# Evaluation of IMG level 2 data using GTS

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## ABSTRACT

Interferometric Monitor for Greenhouse Gases (IMG)) is a sensor to monitor the earth's radiation balance, the temperature profile of the atmosphere, the temperature of the earth's surface, and physical properties of clouds, and was loaded on ADEOS satellite.

In this paper, we estimated IMG level 2 data by comparing with a Global Telecommunications System data (GTS).

The IMG level2 data over sea without cloud cover gave good agreement with the value that had been obtained by buoy and sonde.

## 1. Introduction

ADEOS satellite was launched in August 1996. But ADEOS satellite was failure in June 1997. However, the data of ADEOS observed for about ten months have been available.

IMG sensor is consisted from three bands as Michelson Fourier spectrometer to monitor thermal infrared spectrum from 3.3um to 14um.

IMG level 2 data is defined as physical values such as a profile of temperature, $H_2O$, $CO_2$, $CH_4$, $N_2O$ and CO, a total of $O_3$ and $HNO_3$. Also IMG level 2 data were converted from a spectral data ( IMG level 1 data ).

We estimated the accuracy of IMG level 2 products using buoy and sonde data.

## 2. GTS data

Daily GTS data have been collected from the world. The observation points of buoy and sonde show figure 1 and figure 2 respectively.

The location of observation point are defined in the international GTS table. However, the table is change sometimes. We get the table from the follows internet address.

http://www.ncdc.noaa.gov/pub/data/globalsod/stnlist-historical.txt
http://www.ncdc.noaa.gov/pub/data/globalsod/stnlist.txt
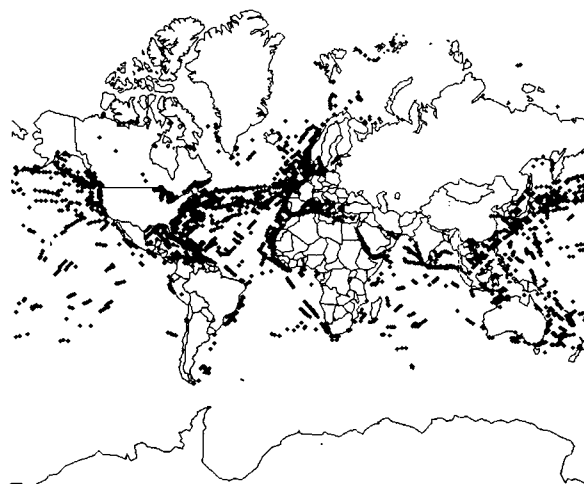http://www.wmo.ch/web/ddbs/publicat.html
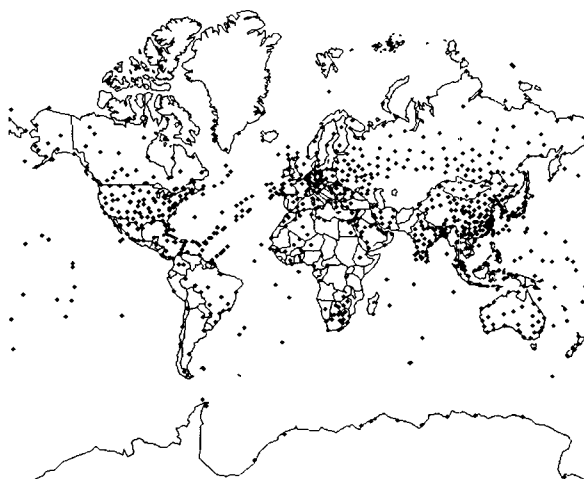


Fig. 1 Observation point of buoy data



Fig. 2 Observation point of sonde data

For example, the number of observation point and one of GTS data in September 1997 data were approximately 750 and 6500 respectively.

Table.1 Number of GTS data

| sonde | 9/1 | 9/2 | 9/3 | □ | 10/1 | 10/2 | □ |
|---|---|---|---|---|---|---|---|
| observation point | 746 | 776 | 767 | □ | 772 | 770 | □ |
| observation data # | 7476 | 7189 | 7393 | □ | 6873 | 5586 | □ |

The GTS data were separately preserved month by month for rapidly data search.

Also, the data were unformatted in database. the data were formatted when the data are picked up.

The structure shows the following list.

```
/gts                  main directory
/cYYMM                monthly directory
/cYYMMDDHH.sea
/cYYMMDDHH.ue
/cYYMMDDHH.uej
/cYYMMDDHH.uev
/cYYMMDDHH.uk
/cYYMMDDHH.ukj
/cYYMMDDHH.ukv
/cYYMMDDHH.ul
/cYYMMDDHH.ulj
/cYYMMDDHH.ulv
/cYYMMDDHH.us
/cYYMMDDHH.usj
/cYYMMDDHH.usv
Where; YY:year,MM:month, DD:date,
HH:time /index            location directory
/stnlist.txt
```

Table.2 Relation file extension of and GTS data

| | TTAA | TTBB | TTCC | TTDD | UUAA | UUBB | UUCC | UUDD |
|---|---|---|---|---|---|---|---|---|
| ue | * | * | * | * | | | | * |
| uej | | | | * | | | | |
| uev | | | | | | | | * |
| ug | | | | | | | | |
| ugj | | | | | | | | |
| uk | * | * | * | * | | * | | |
| ukj | | * | * | | | | | |
| ukv | | | | | | * | | * |
| ul | * | * | * | * | | | * | * |
| ulj | | | | | | | | |
| ulv | | | | | | | * | * |
| up | | | | | | | | |
| us | * | * | * | * | * | * | | |
| usj | * | | | | | | | |
| usv | | | | | * | | | |

## 3. IMG data

On the other hands, IMG data were stored by the satellite operation periods. Also, IMG data weren't formatted. Because IMG data are going to be re-calculate by revised the processing algorithm.

The accuracy of IMG level 2 data is depended on the retrieval algorithm of level 1 data. But the factors are very complex by the observation condition.

In this paper, the condition were classified such as over the sea or land, cloud or clear sky and high latitude or low latitude.

Especially, cloud were detected by ADEOS/OCTS data that were simultaneously observing.

## 4. Comparison Method

The evaluation system for IMG level 2 data was developed. The system is mainly consisted from database built and data search with specified condition.

The developed system has the following functions.
(1) A database generation from a daily raw Global Telecommunications System (GTS) data
(2) A data search with the specified conditions.
(3) A data set extraction combined with GTS and IMG level 2.
(4) Cloud Extraction from OCTS data.

### 4.1 Data search method

Some pairs of IMG data and GTS data on the condition of the almost same observation time and same observation location are searched by the developed system.

However, it's impossible to be coincided completely the time and the location. Therefore, the nearly conditions were specified by user. For example, the following conditions were specified.
# The substitution of the observation time is within three hours.
# The substitution of the observation location is within three degree in latitude and longitude respectively.

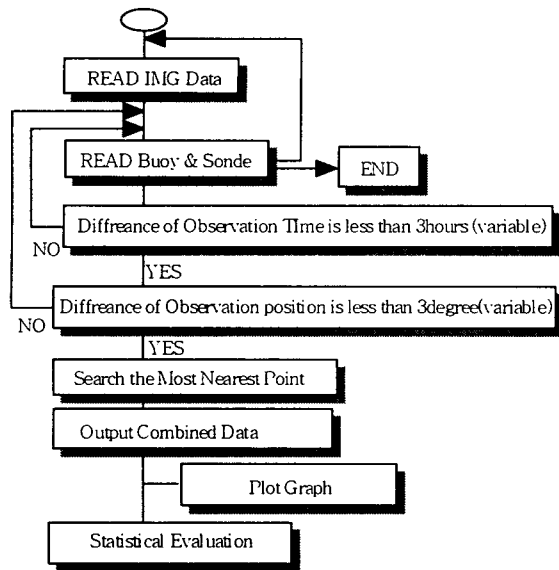Fig.3 shows the data search flow.

Fig. 3 The search flow both IMG and GTS

## 5. Results

IMG level 2 data were evaluated using the developed system.

In the case of January 1997, the 43 combination data were founded on the condition within 3 hours in time and 3 degree in location.

Next list shows the results of comparison without the consideration of cloud condition.

| 1997/1/25 11:03:29 | Lat: -37.7 Lon: -12.3 |
| average -20.40? | S.D. 34.53□ |
| 1997/1/25 11:38:18 | Lat: -21.8 Lon: 169.1 |
| average 3.34? | S.D. 29.37□ |
| 1997/1/27 11:25:14 | Lat: 53.6 Lon: 1.1 |
| average 12.20? | S.D. 31.61□ |
| 1997/1/27 11:27:03 | Lat: 44.3 Lon: -3.0 |
| average -1.13? | S.D. 9.10□ |
| 1997/1/27 11:28:52 | Lat: 37.9 Lon: -5.2 |
| average 11.04? | S.D. 20.47□ |
| 1997/1/27 11:28:52 | Lat: 38.7 Lon: -4.9 |
| average -11.04? | S.D. 20.47□ |
| 1997/1/27 12:42:10 | Lat: 40.2 Lon: 142.2 |
| average -35.6? | S.D. 22.47□ |
| 1997/1/28 11:10:27 | Lat: 11.2 Lon: -5.4 |
| average -28.64? | S.D. 39.43□ |
| 1997/1/28 11:08:37 | Lat: 17.7 Lon: -3.9 |
| average -34.13? | S.D. 41.53□ |
| 1997/1/29 00:32:48 | Lat: 26.7 Lon: 156.5 |
| average -30.23? | S.D. 43.30□ |



Level2 Data
1997/01/28 10:57:36
Lat:52.5 Long:7.3
Gts Data
1997/01/28 11:00:00
Lat:52.1 Long:5.2

Fig.4 plot of IMG level2 and GTS



Level2 Data
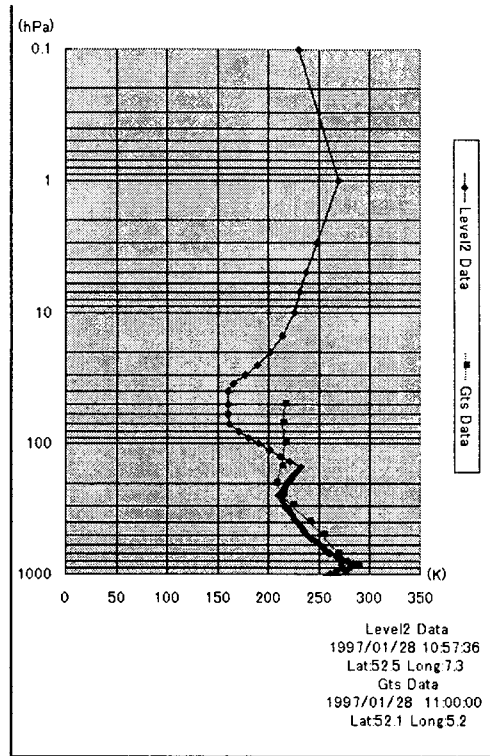1997/01/28 13:57:09
Lat:42.7 Long:122.9
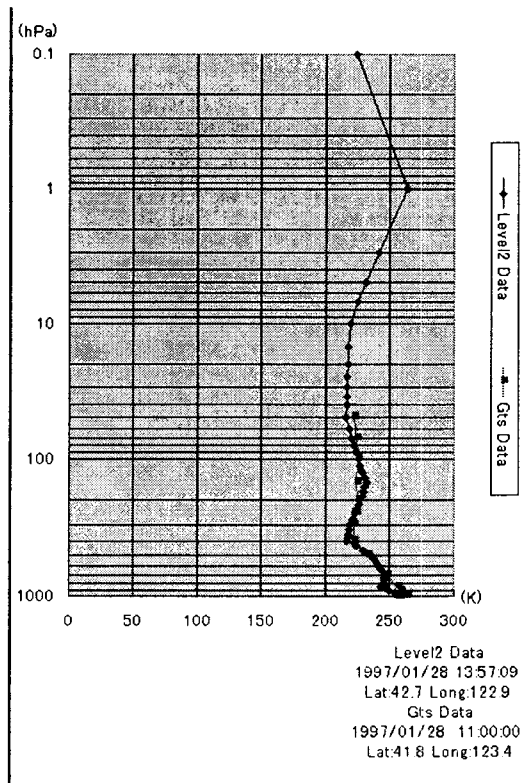Gts Data
1997/01/28 11:00:00
Lat:41.8 Long:123.4

Fig.5 plot of IMG level2 and GTS on clear sky

The whole average and S.D were -13.5 degree and 29.2 degree respectively.

However, the accuracy of data picked up the condition of observation was clear sky became more better. The average and S.D were 3.4 degree and 22.6 degree.

## 4.Conclusion and Future

The quality of the products was uneven. It's major reason is assumed with the influence of a cloud cover. Therefore, IMG data must be evaluated, after the products are classified by cloud covered or not. Cloud detection process isn't carried out in this time, because some OCTS data couldn't get by the reason why OCTS data is under checking in initial stage.

As profiles of temperature of IMG and sonde data are evaluated in this time, water vapor will be also evaluated using GTS data.

Additionally, IMG level 2, GTS and model data will be compared.

The evaluation paper of IMG level 2 products is going to be issued at September 1997.
In this time, IMG data don't become steady yet.
Because IMGDIS is still a state of initial confirmation.
Therefore, the accuracy of the products will be change. In other words, that algorithm on IMGDIS will possibly to be change in future.
Actually, retrieval algorithm converted into a quantity of physics from a spectrum will be change. Also, absorption line database and the climate model data may be changed furthermore, too.

It is recognized that the standard deviation of temperature is 20-40 degree.
As the next figure shows, 2 observation points hang an illustration of next among 6 observation points. the distance of those data is about 86Km.
Therefore, the climate model would be checked in detail.
Still, the Observation points are above Congo republic.

The IMG standard product should be estimated after the results are classified by the observation condition. the condition may be the follows.

- covered cloud or not.
- Over sea or land.
- day time or night time.
- high latitude or middle latitude.

## Reference

(1) Ha-Man Cho, Won-Tae YurL Seung-Hee Som Ju-Kong Kim, Intercomparision of ADEOWIMG Measurements with the Sonde Observations in Korea, Proc. of 1998 IGARSS
(2) The second ADEOS symposium / Workshop in YOKOHAMA, 1997
(3) Haruhisa Shimoda, Kayoko Kondo, Yoshihiko Kameda ,Characterization of IMG, Proc. of 1998 IGARSS