

MEMBER REPORT

ESCAP/WMO Typhoon Committee
41st Session

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Chiang Mai, Thailand

Meteorological Services Division
National Environment Agency
Singapore

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I. Overview of tropical cyclones which have affected/impacted Member's area in 2008

1. Meteorological Assessment (highlighting forecasting issues/impacts)

For the period of assessment from 1 September 2007 to 31 October 2008, the tropical cyclones that moved across the South China Sea had some indirect impact on the weather in Singapore.

The indirect impacts were due to the strengthening and convergence of southwesterly winds in the near-equatorial region of the South China Sea. In particular, on 7 August 2008, the passage of Tropical Storm "Kammuri" through the South China Sea, enhanced the afternoon convection over Singapore that triggered a wet microburst with 133.9 mm of rainfall recorded. The wet weather conditions and above average rainfall in September 2008 were also indirectly due to the tail-end of the spiral rain bands from the series of tropical cyclones ("Hagupit", "Jangmi", "Mekkhala" and "Higos") traversing the South China Sea.

2. Hydrological Assessment (highlighting water-related issues/impact)

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3. Socio-Economic Assessment (highlighting socio-economic and DPP issues/impacts)

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4. Regional Cooperation Assessment (highlighting regional cooperation successes and challenges)

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II. Summary of progress in Key Result Areas (For achievements/results which apply to more than one Key Result Area, please describe them under the most applicable Key Result Area. Then, at the end of the description, place in parentheses () the other applicable Key Result Areas)

1. Progress on Key Result Area 1: Reduced Loss of Life from Typhoon-related Disasters. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

- (i) Tropical storm alerts/warnings are provided to Singapore's shipping communities. (KRA 2(a))
- (ii) Singapore began receiving data from FY2D satellite in 2008. The data is received on an hourly basis and is processed into imageries for operational weather forecasting and aviation users. Images from FY2D and MTSAT are used to produce a mosaic image that extends the hourly images to cover a larger domain consisting of the Pacific Ocean as well as the Indian Ocean.
- (iii) Data from JMA's MTSAT-1R satellite have been received since 2006. In March 2008, Singapore began receiving HRIT data and is currently exploring the production of various derived products such as cloud classification, precipitation estimate and aerosol optical depth.
- (iv) To help alleviate the impact of storms such as squalls, or tropical cyclones, Singapore provides heavy rain and strong winds advisory and warning to various government agencies for enhancing preparedness for expected heavy rain and strong winds. The warnings are also issued to the public via the media.

b. Hydrological Achievements/Results

- (i) Heavy rains from the indirect impact of tropical cyclones could cause flooding in low lying areas of Singapore when the rains coincide with high tides. Our drainage system is designed with a capacity to cope with floods from very heavy rain that occurs once in 5 years. The drainage code has a deliberate requirement to raise low-lying grounds in conjunction with redevelopment proposals and this helps to

reduce the severity of floods caused by heavy rain. The ground levels of our reclaimed sites are at least 1.25 m above the highest tide.

- (ii) Improvements in the content and mode of dissemination of heavy rain warnings were provided to Singapore's national water agency, the Public Utilities Board (PUB). The improvements have enabled a more efficient and faster dissemination and tracking of heavy rain warnings not only to the PUB but to other government agencies in their preparedness against heavy rain events.
- (iii) The Public Utilities Board officially opened the Marina Barrage on 31 August 2008. The Marina Barrage forms part of a comprehensive flood control scheme to alleviate flooding in the low-lying areas of Singapore. In the event of a heavy rain which may be a result of the indirect impact of tropical cyclones in the South China Sea, a series of nine crest gates at the dam are activated to release excess storm water into the sea when the tide is low. In the case of high tide, giant pumps will drain the excess storm water into the sea. (KRA 2(b))

c. Disaster Prevention and Preparedness Achievements/Results

- (i) The tsunami modelling software "Operational Tsunami Alert System" (OPTAS) designed to assess the potential impact of tsunami on Singapore was completed in August 2008. This is part of the development of Singapore's national Tsunami Early Warning System (TEWS) which consists of real-time exchange of data with countries in the region including tide data from the tidal gauge network. The TEWS and the new numerical modelling software (OPTAS) would thus enable Singapore to better assess potential impacts of tsunamis and storm surges on the country, enhance its natural preparedness and contribute to regional and international efforts to monitor and mitigate potential disasters.
- (ii) The establishment of TEWS has enhanced Singapore's overall preparedness for natural disasters and on 1 September 2008, enhanced co-operation between various units in the organisation has led to the formation of a section overseeing multi-hazards early warnings. More officers have thus been trained to support and contribute to the monitoring and mitigation of natural disasters.
- (iii) In addition, a national emergency response plan involving multi-agency effort has been developed to enable preparedness among the response agencies in the event of a tsunami incident in Singapore. The plan is also applicable to storm surge events.

d. Regional Cooperation Achievements/Results

As in (c) above.

e. Identified Opportunities/Challenges for Future Achievements/Results

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2. Progress on Key Result Area 2: Minimized Typhoon-related Social and Economic Impacts.
(List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

As in KRA 1(a) part (i)

b. Hydrological Achievements/Results

As in KRA 1(b) part (iii)

c. Disaster Prevention and Preparedness Achievements/Results

As in KRA 1(c) part (iii)

- d. Research, Training, and Other Achievements/Results
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 - e. Regional Cooperation Achievements/Results
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 - f. Identified Opportunities/Challenges for Future Achievements/Results
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3. Progress on Key Result Area 3: Enhanced Beneficial Typhoon-related Effects for the Betterment of Quality of life. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)
- a. Meteorological Achievements/Results
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 - b. Hydrological Achievements/Results
 -
 - c. Disaster Prevention and Preparedness Achievements/Results
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 - d. Research, Training, and Other Achievements/Results
 - (i) Singapore participated in several training workshops/conferences/meetings during the year. Some were sponsored/organized by the Typhoon Committee. Singapore would like to express her thanks and appreciation to the Typhoon Committee for giving us the opportunity to participate in the workshops which our officers have found very useful and beneficial in their course of work. Below is a list of the relevant workshops/conferences attended.
 - Typhoon Committee Roving Seminar 07, 4 – 9 Sep 2007, Manila, Philippines.
 - Integrated Workshop on Coping with Climate Change in the Typhoon Committee Area, 21-27 Sep 2008, Beijing, China.
 - Weather Research and Forecasting (WRF) Model, 13 – 18 Jan 2008, USA
 - Data Assimilation and Use of Satellite Data Training, 20 Apr 2008 – 5 May 2008, Reading, UK
 - Training Workshop on the Development of Standard Operating Procedures for Indian Ocean and Southeast Asian Countries - Strengthening Tsunami Warning and Emergency Responses, 11 – 17 May 2008, Bangkok, Thailand.
 - Training Workshop of ASEAN Regional Climate Model Validation, 6 – 9 Jul 2008, Yogyakarta, Indonesia.
 - Training of Upper Air Observatory Systems, 18 – 27 Oct 2008, Turkey.
 - International Training Workshop on Earthquake Hazard reduction Strategy, 27 – 30 Oct 08, Bandung, Indonesia
 - ASEAN-ROK Training Workshop on Aviation Meteorology, 10 – 14 Nov 2008, Seoul, Korea.
 - e. Regional Cooperation Achievements/Results
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 - f. Identified Opportunities/Challenges for Future Achievements/Results
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4. Progress on Key Result Area 4: Improved Typhoon-related Disaster Risk Management in Various Sectors. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)
- a. Meteorological Achievements/Results
 - (i) Replacement of Mainframe Computer System:
The mainframe computer system is the main data processing system in Singapore's meteorological office. The mainframe processes, customizes and disseminates

weather information (inclusive of Tropical Cyclone information) to the civil aviation authority, airlines and other users. In the first quarter of 2008, the mainframe computer system was migrated to a newer, more cost effective open platform. The new system provides for better processing capability and more user friendly interfaces for users.

- (ii) Upgrade of the Wind Profiler Radar:
Singapore's Wind Profiler radar has been operational since 1998 to provide continual measurements of the vertical wind profile up to about 5,000 m above ground level. The data is used by forecasters to monitor the weather and provide more timely and accurate forecasts to users. The wind profiler radar was replaced in November 2008 with a more enhanced system that provides better features such as higher resolution and temperature sounding.
 - (iii) Replacement of Weather Radar:
Singapore's existing S-band Doppler weather radar is in progress of being replaced with a new system which will provide better functionality, such as forecast guidance applications.
 - b. Hydrological Achievements/Results
As in KRA 1(b)
 - c. Disaster Prevention and Preparedness Achievements/Results
As in KRA 1(c)
 - d. Research, Training, and Other Achievements/Results
As in KRA 3(d)
 - e. Regional Cooperation Achievements/Results
 - (i) Singapore contributed to TCDIS with updates on our early warning and disaster management systems.
 - f. Identified Opportunities/Challenges for Future Achievements/Results
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5. Progress on Key Result Area 5: Strengthened Resilience of Communities to Typhoon-related Disasters. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)
- a. Meteorological Achievements/Results
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 - b. Hydrological Achievements/Results
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 - c. Disaster Prevention and Preparedness Achievements/Results
 - (i) Singapore has a Public Warning System (PWS) consisting of a network of sirens, to provide early warning to the general population of any imminent threats that could endanger lives and property. The outdoor sirens are strategically located and provide a comprehensive island-wide acoustical coverage. In the event of a natural disaster, the PWS will be sounded to alert the public to seek refuge at communal or household shelters. In conjunction with the activation of the PWS, the commercial radio and television stations will also broadcast any advisory messages from the Singapore Civil Defence Force (SCDF). As at Jun 2008, the PWS coverage of the island is 98%.
 - (ii) The SCDF has undertaken to acquaint and educate the public with the various types of warning signals and corresponding actions to be taken. Sounding tests are conducted on a monthly basis to ensure the operational readiness of the PWS.

- (iii) To further equip emergency preparedness knowledge and skills among the community, the publication of the 6th edition of the Civil Defence Emergency Handbook was made available to members of the public in September 2008. The handbook is a comprehensive guide on emergency procedures in handling conventional and unconventional threats and natural disasters.
 - d. Research, Training and Other Achievements/Results
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 - e. Regional Cooperation Achievements/Results
 - (i) Singapore's SCDF hosted the ASEAN Regional Disaster Emergency Response Simulation Exercise 2007, code-named (ARDEX-07). The exercise focused on a disaster relief operation that was jointly performed by Singapore as a host country, participating ASEAN member countries, as well as invited teams from the United Nations and International Organisations. This multi-agency exercise had effectively validated the ASEAN Standard Standby Arrangement for Emergency Response and Disaster Relief SOP (SASOP).
 - f. Identified Opportunities/Challenges for Future Achievements/Results
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- 6. Progress on Key Result Area 6: Improved Capacity to Generate and Provide Accurate, Timely, and understandable Information on Typhoon-related Threats. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)
 - a. Meteorological Achievements/Results
 - (i) As in KRA 1(a) and KRA 4(a)
 - (ii) The GTS link to Brunei was upgraded to 64 kbps in Apr 08.
 - b. Hydrological Achievements/Results
 - As in KRA 1(b)
 - c. Disaster Prevention and Preparedness Achievements/Results
 - As in KRA 1(c)
 - d. Research, Training, and Other Achievements/Results
 -
 - e. Regional Cooperation Achievements/Results
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 - f. Identified Opportunities/Challenges for Future Achievements/Results
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- 7. Progress on Key Result Area 7: Enhanced Typhoon Committee's Effectiveness and International Collaboration. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)
 - a. Meteorological Achievements/Results
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 - b. Hydrological Achievements/Results
 -
 - c. Disaster Prevention and Preparedness Achievements/Results
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 - d. Research, Training, and Other Achievements/Results
 -
 - e. Regional Cooperation Achievements/Results
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- f. Identified Opportunities/Challenges for Future Achievements/Results
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III. Resource Mobilization Activities

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IV. Update of Members' Working Groups representatives

1. Working Group on Meteorology
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2. Working Group on Hydrology
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3. Working Group on Disaster Prevention and Preparedness
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4. Training and Research Coordinating Group
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5. Resource Mobilization Group
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