15th Integrated Workshop on Typhoon Committee

Presenting Country: Malaysia

CONTENTS

ESCAP/WMO TC Committee Research Fellowship 2019

MET Malaysia Contributions

Future Enhancements of Nowcasting in MET Malaysia



Malaysia's Contribution

Preliminary Project (PP) Attachment Training on Radar Integrated Nowcasting System (RaINS)

Host / Coordinator

Teaching

Software

Contribution of Malaysia: Teaching





Contribution of Malaysia: Software

Tools (RaINS Source Code) given to Participants

Good skill score in Thailand & China (PP Research Fellowship 2019)

Useful SKILL SCORES



Figure 1: The performance of RaINS for both case studies

Figure 1 (top) depicted the performance of RaINS in a heavy rainfall case study in China on 26 May 2019 while Figure 1 (bottom) depicted the performance of RaINS during Tropical Storm Pabuk in Thailand. Both visual and skill score verification indicate useful skill at lead times of 84 minutes (China) and 130 minutes for Pabuk, Southern Thailand. The Fraction Skill Score (FSS) depicted on Figure 1 (top:right) was applied to the China case with blue line indicating 60 minute lead time & orange line showing 90 minute lead time. Red shading showed radar observation while blue shading indicates nowcasts in Figure 1 (top and bottom left) showed reasonable agreement between observed and nowcasts up to 90 minutes ahead.

Proposed Training: 2021 AOP

- Radar Satellite Blending & Nowcasting.
- Himawari Satellite Data Available to NHMSs
- > May help countries without extensive radar network
 - > Method originally developed by HKO.
- > MET Malaysia adopted the method (will be operationalized soon).
 - > MET Malaysia proposed to help HKO train other countries.



Proposed Training (Continued)

Compositing Multiple Radars

➢ Principles of Radar Nowcasting.

FUTURE ENHANCEMENT OF RAINS: Include Satellite Data (Contd...)





FUTURE ENHANCEMENT OF RAINS: BLEND Radar with Satellite Data (Contd...)



Écho in Peninsular East Coast well-defined in Satellite

FUTURE ENHANCEMENT OF RAINS:

INTEGRATE RAIN-GAUGE



FUTURE ENHANCEMENT OF RAINS: INTEGRATE RAIN-GAUGE

Window Correlation Matching Method

Compare Gauge vs. Radar Average

dBZ	dBZ	dBZ	
dBZ	R	dBZ	
dBZ	dBZ	Dbz	

R is rain gauge averaged t-10 to t+10 mins Calculate ZR Relationship

$$\underbrace{dBZ_i}_{y} = \underbrace{b}_{m} \underbrace{10\log R_i}_{x} + \underbrace{10\log R_i}_{c}$$



Barnes Successive Correction Scheme

> Correction based on Radar – Raingauge Residuals

Successive Iteration to Minimize Residual



G

G

G

G –	Residual	of	Radar
Raingauge			

W is Barnes Weight

B is Barnes Correction

L is Barnes Search Radius

h is the distance between rain gauge and radar grid point B.

FUTURE ENHANCEMENT OF RAINS: INTEGRATE RAIN-GAUGE

Example of Radar – Raingauge QPE in Hong Kong

Codes available in the COM-SWIRLS software



Rainfall Analyses performed by the Hong Kong Observatory

a) Co-kriging

- b) Kriging c) Barnes
- d) Radar Observation

Yeung H.Y. et al. (2011). Application of Radar-Raingauge Co-Kriging to Improve QPE and Quality Control of Real-time Rainfall Data. HKO Reprint 968.

FUTURE ENHANCEMENT OF RAINS: Mobile App

RaINS Mobile Apps

- <u>Researcher Industry Scientific Exchange (RISE).</u>
- Collaboration between government researcher and industry.
- Government funding.
- MET Malaysia is collaborating with MAP2U SDN. BHD.
- MET Malaysia provides the RaINS nowcasting system data.
- MAP2U develops the mobile apps of RaINS.
- A prototype of RaINS has been developed.





THANK YOU!