Satellite Cloud Information Chart*
—Advanced T_{BB} Contour Chart—

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Abstract

Advanced T_{BB} contour chart is a new product improved from the present nephanalysis chart and the T_{BB} contour chart, and are disseminated in quasi-real-time. This chart will contain the cloud area information which are added automatically and/or manmachine interactively. There are two kinds of products; one covers Far East area including Japan and its contiguous seas, and the other Asian and Western Pacicfic area, which are called Far East (FE) area chart and Asian and Pacific (AP) area chart respectively.

The FE area chart designed to support the local field forecaster is disseminated within 45 minutes after the 3-hourly map time to JMA (Japan Meteorological Agency) local stations by using land line.

The AP area chart designed to support the aviation field forecaster is disseminated within 50 minutes after the 3-hourly map time. The analysis area covers the area of the equater to 60 N and 90 E to 170 W. This product will be disseminated to local aviation stations of JMA by using land line.

1. Introduction

After the replacement of the computer system in MSC, current product of Nephanalysis Chart and T_{BB} Contour Chart will be discontinued, and they will be replaced by a new product which is tentatively called Advanced T_{BB} contour Chart (ATC). There are two kinds of samples. Prototype product produced with the current computer system and IR imagery are shown in Fig. 1 and Fig. 2. Sample of product produced with the new computer system and IR imagery are shown Fig. 3 and Fig. 4. These charts are designed to support operational forceasting. The ATC shown in Fig. 1 covers Far East (FE) area including Japan and its contiguous seas (FE area chart) and is to be disseminated to local forecasters after about 45 minutes from every 3-hourly map time. Another type of ATC shown in Fig. 3 covers Asian and Western Pacific area (AP area chart) and is to be sent aviation forecasters after about 50 minutes from every 3-hourly map time. Refinement of these products is now underway, and in parallel with this, also software conversion to adjust to the new computer system are now underway.

2. Data Processing

Basic data set for ATC is "grid point cloud data set" which contains several kinds of physical parameters extracted from each 0.25 lat. $\times$0.25 long. box. The physical parameters are, for example, cloudy/open indication, mean T_{BB}, mean albedo, cloud top T_{BB}, total cloud amount, low level cloud

* Recently these charts are to be called Satellite Cloud Information Chart: Vicinty of Japan Chart (VJ) and Far Eart Chart (FE).

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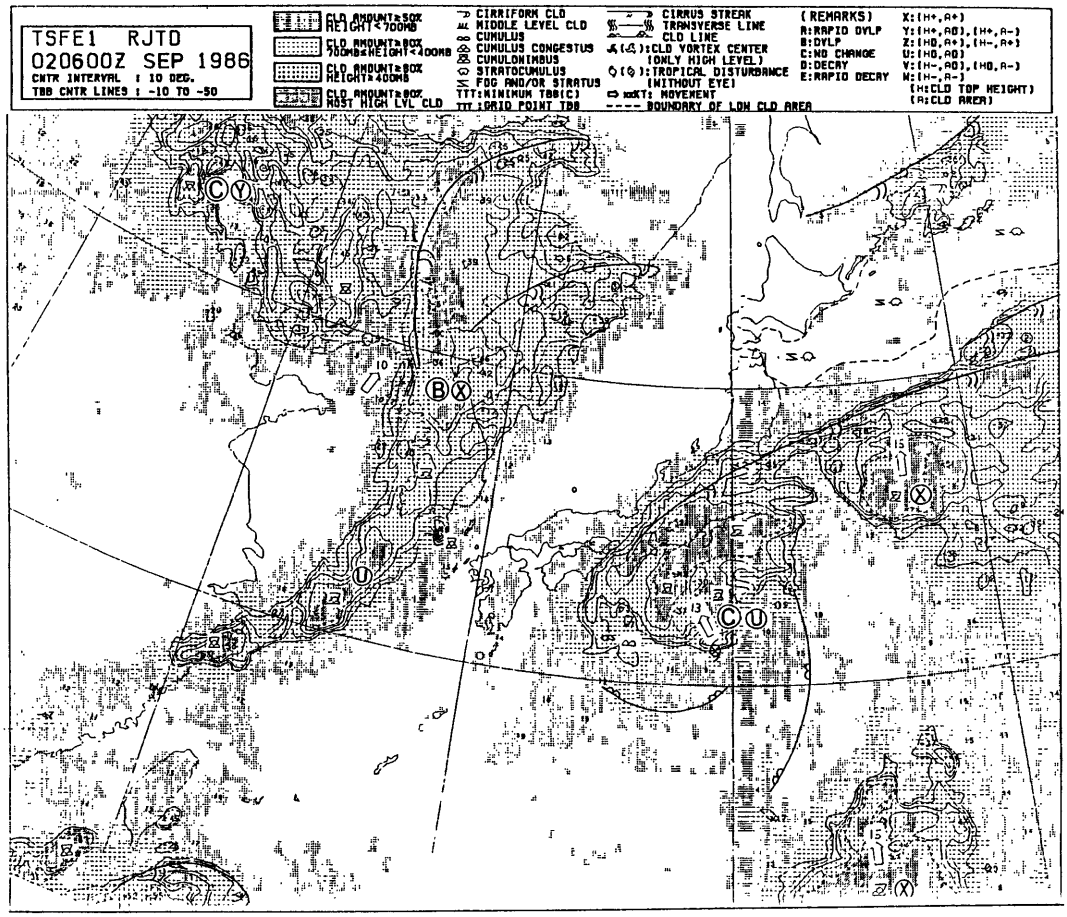

Fig. 1 An example of the Advanced T_{BB} Contour Chart for the Far East (FE) area. Observation time is 0600Z 02 September 1985. T_{BB} contour interval is 10 degrees from −10°C to −50°C. Contour lines of −10°C and −30°C are presented by thick full line, and those of −20°C and −40°C by thin full line. Areas surrounded by tick mark lines are those colder than −50°C. Categorized cloud top levels are presented by the shading with thin short line, thin long line, thick short line, and oblique line. Minimum/maximum T_{BB}s within contours are shown in numerics. Grid point T_{BB}s in the cloud area without contours are also presented by numerics with equal interval. Letters A, B, and C indicate the developing/decaying features of cloud systems. Cloud shapes and cloud line/streaks in the significant cloud portions are indicated by several kinds of symbols. Fog areas which are detected by man-machine interaction are presented by the dashed line.

amount, high level cloud amount, etc. They are calculated from the basic histogram data set which is propared in the primary image data processing system referring to numerical predicted atmospheric vertical profile information and objectively estimated surface temperatures from GMS image data taken 24 hours before. In short, ATCs are produced from the grid point cloud data set and sent to users via land line.

Among those parameters, mainly cloud top T_{BB} and cloud amounts are used. The

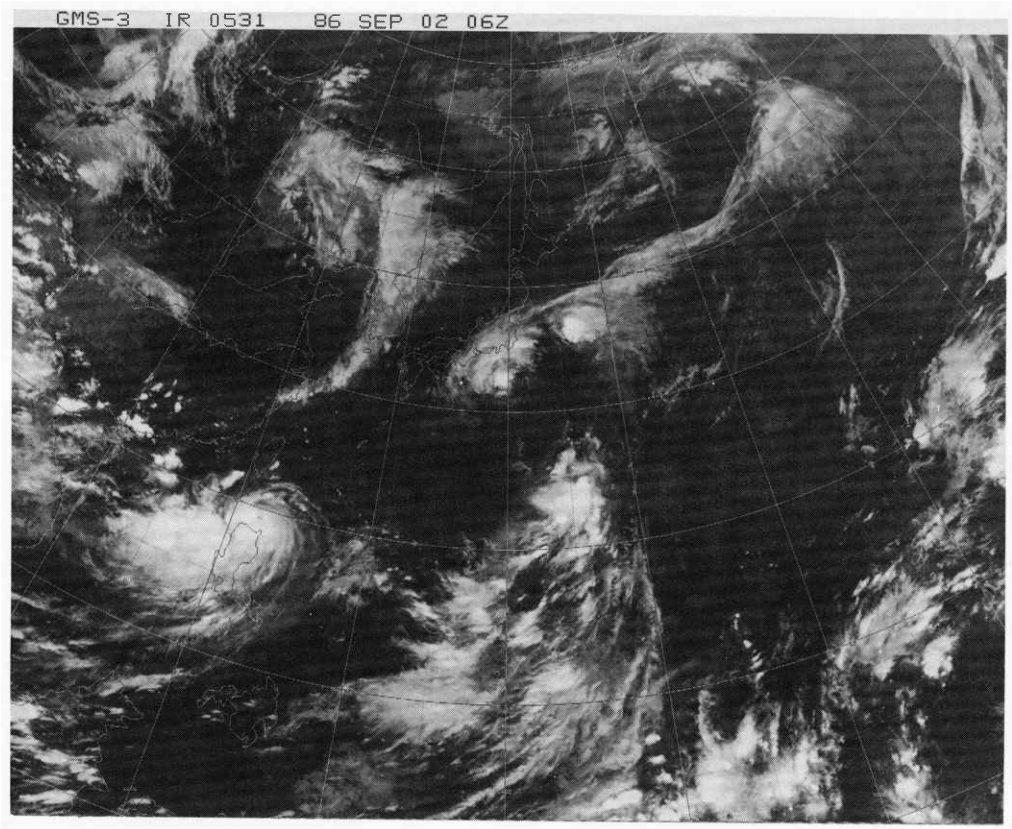

Fig. 2 The picture of 06Z 02 Sep. 1986(IR).

latter are transformed into "categorized cloud top levels" according to dominant cloud top level of the box. The categorized cloud top level represents horizontal cloud top level represents horizontal cloud distributions, in contrast with that the cloud top T_{BB} represents vertical development of clouds. Cloud distribution pattern is visualized by means of combination of cloud top T_{BB} contour lines and shaded patterns of categorized cloud top levels, and maximum or minimum T_{BB} values for notable clouds.

In case of FE area charts, results of picture analysis through man-machine interaction by means of Image Processing Console are added to the automatically produced information described just above, using various kinds of symbols which denote, for example, cloud type, cloud line, cloud streak, vortex center, cloud system movement, Cb or Ci identification, etc. As to developing or decaying features of cloud systems, letters A through E are used, and as to temporal change of cloud top height and cloud extent of cloud portions, letters x, y, z, u, v and w are used.

3. Categorized Cloud Top Level

Threshold temperature levels to be referred in the calculation of partial cloud amounts are selected as follows;

L1: surface temperature minus TTA

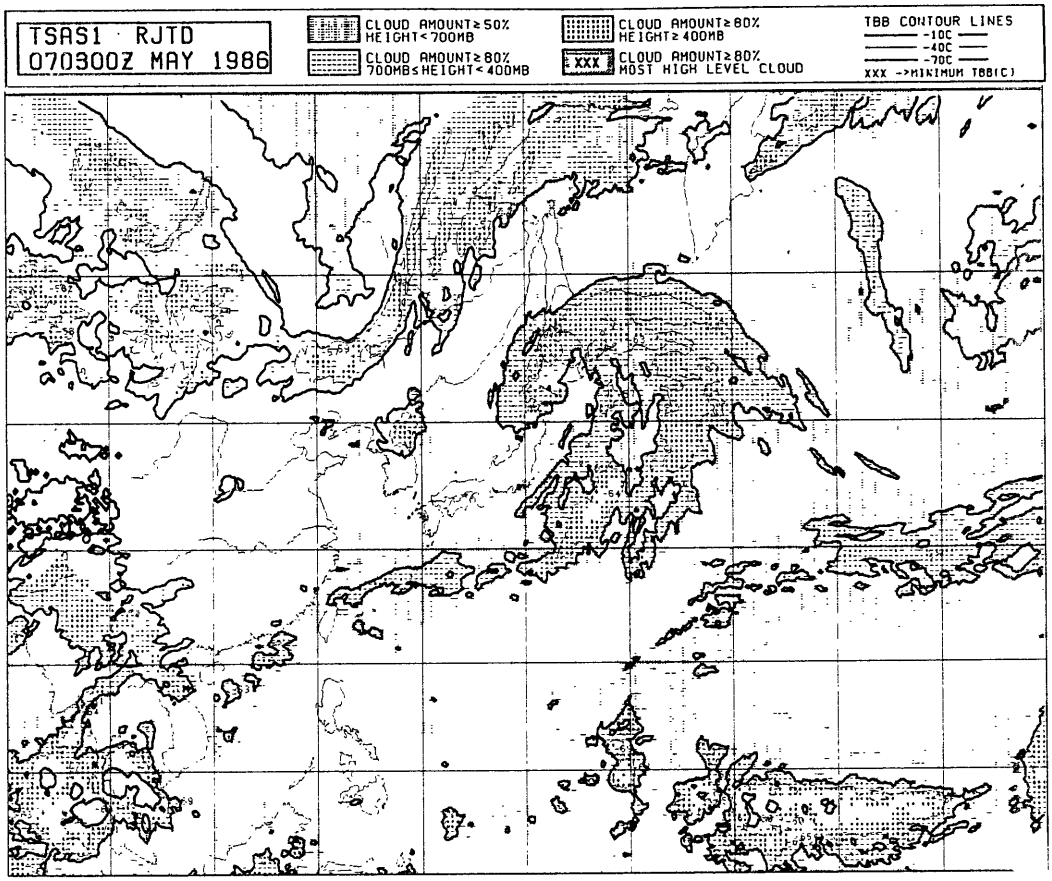

Fig. 3 An example of the Advanced T_{BB} Contour Chart for Asian and Western Pacific (AP) area. Observation time is 0300Z 07 May 1986. T_{BB} contour intervals are 30 degrees from −10°C to −70°C. Categorized cloud top levels are given by the same shaded patterns as shown in Fig. 1. Minimum T_{BB} are presented on each Most-high level cloud area.

L2: 700 mb temperature

L3: 400 mb temperature

L4: Ci-level T_{BB} minus TTB

where TTA and TTB are bias values, and Ci-level T_{BB} is described afterwards. Threshold levels are determined for each grid box, and partial cloud amounts are calculated referring to them. The categorized cloud top levels are determined according to the dominant partial cloud amount, as described below,

Low level cloud area;

Partial cloud amount between L1 and L2 is greater than or equal to 50 percent.

Middle level cloud area;

Partial cloud amount between L2 and L3 is greater than or equal to 80 percent. Boxes where total cloud amount is greater than or equal to 80 percent are also regarded as this category.

High level cloud area;

Partial cloud amount above L3 is greater than or equal to 80 percent.

Most-hight level cloud area;

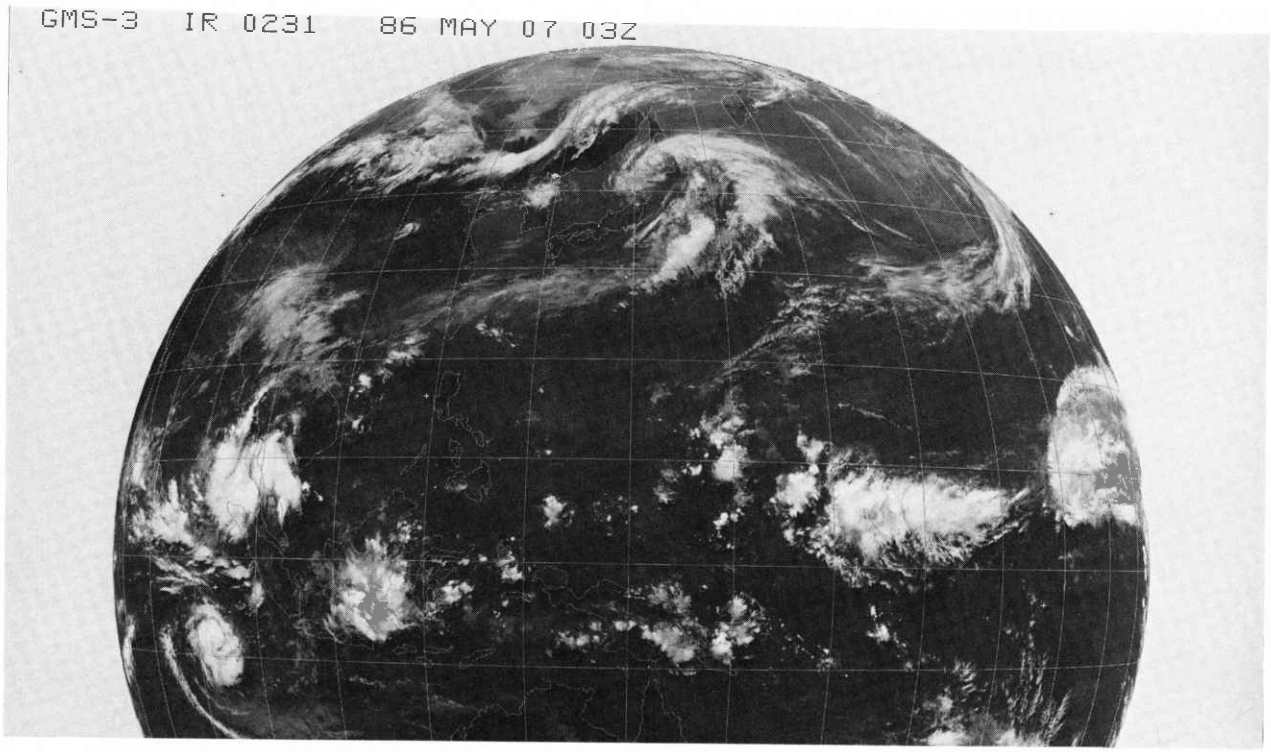

Fig. 4 The picture of 03Z May 1986(IR).

Same as the case of high level cloud area but its cloud top T_{BB} is colder than L4.

In test runs, climatic vertical temperature profiles, GMS Standard Atmosphere (GMSSA) data, data, which are currently used in MSC were used to obtain the threshold values. For sea surface temperatures 10-day mean surface T_{BB} data which were prepared for the tests runs were used. The bias temperature, TTA for low level cloud area was set 3 degree from results of tests. The L4 level T_{BB} which separates Most-high level from high level was set around 250 mb level according to the results of a case study made by Motoki (1983). We have no climatic or reliable value for Ci-level T_{BB} decision algorithm as follows.

First, a threshold value is given and a histogram is made from T_{BB} data colder than the threshold value for each box. Then Ci-level T_{BB} is set the mode T_{BB} of the histogram. The threshold value is empirically set 400 mb temperature minus 15° and the bias temperature is set 4 degree.

In the process of cloud level categorization algorithm development, the Most-high cloud top level was introduced in view of more easy recognition of atmospheric conditions, because Most-high level cloud area may call the attention of forecasters.

Cb area location is very important for local forecasters, however there are some difficulties in identifying Cb area by means of IR data analysis only. So in ATC, very cold T_{BB} area which has high probability to have Cb area is identified simply as

Most-high level cloud area; for example, high brightness areas in Fig. 2 and Fig. 4 are mostly identified as Most-high level cloud area in FEA and AP chart. In FEA charts Cb/Ci identification is to be added man-machind interactively.

Occurrence of dense Ci coverage having long life-time is also useful information. For example, anticyclonic expansion of dense Ci coverage is often observed before or during rapid development of extratropical disturbances. We believe that dense Ci coverage lasting long time is closely related to the activity of jet stream.

The newly developed ATC will be disseminated 3-hourly, and give users information about the temporal change of synoptic/subsynoptic systems, and usefulness of the chart will be increased when it is used in combination with digital radar data and/or rainfall data of densely distributed rain gauges from Automatic Meteorological Data Acquisition System (AMeDAS) of JMA.

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References

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雲画像情報図について

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気象衛星センター　システム管理課

現在，気象衛星センターで作成されている雲解析図・輝度温度分布図に替わって，２種類の雲画像情報図が1987年３月から１日８回３時間毎に配信されることが予定されている。これらの出力図は，雲域に関する情報の迅速な伝達を主目的としており，極東域図（FE）は正時から45分以内，アジア及び西部太平洋域図（AP）は50分以内に気象衛星センターからアデスへ送信される。予報担当官署を対象とする極東域図は自動処理方式とマンマシン処理方式を併用して作成され，ポーラステレオ図（１／1000万）形式で伝達される。航空予報担当官署を対象とするアジア・西部太平洋域図は自動処理方式で作成され、メルカトール図（１／2500万）形式で伝達される。本報告では，雲画像情報図に表現される情報の作成手順の概略および２種類の雲画像情報図の原形図面を示した。