



International Civil Aviation Organization

**THE SECOND MEETING OF ASIA/PACIFIC METEOROLOGICAL  
ADVISORIES AND WARNINGS IMPLEMENTATION TASK FORCE  
(METWARN/I TF/2)**

Bangkok, Thailand, 19 – 20 April 2012

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**Agenda Item Conjoint: SIGMET**

**b) Regional participation in SIGMET advisory trial (monitoring and  
coordination)**

**REVIEW AND EVALUATION OF SIGMET ADVISORY TRIAL IN ASIA**

(Presented by China)

**SUMMARY**

This paper presents results of SIGMET advisory trial in Asia hosted by China and the evaluation of its performance.

**1. INTRODUCTION**

1.1 The third meeting of the ICAO Meteorological Warnings Study Group (METWSG/3) had designated China, France and South Africa to be the host States of the SIGMET advisory trials. China is responsible for conducting the SIGMET advisory trial in Asian region during 4 May to 30 July, covering 10 countries, namely Bangladesh, Cambodia, Mainland China, Democratic People's Republic of Korea, Lao People's Democratic Republic, Mongolia, Myanmar, Nepal, Thailand and Vietnam, totally 18 MWOs for 19 FIRs), shown in Figure 1.

1.2 Since the second meeting of the ICAO Meteorological Warning Study Group (METWSG/2), China paid high attention to the SIGMET advisory feasibility study and SIGMET guidance study. A working group, with members from 9 Meteorological Watch Offices (MWOs) in Mainland China, was established in 2009 to carry out related studies and tasks. Two working group meetings were held in December 2009 and June 2010 to discuss detailed plan and task decomposition and allocation for conducting the feasibility study of the issuance of SIGMET advisory, such as monitoring SIGMET issuance of MWOs in Southeast Asia, discussing the format and dissemination of SIGMET Advisory and the forecasting techniques of related phenomena. After the third meeting of METWSG, the third working group meeting was held in December 2010 to discuss the plan and tasks to make preparation for the coming trial.

1.3 Meanwhile, a programme for SIGMET advisory study, collaborated with PLA University of Science and Technology, was set up by China in April 2010, to carry out the study of techniques of SIGMET advisory issuance and to develop a system for weather monitoring and for the preparation, issuance and dissemination of SIGMET advisory. This system based on numerical weather prediction model system, meteorological satellite products, weather radar data and other weather information, named SIGMET Advisory Information System, contributed much to the conducting of the trial.

1.4 Before the trial, during 11 to 15 April 2011, China organized a Regional Seminar on Asian Aeronautical Meteorology Services -- a World Meteorological Organization (WMO) Voluntary Cooperation Programme (VCP) training, with the main purposes to introduce the SIGMET advisory trial, to enhance its application and to improve the issuance of SIGMET. More than 40 delegates from 12 Asian countries and China attended this seminar, including eleven delegates from States participating in the trial mentioned above except Mainland China.

## **2. IMPLEMENTATION OF SIGMET ADVISORY TRIAL**

### **2.1 Issuance and dissemination of SIGMET advisory**

2.1.1 The advisories were issued and disseminated through the above SIGMET Advisory Information System. The graphical advisory was first completed by forecasters based on the guidance of the advisory generated automatically by the system, through the man-machine interaction, and then the corresponding textual advisories were generated automatically. The textual advisories were disseminated via both AFTN and internet (the Asian Aeronautical Meteorology Service website, <http://www.aamets.org>), while the graphical ones were disseminated only via the internet.

2.1.2 The SIGMET advisories were issued only for thunderstorms and severe turbulence occurring above 10,000 feet (> FL100) during the trial as described in the summary discussions of METWSG/3. There is mainly due to the weather itself that no advisories issued for severe icing. And for the reason that no advisories issued for severe mountain wave, it is basically due to limit of observations or reports about severe mountain wave.

2.1.3 The SIGMET advisories were issued every 4 hours at about 2350Z, 0350Z, 0750Z, 1150Z, 1550Z and 1950Z regularly, with some timely updated advisories when a significant change in any of the above phenomena are expected before next suggested advisory, which were only issued for thunderstorms during the trial. The validity period is no greater than 6 hours.

### **2.2 Feedbacks during the trial**

2.2.1 In order to further improve the issuance of SIGMET advisory, daily and weekly feedback forms were designed for MWOs participating in this trial to feedback the detailed performance of the SIGMET advisories. The daily feedback forms were designed for 9 MWOs in China and collected every day, while the weekly ones were designed for all MWOs participating in this trial and collected every week from 9 MWOs in China and several MWOs from some neighbouring States or every month from some other MWOs.

2.2.2 During the trial, more than 700 daily feedbacks and about 108 weekly feedbacks were received from the MWOs in Mainland China, and more than 50 weekly feedbacks were received from MWOs in Bangladesh, Thailand, Vietnam, Myanmar and Lao PDR, which made a contribution to the further improvement of the issuance of SIGMET advisory.

## **3. EVALUATION OF THE TRIAL IN ASIA**

### **3.1 Statistics of SIGMET advisories and SIGMETs**

3.1.1 The number of the textual SIGMET advisories issued by Beijing, China is 2533 (calculated for the advisory itself, one sequence number for one advisory), with 2411 advisories for thunderstorms and 122 for severe turbulence. When the advisories were decomposed for each FIR, there would be 6048 advisories (with 5738 about thunderstorms and 310 about severe turbulence) issued in Asia.

3.1.2 Most of the advisories issued are related to thunderstorms, which is mainly due to the weather itself in summer season. And the reason for not issuing advisories about severe icing and severe mountain wave was mentioned above. The issuance of SIGMET messages in response to the SIGMET advisory messages received was monitored by Hong Kong, China. More detailed comparisons between the statistics of SIGMET advisories and SIGMETs issued during the trial for each FIR is given in Appendix A.

3.1.3 In addition, the comparison of the numbers of SIGMETs received from each MWO during the same period (May to July) for the recent three years (2009 to 2011) was shown in Figure 2, where Wuhan and Haikou MWOs missed the data in 2009. Since no advisories for severe icing were issued, the comparison of SIGMETs for severe icing was not shown. Compared with the numbers of SIGMETs received in 2009 and 2010, for most MWOs, the numbers for all phenomena and for thunderstorms during the trial had an increase or were comparable.

3.1.4 During the trial, two MWOs with MET deficiency, namely, Lao PDR and DPR Korea issued some SIGMETs in response to the SIGMET advisories, which was a sign of improvement. Lao PDR issued their first SIGMET in 18 May 2011 after their MWO implemented and totally issued 18 SIGMETs during the trial (information from experts of Lao PDR). DPR Korea issued 7 SIGMETs in the same period with 3 SIGMETs with format errors in 2009, and no SIGMETs were issued in 2010. Though they issued only 4 SIGMETs during the trial but without any format errors, which was also a sign of improvement.

3.1.5 For Mongolia, SIGMETs for both thunderstorms and severe turbulence received from Ulaanbaatar MWO also had an increase during the trial.

3.1.6 It must be noted that, before the handover of Kunming MWO to Chengdu MWO in 2009 and 2010, the SIGMETs for Chengdu CTA and Lhasa CTA issued by Chengdu MWO were also included in the statistics of SIGMETs for Kunming FIR which sometimes were reissued by Kunming MWO for international exchange. This is why the numbers for Kunming MWO in 2009 and 2010 are much greater than that in 2011. For Myanmar, the reason that no SIGMETs issued in 2011 was explained in Appendix A.

## **3.2 Feedbacks for specific cases from MWO**

3.2.1 Two more detailed and much appreciated feedbacks with a particular evaluation of the SIGMET advisory trial were provided by Beijing MWO and Guangzhou MWO. Details are given in Appendix A.

3.2.2 According to the comparison and verification, Beijing MWO reflected that the advisories were somewhat useful for them to prepare the content of SIGMETs, and had good practical guidance on their SIGMET issuance to a certain extent.

3.2.3 Guangzhou MWO gave a detailed verification using satellite observations, and concluded that most of the SIGMET advisories for thunderstorms agreed well with the satellite observations. Detailed verification and two examples are given in Appendix A. They considered that the advisories provided forecasts with sufficient lead time guiding their forecasters in advance to prepare and issue SIGMETs and proved to be effective. In addition, Guangzhou MWO also gave a comment that the graphical advisories were more friendly and convenient for application than the textual ones and the current SIGMETs (in text).

### **3.3 Feedbacks for the overall performance from MWOs and users**

3.3.1 Fourteen completed feedback forms were received from MWOs in Mainland China (9 MWOs), Bangladesh, Lao PDR, Myanmar, Thailand and Vietnam after the trial. Most of the MWOs considered that the advisories are useful for SIGMET preparation, particularly for thunderstorms.

3.3.2 Seven completed feedback forms were received from ALPA Japan, ALPA Thai, Air China, China Southern Airline, Xiamen Airline and Hainan Airline (2 forms, from control section and flight section). The users also generally considered that the advisories are helpful for the improvement of SIGMET issuance by the MWOs.

## **4. SUMMARY AND EXPERIENCE**

### **4.1 Summary**

4.1.1 Many efforts were put into the conducting of the SIGMET advisory trial and the improving of SIGMET issuance. Some achievements were made during the trial.

4.1.2 The statistics of the SIGMETs received during the same period for the past three years showed there were some improvements of the SIGMET issuance during the trial, where a sign of improvement was evident for two MWOs in LAO PDR and DPR Korea concerned with SIGMET deficiency.

4.1.3 The feedbacks from MWOs (both the feedbacks for specific cases and for overall performance) and users considered that the SIGMET advisories for thunderstorms were generally useful or helpful for SIGMET issuance, followed by severe turbulence and severe icing, and generally supported the permanent establishment of the regional SIGMET advisory centres.

### **4.2 Experience**

4.2.1 Except with the suggestions or comments mentioned in this paper, there have some experiences for SIGMET advisory issuance.

4.2.2 Firstly, a good system is essential for weather monitoring and for the preparation, issuance and dissemination of SIGMET advisory, without which the advisory, particularly the graphical one, is difficult to prepare. A dedicated website for the dissemination of graphical SIGMET advisory is necessary.

4.2.3 Secondly, it is very important that the forecasters who are in charge of the monitoring of weather and issuance of the advisory information should have relatively comprehensive knowledge about the weather and climate characteristics in the whole area involved.

4.2.4 Thirdly, it is also important that the regulation for the issuance of SIGMET advisory should be manoeuvrable in operation. For the trial in Asia, advisories were issued every 4 hours regularly, with some timely updated advisories when a significant change in any of the above phenomena are expected before next suggested advisory, which was considered to be more manoeuvrable than that all advisories were issued timely.

4.2.5 Fourthly, timely feedbacks from MWOs and users for performance of the SIGMET advisories are also vital for further improvement of the advisory.

4.2.6 Finally, more observations about local weather would be better for improved SIGMET advisory.

**4.3 Acknowledgement**

4.3.1 The centre of the Asian SIGMET advisory trial, Beijing, China would like to express their appreciation and thanks to all the participating MWOs and users who gave valuable suggestions or comments that contributed much to the accomplishment of the trial in Asia.

**5. ACTION BY THE GROUP**

5.1 The group is invited to:

- a) note the information in this paper; and
- b) discuss any relevant matters as appropriate.

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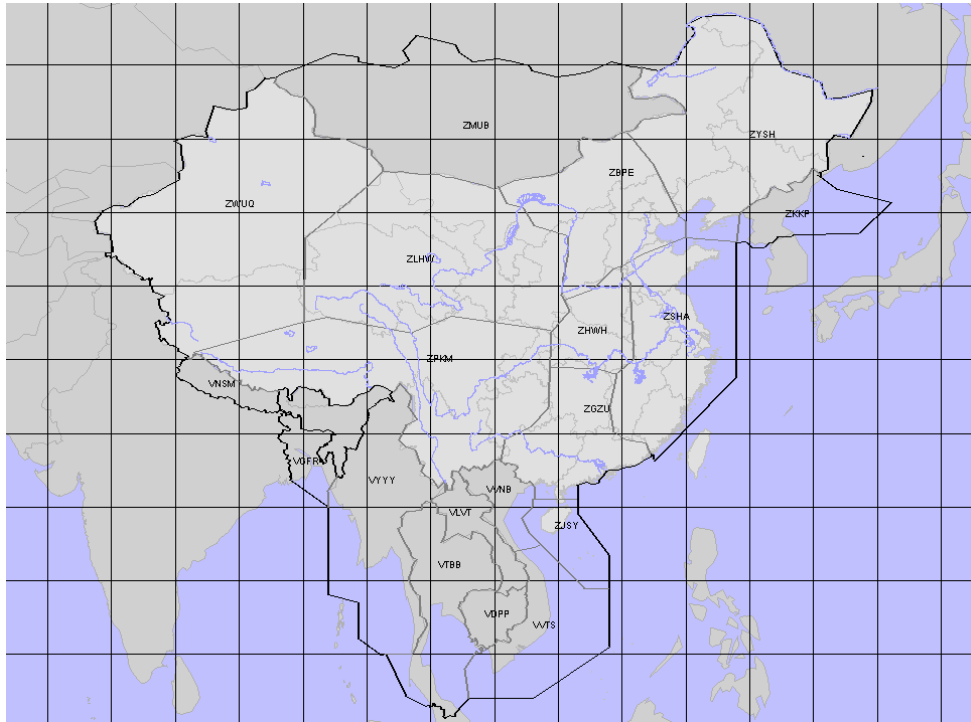
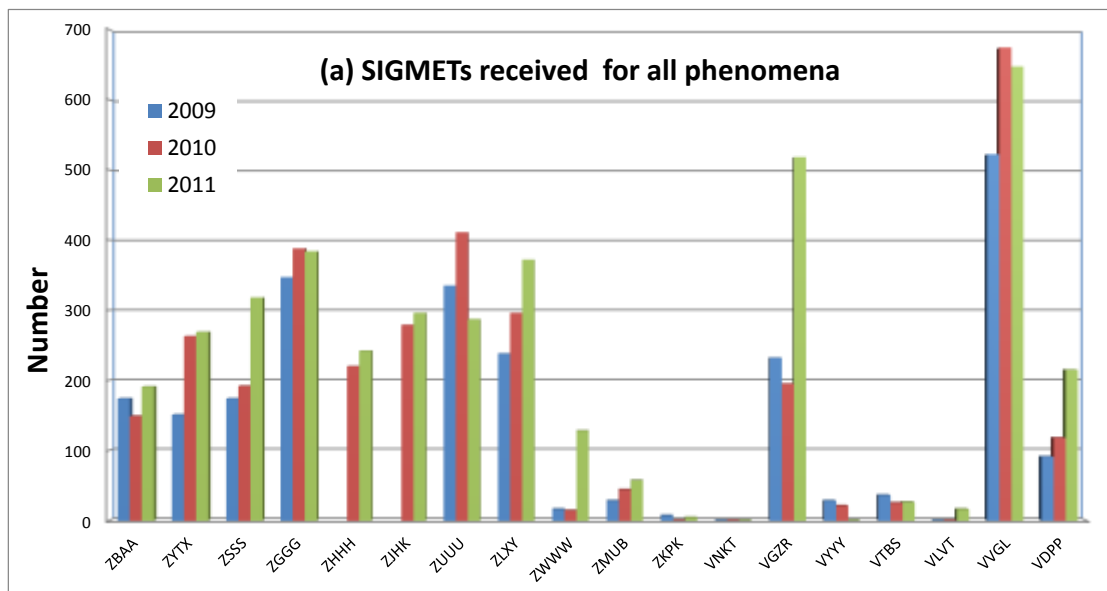


Figure 1 Geographical areas covered by the trial for Asia



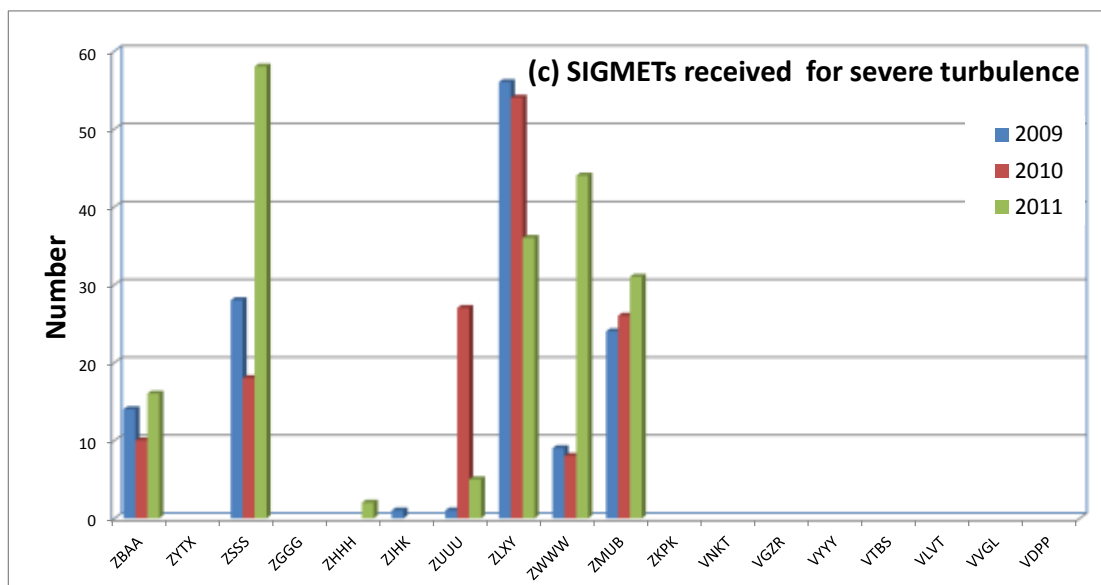
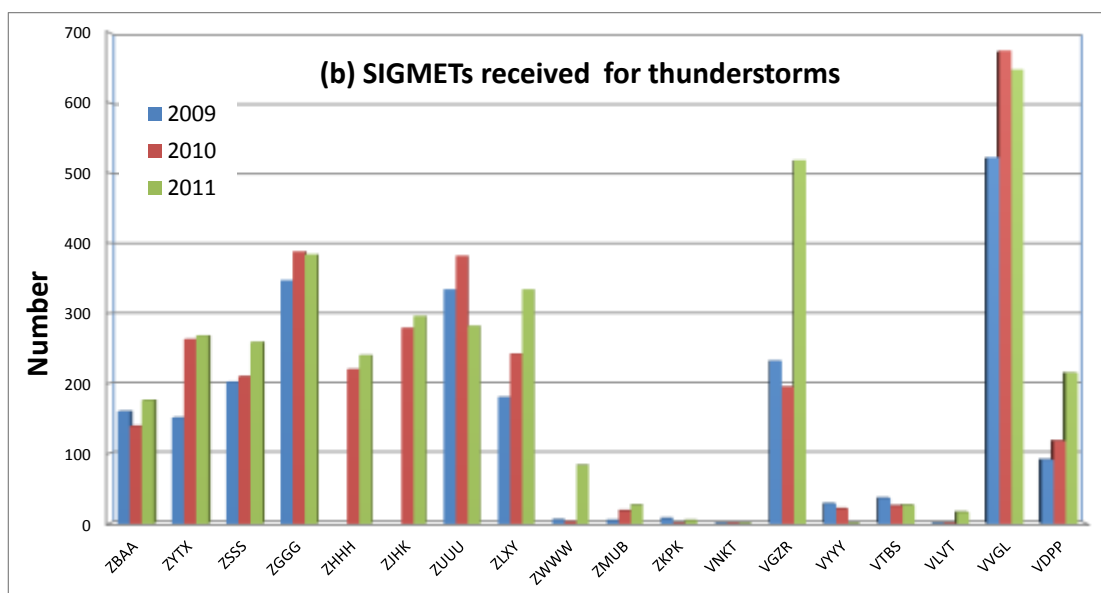


Figure 2 SIGMETs received during the same period (from May to July) in 2009, 2010 and 2011 for all phenomena (a), thunderstorms (b), and severe turbulence (c).

### Appendix A –Feedbacks for specific cases from two MWOs

#### 1. Feedback from Beijing MWO

A detailed evaluation for the SIGMET advisories received for Beijing FIR during the trial was carried out by Beijing MWO. Figure A-1 showed the number of SIGMETs issued for Beijing FIR during the same period with the trial (May to July) from 2009 to 2011. It indicated that, during the trial, the number of SIGMETs about thunderstorms in May and July had an increase, while the number in June had a little decrease. The number of SIGMETs for severe turbulence also had an obvious increase in May.

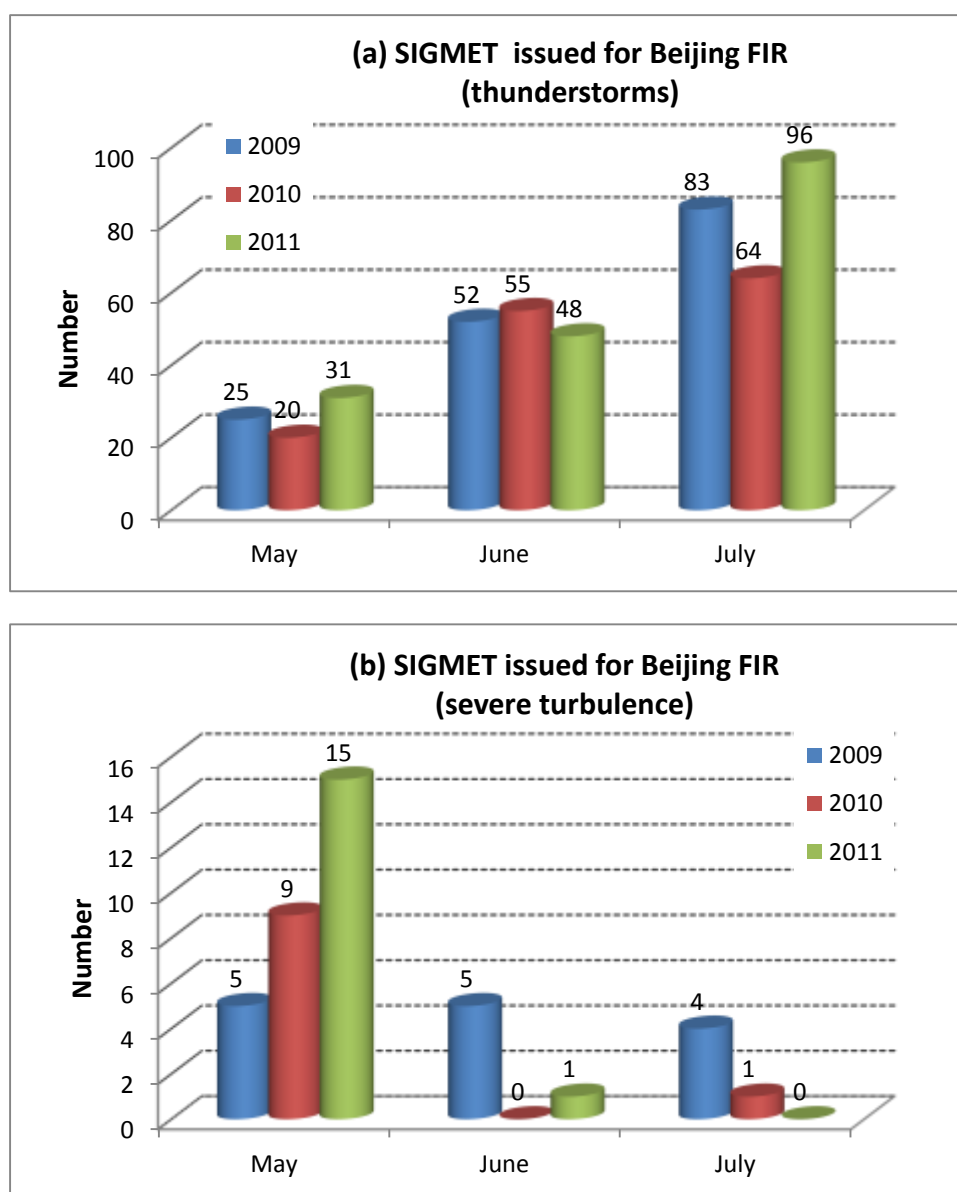


Figure A-1 SIGMETs issued for (a) thunderstorms and (b) severe turbulence for Beijing FIR during May to July from 2009 to 2010.



Compared with the number of SIGMETs issued and that of SIGMET advisories received for Beijing FIR, generally, the latter was greater as shown in Figure A-2. The two numbers were comparable for thunderstorms in May and July, while, in June, some missing forecasts with SIGMETs about thunderstorms were proved that the number of SIGMETs was much less than that of the advisories. For severe turbulence, the number of the advisories is much greater than that of SIGMETs in May. However, due to the limit of air reports about turbulence, it was unknown that which one was more consistent with the fact.

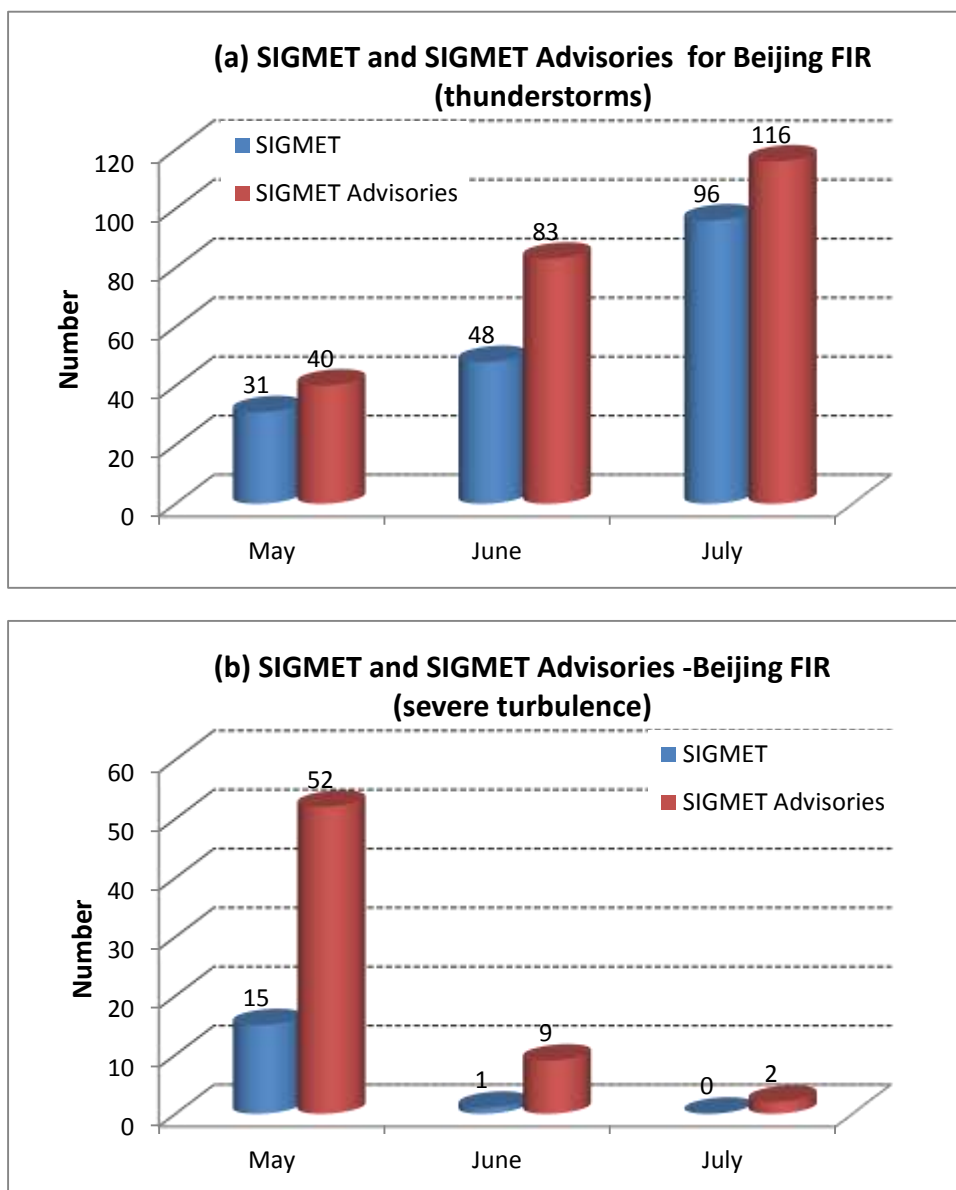


Figure A-2 SIGMETs issued and SIGMET Advisories received for (a) thunderstorms and (b) severe turbulence for Beijing FIR during the trial.

The two numbers of SIGMET advisories (SMA) and SIGMETs issued per day for Beijing FIR during the trial, 88 days, were also compared as shown in Figure A-3. It can be seen that there are 36 days (41%) with the number of SMA equal to that of SIGMETs and most of the days (77 days) with the

difference between the two numbers are less than 2. It indicates that the number of advisories and that of SIGMETs issued per day are much comparable.

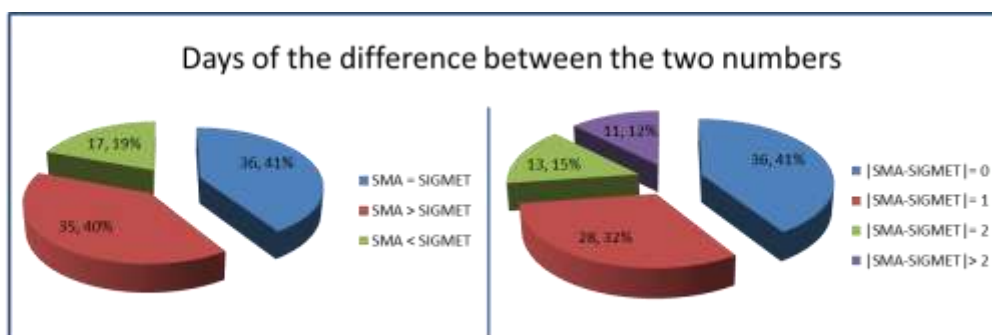


Figure A-3 Comparison of the two numbers of SIGMET advisories and IGMETs issued per day for Beijing FIR.

Moreover, the observations and air reports were used to verify the SIGMET advisories by Beijing MWO. The results showed that there were 124 advisories confirmed by the observations or air reports, about 41% of the total advisories, while the others can not be verified due to the limit of observations and reports. In the aforementioned advisories confirmed, there were only 8 advisories about severe turbulence confirmed because turbulence can only be verified by air reports, while most of the flight crews are unwilling to report even they encounter severe weather. In addition, according to the observations or air reports, there were 25 advisories (24 advisories about thunderstorm and 1 about severe turbulence) confirmed to be missed.

According to the above comparison and detailed evaluation, Beijing MWO reflected that the advisories are generally useful for them to prepare the content of SIGMETs and had good practical guidance on their SIGMET issuance to a certain extent, especially about thunderstorms.

## 2. Feedback from Guangzhou MWO

Guangzhou MWO implemented a particular verification for the SIGMET advisories about thunderstorms received for Guangzhou FIR during the trial using the satellite cloud images. Two cases verified are shown as follows.

(a) On 7 July at 0350Z, Asia Regional SIGMET Advisory Centre (RSAC) issued an advisory (sequence number 05) with a validity period of 0400Z/1000Z predicting an area of thunderstorms in the northwest part of Guangzhou FIR (shown in Figure A-4), which reminded the forecasters to pay attention to this area about thunderstorms. Then a SIGMET for thunderstorms (sequence number 1) was issued at 0600Z with a validity period of 0615Z/1015Z in the northwest part of Guangzhou FIR as indicated by the orange solid line in Figure A-4. From the satellite imageries (Figure A-5), it was evident that an area covered by thunderstorms moving southeast (circle with red line) was observed in the northwest part of Guangzhou FIR, which agreed well with the forecast of the advisory. In fact, a smaller area of thunderstorms in the west of Guangzhou FIR (circle with green line) developed at 0802Z, then intensified and move northeast, which also predicted by the advisories (sequence number

08) but without any corresponding SIGMETs issued. This case indicated that the forecast of the advisory was successful and can have guidance for forecasters in advance.

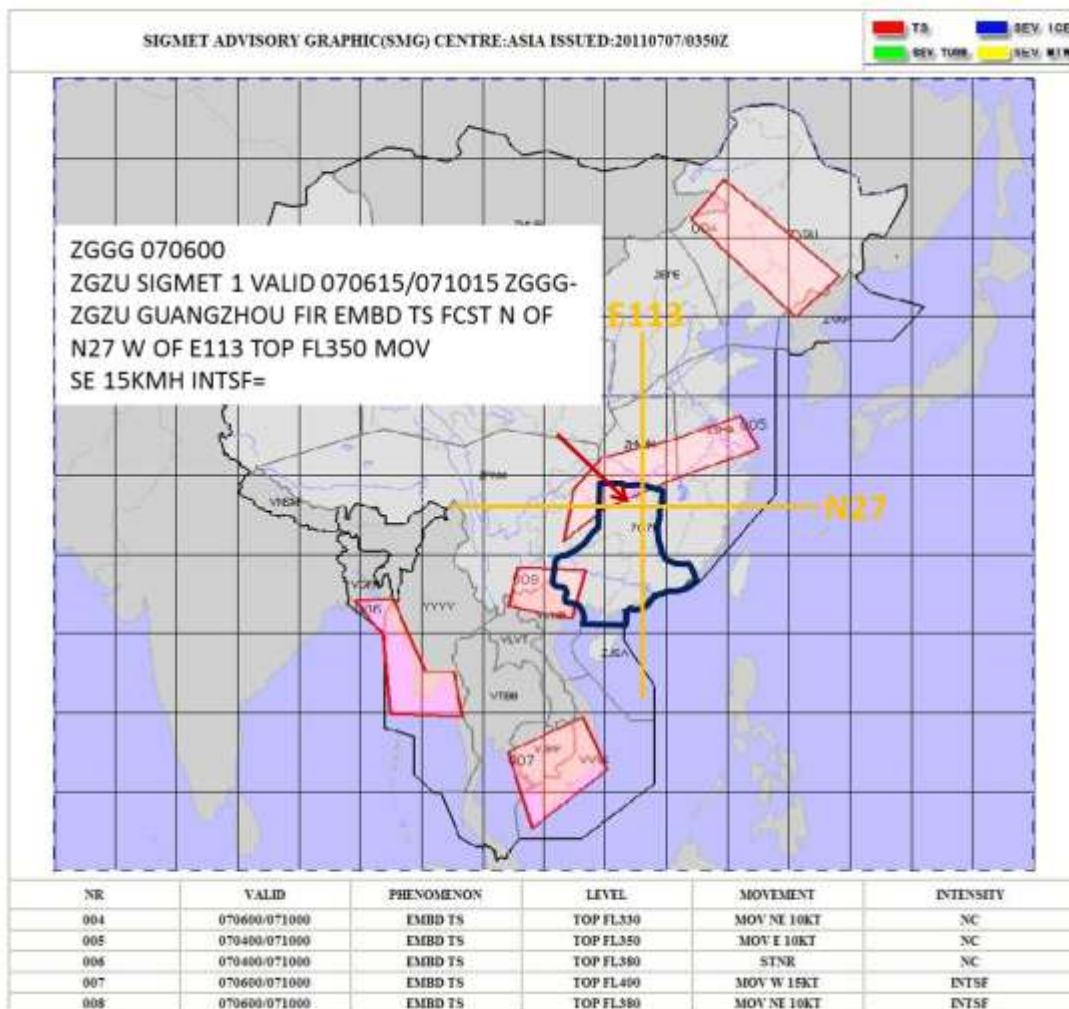


Figure A-4 Graphical SIGEMT advisories issued at 070350Z in July by Asia SIGMET advisory center and a SIGMET issued by Guangzhou MWO at 070600Z.

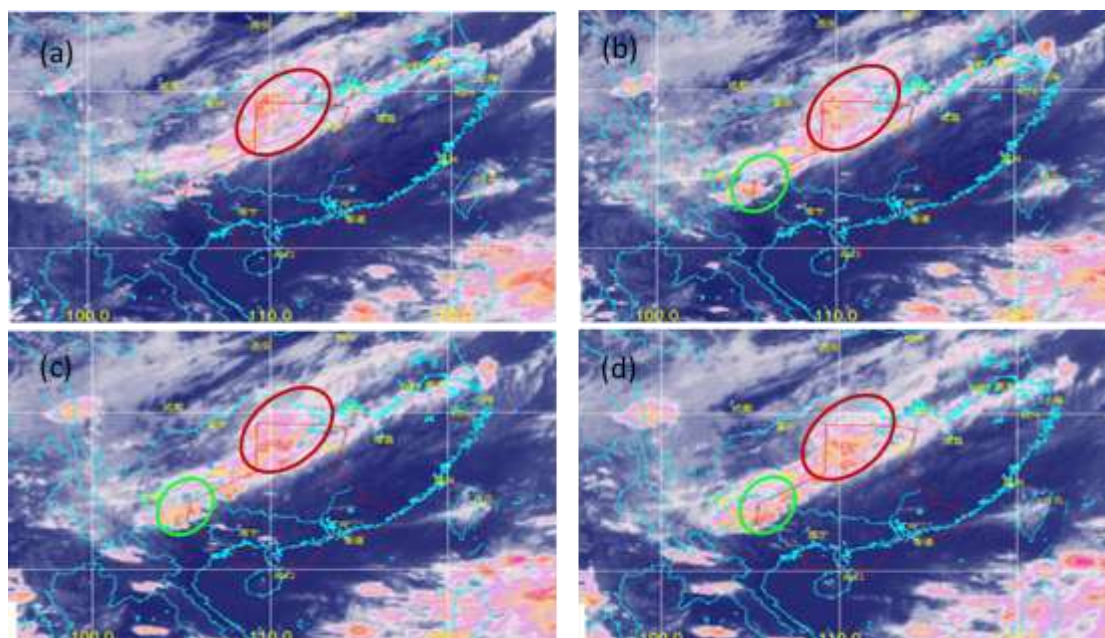


Figure A-5 FY2E satellite cloud images at (a) 2011-07-07-07-02, (b) 2011-07-07-08-02, (c) 2011-07-07-09-02, (d) 2011-07-07-10-02.

(b) On 9 July at 0750Z, Asia RSAC issued an advisory (sequence number 12) with a validity period of 0800Z/1400Z predicting a large area of thunderstorms developed in Guangzhou FIR as shown in Figure A-6, then a SIGMET (sequence number 4) was issued at 1016Z with a validity period of 1030Z/1430Z as indicated by the orange solid line in Figure A-6. According to the satellite observations (Figure A-7), thunderstorms were first observed in the southeast part of Guangzhou FIR, and then the area covered by thunderstorms extended to the east, to the south and to the southwest, which agreed well with the forecast of the advisory. On 9 July, there were totally 7 advisories received for Guangzhou FIR for thunderstorm (figures not shown), and 6 SIGMETs issued by Guangzhou MWO. The advisories were proved to be quite accurate and showed good guidance for SIGMET issuance.

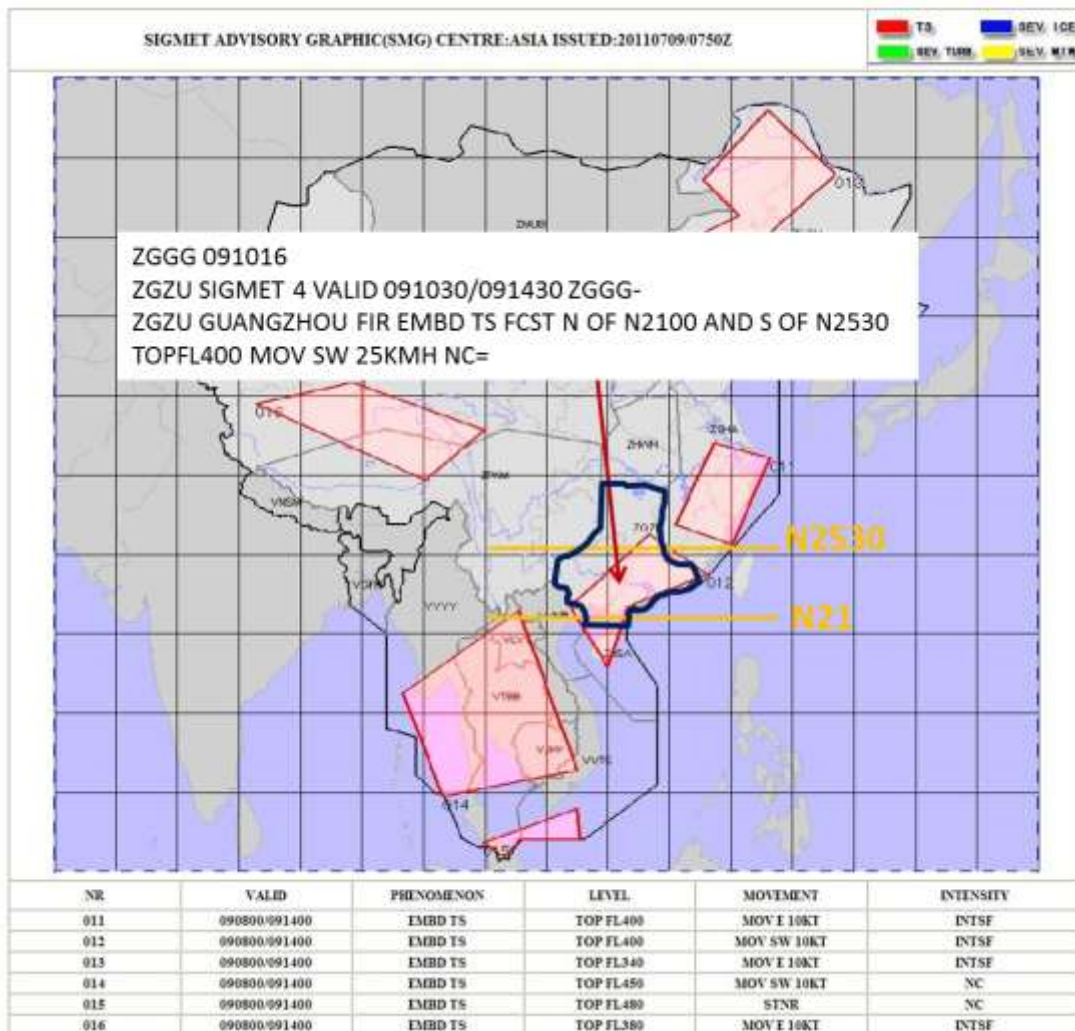


Figure A-6 As in Figure 4, but with graphical SIGMET advisory issued at 090750Z and SIGMET issued at 091016Z.

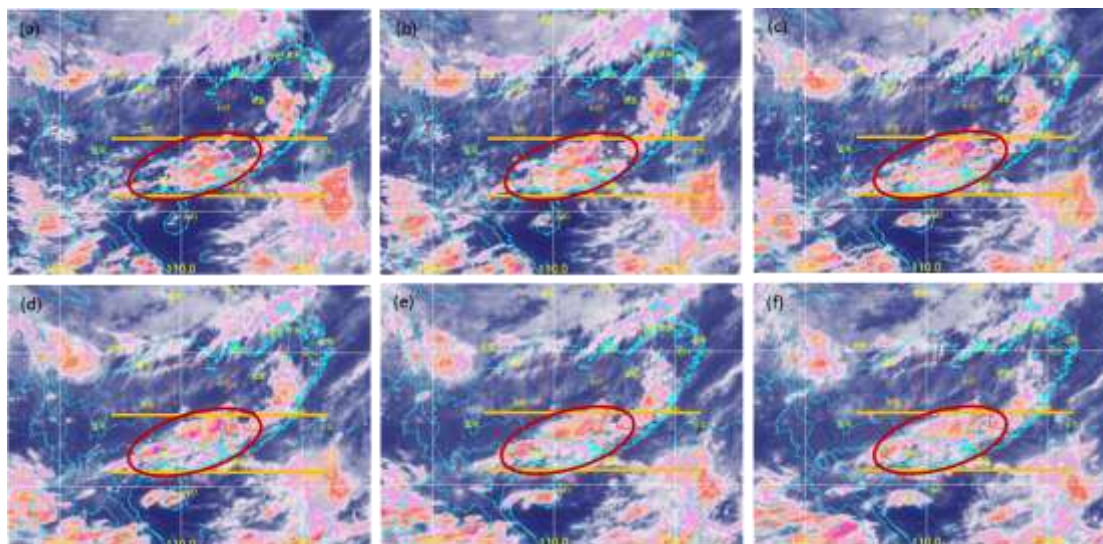


Figure A-7 FY2E satellite cloud images at (a) 2011-07-09-08-32, (b) 2011-07-09-09-32, (c) 2011-07-10-08-32, (d) 2011-07-11-08-32, (e) 2011-07-12-08-32, (f) 2011-07-13-08-32.

According to the verification, Guangzhou MWO found that most of the advisories predicted well for the development and movement of thunderstorms. In addition, since their forecasters usually issue SIGMETs for thunderstorms when thunderstorms were first observed, they considered that the advisories provided forecasting with sufficient lead time and can remind them to pay attention to related phenomena and area and give them a reference. They also gave a comment that the format of graphical advisories is very convenient and friendly for routine application than the text and the current SIGMETs (in text).