17.69	58.0	42.97	32.52	322.54	284.08	282.88	0	0	0	0	1	0	0	0	0	0	0	0

2000-08-12	14:28	2	2	224	492	12.21	54.53	33.8	27.55	322.64	286.57	284.09	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-12	14:28	2	2	85	50	8.99	58.29	41.2	31.2	322.46	286.52	284.07	0	0	0	0	1	0	0	0	0	0	0	0
2000-08-31	03:31	1	1	1374	302	34.42	66.05	2.4	2.75	278.66	275.0	274.0	1	0	0	1	0	0	1	0	1	0	0	0
2000-08-01	12:31	19	19	1572	256	38.92	65.99	3.37	2.32	274.9	273.5	273.23	0	0	0	0	0	0	0	1	0	0	0	0
2000-08-03	14:30	7	7	830	252	22.38	67.13	19.1	14.46	289.98	276.35	275.7	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-03	16:11	7	7	823	260	22.22	67.06	12.85	10.1	296.08	274.04	273.42	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-31	04:05	1	1	1366	305	34.23	66.04	2.53	2.8	278.02	272.24	270.75	0	1	0	0	0	0	0	1	1	0	0	0
2000-08-05	05:13	9	9	36	432	9.2	54.83	13.1	11.8	287.67	260.86	260.47	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-12	03:52	7	7	381	381	14.5	55.66	1.86	1.77	275.55	277.15	276.66	0	0	0	1	0	0	0	1	0	0	0	0
2000-08-05	13:26	9	9	345	317	11.45	66.33	34.72	27.39	290.91	265.6	264.7	0	0	0	0	1	0	0	1	0	0	0	0
2000-08-07	13:04	7	7	135	220	6.4	66.87	38.07	30.0	284.64	269.84	268.98	0	0	0	0	1	0	0	1	0	0	0	0
2000-08-15	14:57	2	2	201	1109	10.78	59.11	4.72	3.51	287.68	280.84	279.03	0	0	0	0	1	0	0	1	0	0	0	0
2000-08-27	14:11	2	2	208	599	9.47	63.65	4.78	4.17	280.63	272.19	270.22	0	1	0	0	0	0	0	1	1	0	0	0
2000-08-11	13:55	9	9	160	734	11.68	52.29	41.32	33.82	292.76	269.17	268.11	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-13	03:40	7	7	106	259	9.88	56.46	0.89	1.12	275.0	279.96	279.14	0	1	0	1	0	0	0	1	0	0	0	0
2000-08-27	03:56	1	1	1527	816	35.08	61.25	1.17	2.49	280.8	278.25	277.75	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-27	14:11	1	1	1314	714	31.49	62.53	4.78	6.89	290.52	286.91	284.57	1	0	0	0	0	0	0	1	1	0	0	0
2000-08-29	05:35	1	1	944	921	24.04	61.07	5.86	5.48	283.62	280.69	279.07	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-06	13:15	7	7	319	319	13.42	56.16	19.7	18.77	301.95	277.55	274.65	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-29	05:35	1	1	786	476	21.27	65.12	4.13	4.28	282.52	282.34	281.62	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-06	13:15	7	7	88	254	9.58	56.48	38.51	30.87	282.48	250.23	249.61	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-27	04:18	0	1	374	671	14.74	53.05	1.43	1.77	282.55	281.27	280.31	1	0	0	1	0	0	0	1	0	0	0	0
2000-08-16	14:34	2	2	762	592	20.54	53.89	4.93	6.15	294.01	288.07	285.52	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-13	04:15	7	7	522	956	16.24	60.76	5.86	4.62	279.52	274.88	274.97	1	0	0	1	0	0	0	1	0	0	0	0
2000-08-31	03:31	7	7	250	378	9.58	65.67	0.67	1.01	270.32	271.03	270.48	0	0	0	1	0	0	0	1	0	0	0	0
2000-08-12	14:28	5	5	331	272	11.0	66.72	22.85	16.7	290.24	277.01	276.33	0	0	0	0	1	0	0	1	0	0	0	0

2000-08-22	13:28	7	7	420	127	12.62	68.11	21.75	17.47	279.71	268.43	268.06	0	0	0	0	1	0	0	1	0	0	0	0
2000-08-15	14:57	9	9	253	682	10.61	62.97	27.44	22.38	275.66	261.45	260.63	1	0	0	0	0	1	0	1	0	0	0	0
2000-08-07	14:39	18	18	267	566	10.55	64.02	39.11	30.49	280.8	248.65	246.0	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-27	14:11	15	15	205	624	9.49	63.42	6.51	7.98	285.73	270.55	267.55	1	0	0	0	0	0	0	1	0	0	0	0
2000-08-28	05:13	19	19	661	142	18.89	57.93	4.4	3.61	295.22	284.54	282.68	0	1	0	0	0	0	0	1	1	0	0	0

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