**Severe Weather Forecasting Demonstration Project (SWFDP)**

**Regional Sub-projects for Southeast Asia (SeA)**

**Training Workshop on**

**Severe Weather Forecasting (Week 1) and Delivery of Warning Services (Week 2)**

(Ha Noi, Viet Nam, 19-30 March 2018)

**Provisional Programme for Week-1 (19-23 March 2018)**

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| **Day 1: Monday, 19 March 2018** |
| 09:00-09:30 | **Registration** | All  |
| 09:30-09:55 | **Opening** * Welcome Remarks by local host
* Message by WMO
* Group Photo
 | NHMS-Viet NamAH (WMO) *All (30 min)* |
| 10:00-10:30 | *Coffee/ Tea Break* |  |
| 10:30-10:50 | **Strengthening capacity of NMHSs in improving forecasts and warnings through SWFDP** | AH (WMO) *(20 min)* |
| 10:50-11:00 | **SWFDP-SeA Training Workshop programme and objectives**  | AH (WMO) *(10 min)* |
| 11:00-11:30 | **SWFDP-SeA Website and portal (RFSC Ha Noi) (Interactive Demo)** | DT (to instruct)*(30 min)* |
| 11:30-12:30 | **What are the major hazards in your country?**Country presentations and Group activity on national forecasting capacity and verification activities at NMHSs (Cambodia, Lao PDR, Philippines, Thailand and Viet Nam)Important Note: Please complete the following e-learning courses<https://www.meted.ucar.edu/tropical/textbook_2nd_edition/navmenu.php?tab=10>Tropical meteorology including nowcasting -- about 5 hour workEssay to tease out ‘forecast practises’ --- about 2 hours work | All trainees TF & AG (to facilitate)(*60 min)* |
| 12:30-13:30 | *Lunch Break* |  |
| 13:30-13:45 | **Current weather discussion**  | NHMS *(15 min)* |
| 13:45-14:45 | **Flipped classroom: Ensemble forecasting**Group activityImportant Note: Participants centred class. We will discuss concepts presented in the eLearning module and review the questionnaire:https://www.ecmwf.int/assets/elearning/ensemble/ens1/story\_html5.html Questions (after completing the module):* Why do you think forecasts can go wrong?
* How does ensemble forecasting address (or does not address) the reasons for 'providing wrong forecasts' you have outlined above?
* What is the EDA?
* What constitutes a 'good' ensemble forecast?
* What is the set up of the ECMWF Ensemble forecasting system?

Please upload your answers on shared Google Drive by the **11th March 2018.** Please make sure to add your name on the document before uploading. | All traineesAG & KJ (to lead)MN/TF/VV/DT /LW (to facilitate) *(60 min)* |
| 14:45-15:30  | **Game (Probability)**(The participants will be able to make better use of the probability forecasts through understanding its relevance and importance in decision making ) | All traineesAG (to instruct)*(45 min)* |
| *15:30-16:00* | *Coffee/ Tea Break* |  |
| 16:00-17:30 | **Introducing model output verification methods: contingency tables and scores** (Lecture 30 minutes, practical 45 minutes) (The participants will be able to carry out contingency table verification with the help of the tools used in the session, and will understand the meaning of the most useful scores)Important Note: Please following e-learning course on forecast verification by 11th March 2018 prior to the workshop. <https://eumetcal.eu/links/> Please click on "Verification module" to take the course on above website. Participants should complete the introductory module and the module on Categorical forecast verification --- about 2 hours work | All traineesLW (to instruct)*(90 min)* |

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| **Day 2: Tuesday, 20 March 2018** |
| 09:00-09:45 | **Severe weather forecasting – the forecasting process**Group activity (discussion on the participants essays)Important Note: Participants should write a short essay on their current forecasting process and upload your document on shared Google Drive as mentioned below. For writing essay, please think about a severe weather event for which you had to provide a forecast. This is sometime a daunting task!Describe briefly the event. Think about the forecasting process you followed and describe it. What were the weaknesses/gaps you encountered? Some of the topics you may want to consider are: clarity of task, user interface/communication, forecast confidence/uncertainty and predictability.------------------------------------Please upload your document (include your name) by **11th March 2018**.Your replies will be the starting base for a 45-minutes discussion on how to address gaps and weaknesses in the forecasting process. Each participant will have 2 minutes to highlight the key points described in the submitted document. | AG & Viet Nam NHMS (to instruct)*(45 min)* |
| 09:45-10:30 | **Flipped Classroom – Extreme Forecast Index (EFI) and Shift of Tails (SOT) index**Important Note: Participants are requested to go through the following e-learning module:<https://www.ecmwf.int/assets/elearning/efi/efi1/story_html5.html>This must be completed by the 11th March 2018. | All trainees to split in 4 teamsAG & TF (to instruct)MN/KJ/MN/VV/DT/LW (to facilitate)*(45 min)* |
| 10:30-11:00 | *Coffee/ Tea Break* |  |
| 11:00-12:00 | **Challenge No.1 – EFI and SOT in practise**We will be looking at severe weather events using EFI/SOT and related products. | All trainees split in 4 teams AG & TF (to facilitate)(*60 min) (10 min for each team; 20 min for discussion)* |
| 12:00-12:30 | **Validation of precipitation forecast from ECMWF products** | DT & NT (to instruct) *(30 min)* |
| 12:30-13:30 | *Lunch Break* |  |
| 13:30-13:45 | **Current weather discussion**  | NHMS *(15 min)* |
| 13:45-14:30 | **RFSC Daily Guidance Products** * Forecast process: product checklist, use of NWP guidance, etc.
* Guidance preparation: graphics and alerting message with examples
* Confidence level: how to quantify with examples
* Use and interpretation of short and medium range guidance
 | VV/DT (to instruct)*(45 min)* |
| 14:30-15:30 | **Challenge No.2 – Forecasting damaging/extreme winds** * Each team (4 teams) is given with a high wind case
* Go through the forecast process to identify origins and relevant fields
* Assess for any extreme winds and their potential impacts
* Analyze different scenarios with timing, strength, confidence, alerting/warning strategy
 | All trainees split in 4 teamsMN (to instruct)TF/KJ/AG/VV/DT/LW (to facilitate)*(60 min)* |
| *15:30-16:00* | *Coffee/ Tea Break* |  |
| 16:00-17:30 | **Challenge No.2 – Forecast Presentation and review*** Presentations on damaging winds forecasting by each teams
* Discussion and debriefing by instructor/facilitator(s)
* Forecast process for high winds: product checklist, origins, uncertainties, limitations, etc.
* Assessment of extreme wind events based on EFI and SOT
* Assessment of consequential impacts
* Forecast decision: most likely scenario, alternative/worst case scenarios, extreme events, confidence levels, alerting/warning strategy
* Grades for each teams and award for the best team
 | All teams MN & AG (to facilitate)(90 min) (10 min for each team; 20 min for discussion)All trainees |

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| **Day 3: Wednesday, 21 March 2018** |
| 09:00-09:45 | **Flipped Classroom: Nowcasting**Important Note: Please do the following e-learning courses by 11th March 2018 prior to the workshop.<http://www.wmo.int/pages/prog/amp/pwsp/Nowcasting.htm>Please click on "Proceedings" at the bottom to see detailed introduction of application of Nowcasting techniques.Estimation propagation of MCC/MCS (about 30 minutes):<https://www.slideserve.com/overton/the-propagation-of-mesoscale-convective-complexes> | All traineesTF (to instruct)MN/KJ/AG/VV/DT (to facilitate) *(45 min)* |
| 09:45-10:30 | **Forecast Verification – ensemble/probabilistic forecast** * Overview of forecast verification methods for probabilistic forecasts
* Interpretation of verification statistics
* Including practical activities with verification examples from RFSC

(The participant will understand the meaning of the common verification scores for probability forecasts, so as to be able to interpret verification results prepared by others) | All traineesLW & AG (to instruct)DT/VV (to facilitate)*(45 min)* |
| 10:30-11:00 | *Coffee/ Tea break* |  |
| 11:00-11:30 | Statistical adaptation of NWP products | LW (to instruct)*(30 min)* |
| 11:30-12:30 | **Atmospheric instability and practical use of specific products and indices in diagnosis of deep convection** * K-Index, Total Totals Index, Lifted Index, Vertical Velocity, CAPE, Precipitable water, Theta-E etc.
 | LW (to instruct)(*60 min)* |
| 12:30-13:30 | *Lunch Break* |  |
| 13:30-14:30 | **Tour to the NHMS Forecasting Office and current weather discussion** | Viet Nam NHMS /All *(60 min)* |
| 14:30-15:30 | **Challenge No.3 – Forecasting Heavy Rain*** Each team (4 teams) is given with a heavy rain case
* Go through the forecast process for heavy rain
* Assess for any extreme rainfall and their potential impacts
* Analyze different scenarios with timing, severity, confidence, alerting/warning strategy
 | All trainees split in the same 4 teams TF (to instruct)MN/KJ/AG/VV/DT/LW (to facilitate)*(60 min)* |
| 15:30-16:00 | *Coffee/ Tea break* |  |
| 16:00-17:00 | **Challenge No.3 – Forecast Presentation*** Presentations on heavy rain forecasting by each teams
* Discussion and debriefing by instructor/facilitator(s)
* Grades for each teams and award for the best team
 | All teams TF (to facilitate)*(60 min)* *(10 min for each team; 20 min for discussion)*   |
| 17:00-17:30 | **Review of challenge No. 3:*** Forecast process for heavy rain: product checklist, conceptual models, rainfall categories, uncertainties, limitations, etc.
* Assessment of extreme rainfall events based on EFI and SOT
* Assessment of consequential impacts, e.g. landslide, flash floods, etc.
* Forecast decision: most likely scenario, worst case scenarios, extreme events, confidence levels, alerting/warning strategy
 | All traineesAG & TF (to facilitate)*(30 min)* |

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| **Day 4: Thursday, 22 March 2018** |
| 09:00-09:45 | **Tropical cyclone analysis & forecasting*** TC position fixes and track forecast
* TC genesis and intensity forecast
* Useful NWP/EPS products and tools for TC track/intensity forecast
* Uncertainties and representations
 | MN (to instruct) *(45 min)* |
| 09:45-10:30 | **Forecasting tropical cyclone impacts*** High/extreme winds/rainfall
* High/extreme waves/swells
* Flooding due to storm surge
* NWP/EPS products and tools
 | MN & AG (to instruct)*(45 min)* |
| 10:30-11:00 | *Coffee/ Tea break* |  |
| 11:00-12:30 | Verification of forecast * Verifying forecasts and warnings including TC verification
* SWFDP verification tasks (probability of detection, false alarm ratio etc.) (theory and hands-on session)
 | LW (to instruct)*(90 min)* |
| 12:30-13:30 | *Lunch Break* |  |
| 13:30-13:45 | **Current weather discussion**  | NHMS-Viet Nam *(15 min)* |
| 13:45-14:30 | **Exercise: Severe weather forecasting for Short-range** Preparing forecasts for Day 1 & Day 2 | All trainees split in the same 4 teams TF & KJ (to lead)MN/DT/VV/AG/LW (to facilitate) *(45 min)* |
| 14:30-15:30 | **Combining nowcast, NWP forecast & conceptual models*** Concept models for heavy rain with examples
* Blending of nowcast and NWP forecast
 | WK (to instruct)*(60 min)* |
| 15:30-16:00 | *Coffee/ Tea Break* |  |
| 16:00-16:45 | **Looking back: Nowcasting based on radar products** * Rainfall nowcasting basics (radar QPE/QPF)
* Use of nowcast products
* Performance and limitations

Important Note: Please do the following e-learning courses by 11th March 2018 prior to the workshop.Basic Principles of Weather Radar Systems: (about 45 min): <https://www.youtube.com/watch?v=B3S1CUO1JJY> Reflectivity and Rain Rate (about 45 min): <https://www.youtube.com/watch?v=kgoHArE_zNc>Precipitation and Orography (about 1 hour): <https://www.youtube.com/watch?v=lmFe40w9ppc>Radar Signatures for Severe Convective Weather (about 1.5 hours): <https://www.meted.ucar.edu/training_module.php?id=193#.Wo_w6YNuaUk> | WK (to instruct)*(45min)* |
| 16:45-17:30 | **Nowcasting Exercise & Practical work based on radar products** | *All trainees split in the same 4 teams* WK & TF (to lead) DT/VV (to facilitate)*(45 min)* |

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| **Day 5: Friday, 23 March 2018** |
| 09:00-09:45 | **Looking back: Nowcasting based on satellite products** * Satellite basics and products available for severe weather
* Use of satellite products for rainfall nowcast
* Performance and limitations
 | TF (to instruct)*(45min)* |
| 09:45-10.30 | **Nowcasting Exercise & Practical work based on satellite products** | All trainees split in the same 4 teams TF & WK (to lead)DT & VV (to facilitate)*(45 min)* |
| 10:30-11:00 | *Coffee/ Tea Break* |  |
| 11:00-12:30 | **Verification of forecast: Exercise (hands-on session)** | All traineesLW (to lead)DT/VV (to facilitate)*(90 min)* |
| 12:30-13:30 | *Lunch Break* |  |
| 13:30-14.30 | **Reviewing the forecast process****Award for the best forecasting team** **Closing remarks** | All/ AG & LW (to facilitate) |

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| **Sr #** | **Names of Lecturers/Experts** | **Areas of expertise** |
| 1. | AG –  | Dr Anna Ghelli (ECMWF) | NWP especially ensemble products and its interpretation and use in forecasting |
| 2. | TF –  | Mr Tian Fuyou (CMA) | NWP interpretation and its practical use in forecasting and Nowcasting  |
| 3. | MN – | Mr Masami Narita(JMA) | Typhoon/tropical cyclone forecasting and NWP interpretation and use in forecasting |
| 4. | KJ – | Dr Kyungjeen Park (KMA) | NWP and its interpretation and use in severe weather forecasting |
| 5. | WK –  | Mr Wai-kin Wong (HKO) | Nowcasting and NWP interpretation and use in severe weather forecasting |
| 6. | DT – | Mr Du Duc Tien (NHMS Viet Nam)  | NWP including NWP LAM at NHMS Viet Nam and RFSC Guidance products |
| 7. | VV – | Mr Vo Van Hoa (NHMS Viet Nam) | NWP including NWP LAM at NHMS Viet Nam and RFSC Guidance products |
| 8. | NT– | Mr. Nguyen Thanh Tung (NHMS Viet Nam) | NWP including NWP LAM at NHMS Viet Nam |
| 9. | LW –  | Mr Laurie Wilson (WMO consultant) | Verification of forecast, NWP interpretation, statistical adaptation of NWP products, case studies and vast teaching experience  |
| 10. | AH – | Mr Ata Hussain (WMO Secretariat) | SWFDP projects coordination with vast experience in operational forecasting |

**Important Note for Trainees on pre-workshop e-learning Courses:**

All the trainees are required to complete a few e-learning courses (as mentioned above within the training programme) before coming to the training workshop. The objective of the e-learning courses is to assist the trainees to have better preparation and to refresh their knowledge prior to the workshop.