

*International Civil Aviation Organization***WORKING PAPER**

ICAO

Eighteenth Meeting of the Meteorological Information Exchange Working Group (MET/IE WG/18) and Tenth Meeting of the Meteorological Services Working Group (MET/S WG/10)

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Agenda Item 8: Monitoring of meteorological services

A COLLABORATIVE WC SIGMET COORDINATION TABLE-TOP EXERCISE

(Presented by China, Hong Kong, China, Philippines and Vietnam)

SUMMARY

This paper presents and summarizes the findings of a tropical cyclone (TC) table top exercise that simulated the WC SIGMET Coordination for a past TC case crossing multiple FIRs in the north and northwestern part of the south China Sea. The paper also presents the outcomes, issues encountered, and suggests ways for harmonizing WC SIGMET coordination for the region. A draft supplementary practice is also proposed for including in the APAC Regional SIGMET Guide for MWOs' reference.

1. INTRODUCTION

- 1.1 Tropical Cyclone (TC) is common over APAC region and has significant impact towards the operation of aircraft. As a synoptic scale weather system, a TC could affect multiple FIRs in its lifespan and would warrant close coordination across multiple MWOs in the issuance of WC SIGMET and the related WS SIGMET.
- 1.2 The difficulties and a few observations in coordination of WC SIGMET for tropical cyclones affecting multiple FIRs was presented at [MET/S WG/9-IP/13](#) which called for more regional guidance apart from those stipulated in ICAO Annex 3 and the APAC Regional SIGMET Guide. A user survey on WC SIGMET coordination was also conducted and reported in [MET/R WG/8-WP/07](#). The survey pointed out the gaps between the existing TCAC and MWO's practice in WC SIGMET, and suggested the need of additional guidance so as to improve the meteorological services to the users.
- 1.3 Noting that SIGMET Coordination will become a recommendation in Amendment 79 of ICAO Annex 3 in November 2020, Hong Kong, China, together with 3 neighbouring MWOs in the north and northwestern part of South China Sea (SCS), namely, Hanoi, Manila and Sanya as participants, and 2 MWOs, namely, Cambodia and Guangzhou as observers have organized a tropical cyclone table top exercise in early 2020 to explore ways to tackle the challenges mentioned above. This paper presents the exercise and summarizes the findings including the issues identified and discussions emerged from the exercise in terms of WC SIGMET

coordination.

2. DISCUSSION

Tropical cyclone table top exercise 2020

- 2.1 The purpose of the TC table top exercise is to improve the mutual understanding of the relevant MWOs' respective operational practices in WC SIGMET issuance and to facilitate future harmonization of practice in the issuance of WC SIGMET. The exercise was conducted through the playback of a past TC case (TC Son-Tinh in July 2018) which affected multiple FIRs in the northern part of the SCS.
- 2.2 Prior to the exercise, the exercise coordinator (Hong Kong Observatory (HKO)) drafted an exercise directive for the participants listing the background and rundown of the exercise. A pre-briefing meeting was held on 10 December 2019 for the participants to discuss on the exercise rundown and details as well as providing training on the dedicated exercise website. The exercise website contains an enhanced TC module of the HKO SIGMET Coordination platform. Weather information including satellite, radar, TC tracks, etc., WC SIGMET encoding features and a collaborative chatroom were made available on the platform. A screenshot of the exercise platform was shown in Figure 1.
- 2.3 The exercise was carried out over a two days' period from 06 to 10 UTC on 8 and 9 January 2020. The exercise simulated Son-Tinh's movement over the northern part of SCS in a fast-forward mode which collapsed its 48 hours history into an 8 hours' time frame. The exercise rundown schedule was attached in Table 1. In parallel with the web platform, teleconference was also set up for participants and observers to communicate and discuss about the local practice and interact with the coordinator to ensure smooth progress of the exercise.
- 2.4 A de-briefing meeting was held on 10 February 2020 to summarize the findings and discuss on the major issues discovered during the exercise. There were active discussions on the differences of local practice and suggestions for additional tools among the participants and the observers.

Observations and discussions

- 2.5 Throughout the exercise, several issues on the different MWOs' practices on WC SIGMET issuance were observed:
 - 1) **when and how** to issue the forecast SIGMET, especially when:
 - a tropical cyclone or tropical disturbance inside a FIR has not yet reached tropical storm or above intensity but forecast to be intensified into a tropical storm; and
 - a tropical cyclone lying outside of an approaching FIR has already intensified into a tropical storm or above intensity; and
 - a tropical cyclone or tropical disturbance lying outside of an approaching FIR has not yet reached tropical storm or above intensity but forecast to be intensified into a tropical storm as it enters the FIR.
 - 2) **different sources** of TC forecast tracks and actual observations. Regarding the observed TC centre location and CB clouds, some MWOs based solely on TC advisory issued by TCAC, while others also make reference to satellite imageries, radar observation or mixture of the above techniques. Similarly in respect of forecast track, some MWOs formulated their TC

warning track by following the TCAC advisory while others based on additional information such as global model forecast and local TC forecast centre's guidance, etc.

3) **different update frequency** of WC SIGMET practice. Some MWOs issued a new WC SIGMET after the existing one expired according to the pre-set schedule while some would issue a new one when there were updates on the TC track or latest observations from various sources and then cancel the existing WC SIGMET.

4) **different interpretation** about the contents of the WC SIGMET issued. Some MWOs considered the “movement” in the SIGMET message referred both to the TC and the associated CB as one system while others took a different view. (Note that this issue will be resolved with Amendment 79 to ICAO Annex 3 where “movement” will refer to the movement of the TC Centre.)

5) **when and how to switch** from WC SIGMET and WS SIGMET and vice versa. Due to the above different practices and other considerations, neighbouring MWOs showed different practices in switching between WC SIGMET and WS SIGMET when a TC crossed a FIR boundary.

2.6 During the de-briefing meeting, the following were achieved with a view to aligning better the different practices among the MWOs:

1) The participating MWOs were generally open in aligning the different practices in issuing forecast SIGMET but further resources and clear guidelines were required. Some supplementary guidance on top of existing SIGMET Guide might be helpful to facilitate SIGMET coordination.

2) Although there exist differences in the sources of TC tracks and actual observations, the participating MWOs generally agreed that

- a common coordination platform or as a minimum a dialogue platform with effective text or voice chatting function would be beneficial for all relevant MWOs to interact timely and be alerted of any changes on the latest available WC SIGMET; and
- frequent discussions could be helpful in reaching a consensus.

3) The participating MWOs generally agreed that more discussions on SIGMET coordination via similar table top exercises and coordination projects could better align the differences between various MWOs and would achieve more coordinated SIGMETs. HKO will continue to organize future exercises and host coordination projects for SIGMET Coordination. MWOs who are interested in joining these exercises/projects are most encouraged to contact Ms Christy YY Leung (yyleung@hko.gov.hk).

Outcomes

2.7 The TC table top exercise was the first exercise in WC SIGMET coordination conducted in the APAC region which used a simulated multi-party interactive web tool on the internet. Through the exercise, mutual understanding in the different operational procedures adopted by different MWOs was achieved. It also demonstrated that through robust communication between MWOs (e.g. via a designated coordination platform or a commonly accessible chatroom mentioned above), common situational awareness could be realised which could subsequently improve the harmonization of SIGMET information among the relevant MWOs. A successful coordination case was shown in Figure 2.

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- 2.8 The participating MWOs also took the opportunity to provide constructive comments on the SIGMET coordination tool, including improved display and encoding procedure, so as to further facilitate them to conduct coordination effectively and efficiently.

3. SUMMARY AND RECOMMENDATION

- 3.1 Based on the experience from a few coordination projects over APAC region, results from the user survey and the TC table top exercise, the participating MWOs have jointly drafted a proposed “Supplementary Practice in TC-related SIGMET Coordination”. This Supplementary Practice could be helpful to MWOs within the region in TC-related SIGMET coordination. The working draft is attached in **Attachment A** to this paper.

- 3.2 The meeting might like to consider whether it is appropriate to append the proposed Supplementary Practice (Attachment A), after further refinement in response to comments from the group, as an independent Appendix to the APAC Regional SIGMET Guide for States and Organizations’ reference for tropical cyclone related SIGMET coordination. Noting conclusion MET SG/23-5 endorsed the Guidelines for Operational SIGMET Coordination as a reference for States and Organizations concerned and requested ICAO to make the Guidelines available in the APAC Regional SIGMET Guide (as Appendix K to the Guide), alternatively it could be appended as an Annex to that Appendix.

- 3.3 In view of the discussion above, the meeting is invited to consider formulating following Draft Conclusion:

Draft Conclusion MET/S/10/x: Supplementary Practice in TC-related SIGMET Coordination

That, the MET SG approve attaching the proposed Supplementary Practice as an independent Appendix to the APAC Regional SIGMET Guide.

4. ACTION BY THE MEETING

- 4.1 The meeting is invited to:
- a) note the information contained in this paper,
 - b) provide comment on the proposed Supplementary Practice by 10 September 2020,
 - c) discuss the benefit of appending the proposed Supplementary Practice to the Regional SIGMET Guide either as an independent Appendix or as an Appendix to the Guidelines for Operational SIGMET Coordination,
 - d) consider the Draft Conclusion in 3.3, and
 - e) discuss any relevant matters as appropriate.

Attachment A

**Supplementary Practice for TC-related SIGMET COORDINATION
(DRAFT)**

Jointly proposed by China, Hong Kong, China, Philippines and VATM, Vietnam

Objectives

Tropical Cyclone (TC) is common over APAC region and has significant impact towards the operation of aircraft. As a synoptic scale weather system, a TC could affect multiple FIRs in its lifespan and would warrant close coordination across multiple MWOs in the issuance of WC SIGMET and the related WS SIGMET. The coordination of WC SIGMET and related WS SIGMET is necessary to ensure seamless and harmonized SIGMET information for the aviation community.

This document was developed to supplement the Regional SIGMET Guide and provide preferred practices specifically on TC-related SIGMET Coordination for MWOs. MWOs are encouraged to apply the suggested practice in this document for WC SIGMET Coordination and related WS SIGMET Coordination.

Pre-coordination consensus

Prior to implementation of operational SIGMET coordination, there is a need to align the MWOs' practices on the issuance of WC SIGMET as far as possible. It is suggested that MWOs to align on the following aspects of practices:

- Issuance practice of forecast WC SIGMET for TC expected to enter ones' FIR
ICAO Annex 3 7.1.6 stipulates that a WC SIGMET shall be issued as soon as possible but not more than 12 hours before the commencement of the period of validity. For early alerting of the threat of TC approach and the sake of coordination, it is preferred that a forecast WC SIGMET be issued at least 6 hours but no more than 12 hours before a TC of tropical storm or above intensity is expected to enter ones' FIR. The relevant MWOs would endeavour to harmonize the TC position near the FIR boundary.
- Issuance practice of forecast WC SIGMET for TC expected to intensify into a tropical storm or above intensity (Annex 3 7.1.1)
Similar to the proposed practice for TC expected to enter ones' FIR, it is preferred that a forecast WC SIGMET be issued for the expected intensification of the tropical cyclone at least 6 hours but no more than 12 hours before a TC inside ones' FIR is expected to intensify into a tropical storm.
- Issuance practice of WS SIGMET and WC SIGMET
The WC SIGMET allows for inclusion of multiple CB areas associated with TC. To avoid confusing the users, alignment of the practice of including CBs under the WC SIGMET is preferred to avoid one MWO limiting the WC SIGMET to cover the core CB area of the TC

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and then the other CB areas by WS SIGMET while the neighbouring MWO includes all the CB areas under WC SIGMET.

- Validity period of WS SIGMET

To cover the convection arising from TC before it intensifies into a tropical storm or before it enters one's FIR, it is preferred that a WS SIGMET be issued up till the start time of the validity of a forecast WC SIGMET.

- Determination of the time TC crossing the boundary of a FIR

MWOs are recommended to agree as far as possible with neighbouring MWOs on the time when a TC is forecast to cross a FIR boundary. This is especially necessary when a TC only tracks across a FIR for a period of less than 3 hours where the TC would seem to jump from one FIR to another FIR without passing through the FIR in the middle.

- Inclusion of the forecast TC centre in the WC SIGMET

For the sake of coordination and better support to users who nowadays increasingly use graphical decision support tools, it is preferred that MWOs use "TC forecast centre" in the WC SIGMET as far as possible to explicitly specify the predicted location of the TC centre rather than using speed and direction of movement. Moreover, according to amendment 79 to ICAO Annex 3, it would not be possible to provide the forecast CB area if the forecast TC centre is made by way of speed and direction of movement, the use of "TC forecast centre" would avoid any ambiguity in the forecast TC and CB positions. Use of "movement or expected movement" could still be used in straightforward cases such as slow moving TC.

Coordination considerations during operations

During operations, a few suggestions on improving the efficiency of the coordination and ensuring fruitful coordination results are as follows:

1. Holding short pre-briefing(s) for potential TC affecting multiple FIRs in advance. This could help raise common situational awareness and provide opportunity for the related MWOs to share views on the uncertainty of the forecast track, intensity changes and other relevant considerations.
2. Coordination could be bilateral or multilateral depending on the complexity of the tropical cyclone tracks adopted by different MWOs. Forecasters are suggested to coordinate, such as a discussion on the latest observation and agreement with the TCAC advisory, before the issuance of WC SIGMET.
3. For neighbouring MWOs not affected directly by the TC (i.e. the TC centre would not enter one's FIR) but the significant convection could affect one's FIR, it is suggested that forecasters from these MWOs could also join the discussion for the need of related WS SIGMET issuance. It is suggested that the forecasters could propose on the time of issuance, cancellation and parameters in the TC-related WS SIGMET in the same coordination chatroom. The MWOs affected by the significant convection could then coordinate according to procedures similarly as WC SIGMET coordination.

4. The key parameters in the WC/WS SIGMET coordination would be, but not limited to, the followings:

- The timing of upgrade/downgrade of a TC intensity
- The timing of entering/exiting FIRs
- The issuance and cancellation of a WC SIGMET (including both observed and forecast SIGMET) and keep the neighbouring MWOs alerted
- The past 6-hour or 12-hour movement and direction
- The forecast TC movement
- The TC size
- The CB cloud top height
- The TC-related CB clouds' parameters (cloud top height, coverage, movement, etc) (and also for the related WS SIGMET)

5. One of the key element for successful WC SIGMET coordination is common situation awareness which would be greatly facilitated by the availability of a common graphical interface and/or a common dialogue platform. The graphical interface should include all essential observations (satellite, radar, lightning, etc.), tropical cyclone advisory (TCA), NWP and/or NMHS forecast data to provide a “common situation” reference to operational meteorologists’ of the relevant MWOs. Graphical representation of TC and standardized encoding of SIGMET in TAC as well as IWXXM formatted message would shorten the time for forecasters to formulate the SIGMET while reserving sufficient time for carrying out coordination. Automatic generated alerts for the availability of updated information (e.g. TCA) would also help timely initiation of the coordination process.

Post-coordination Review

Post event review is highly useful in improving the effectiveness of the cross-border coordination. During the review meetings, MWOs could evaluate and review the coordination process, discuss on objective verification results, review case studies, and provide training for aviation forecasters. These would be rather beneficial to all participants in improving mutual understanding and to facilitate effective and efficient coordination.

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Table 1: The rundown of the TC table top exercise 2020

Table clock	Data time	Available advisories	Scenario	Main exercise players concerned
Day 1 (8 January 2020)				
06Z	Introduction and setup of the exercise environment			
0630Z	16/7 21Z	12Z model tracks 18Z TCA	- TC expected to intensify into to a Tropical Storm - First issuance of TCA	RPLL VHHH
0730Z	17/7 03Z	12Z model tracks 00Z TCA	- TC intensified to Tropical Storm - TC leaving RPLL and entering VHHH	RPLL VHHH
0830Z	17/7 09Z	00Z model tracks 06Z TCA	- TC entered VHHH and left RPLL	RPLL VHHH ZJHK
0930Z	Quick evaluation and discussion			
Day 2 (9 January 2020)				
06Z	Setup of the exercise environment			
0615Z	17/7 15Z	00Z model tracks 12Z TCA	- TC leaving VHHH and entering ZJHK	VHHH ZJHK
07Z	17/7 21Z	12Z model tracks 18Z TCA	- TC entered ZJHK and left VHHH	VHHH ZJHK
08Z	18/7 03Z	12Z model tracks 00Z TCA	- TC leaving ZJHK and entering VVGL	ZJHK VVGL
09Z	18/7 09Z	00Z model tracks 06Z TCA	- TC entered VVGL and left ZJHK	ZJHK VVGL
0930Z	Quick evaluation and discussion			

Figure 1: A screenshot of the TC table top exercise module

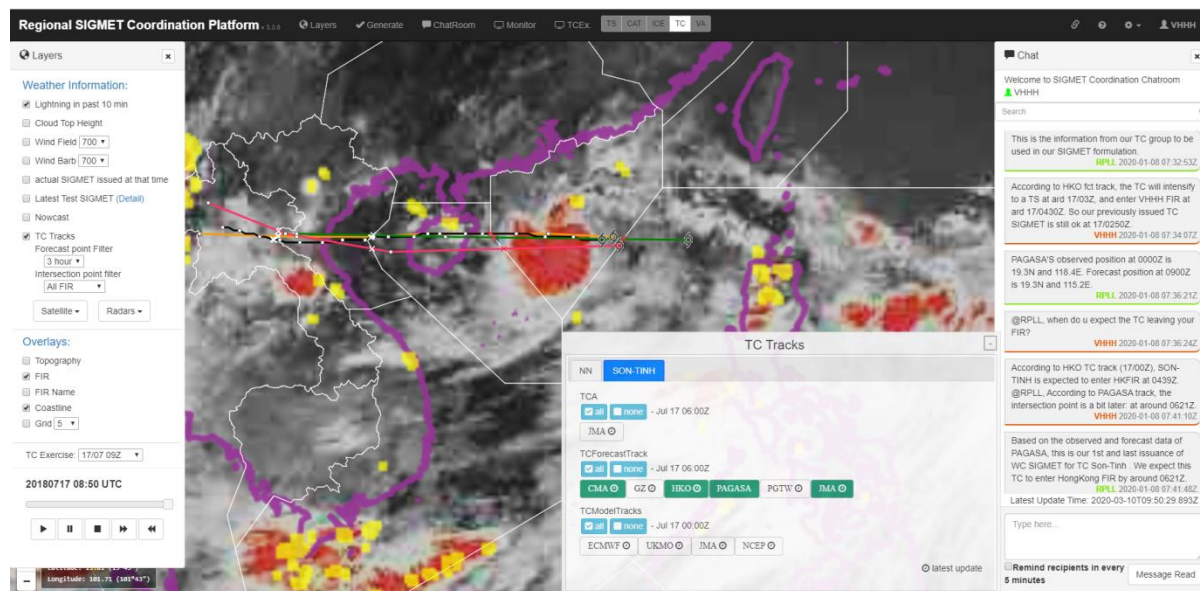


Figure 2: A coordinated WC SIGMET in the TC table top exercise by Hanoi and Sanya MWO

