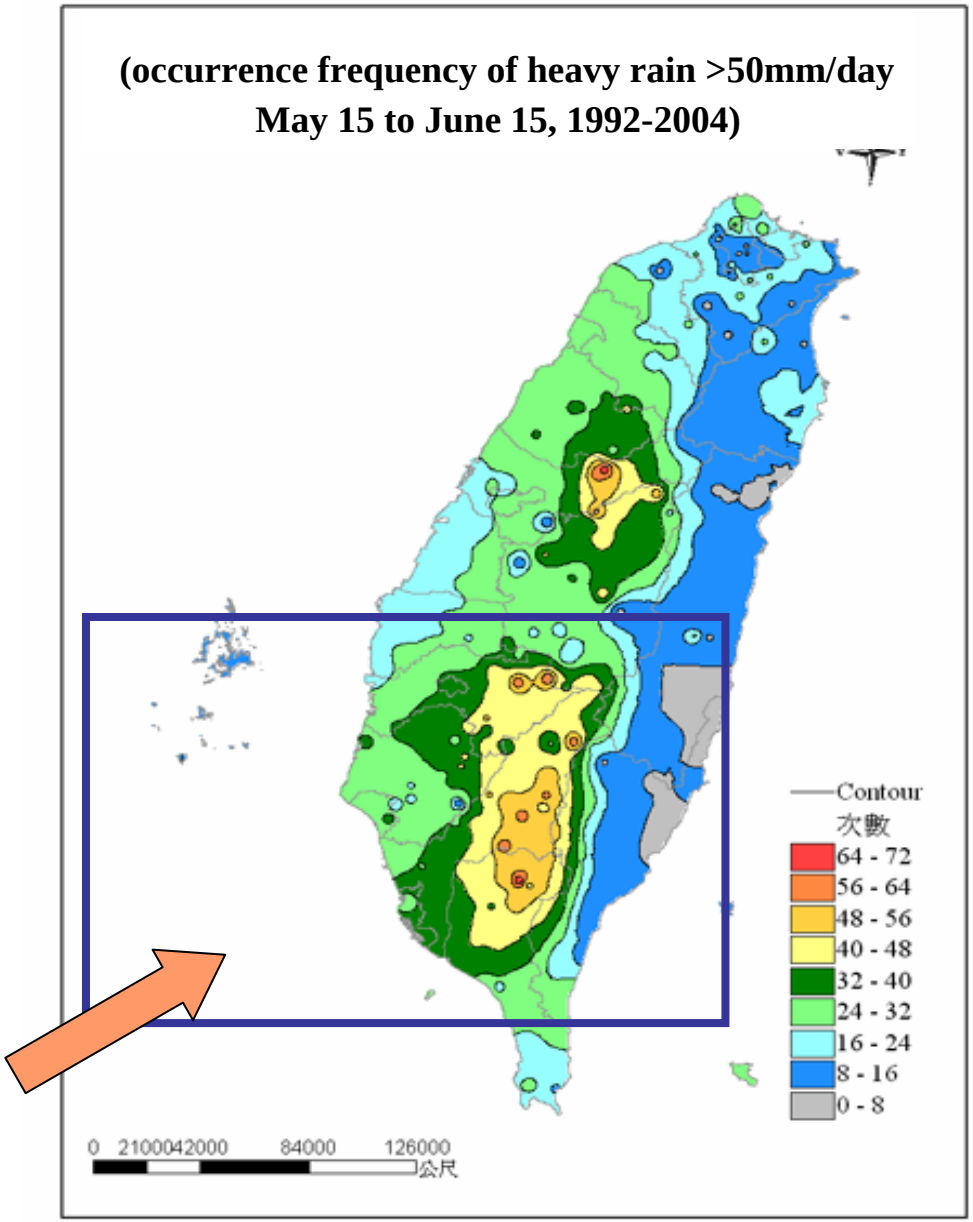
Overview and Update of SoWMEX/TiMREX Southwest Monsoon Experiment/Terrain-influenced Monsoon Rainfall Experiment

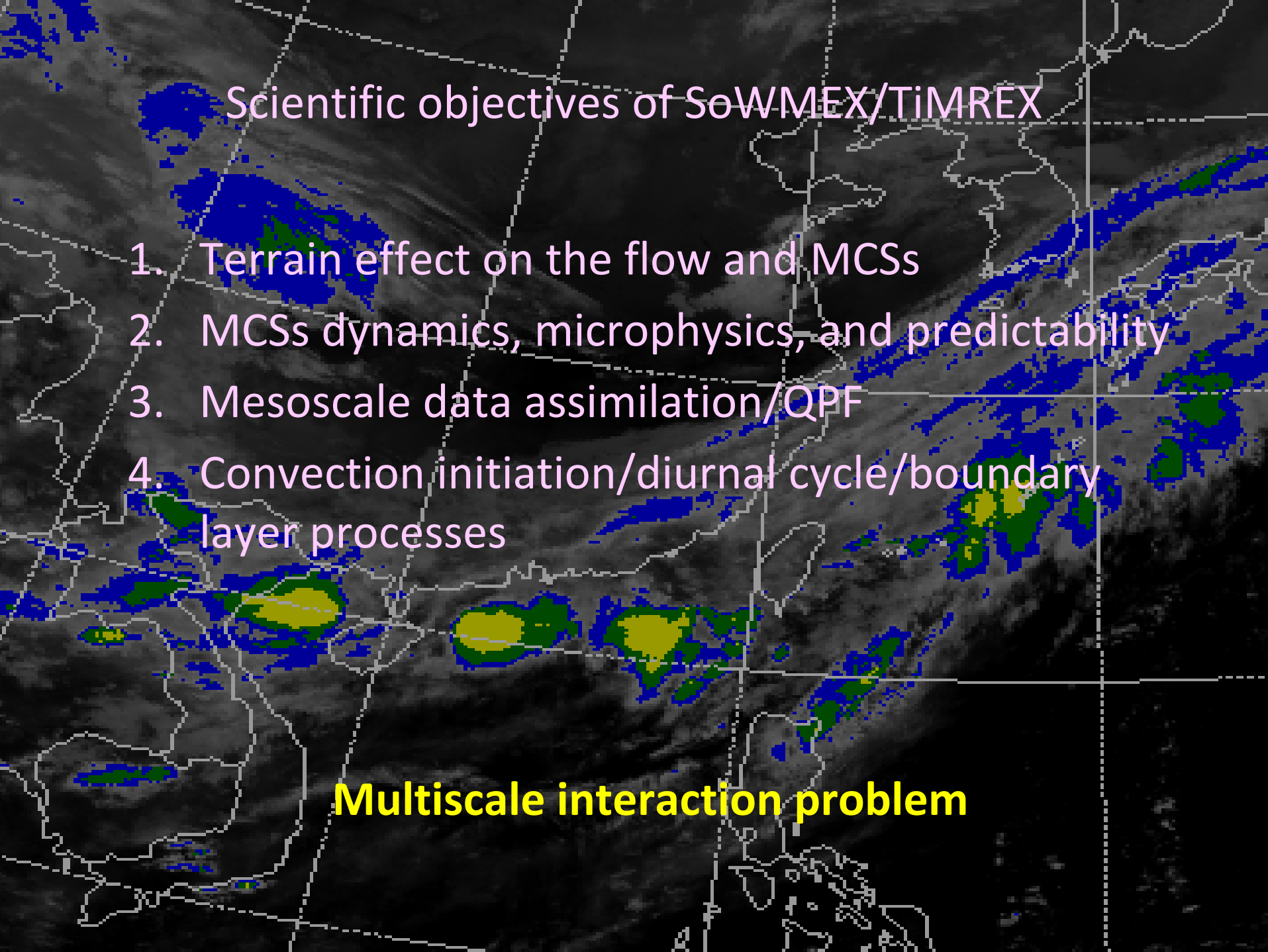
Jong-Dao B. Jou, Wen-Chau Lee, Richard H. Johnson,
Yu-Chieng Liou, and Chia-Rong Chen

November 2010, Taipei



Goal of SoWMEX/TiMREX

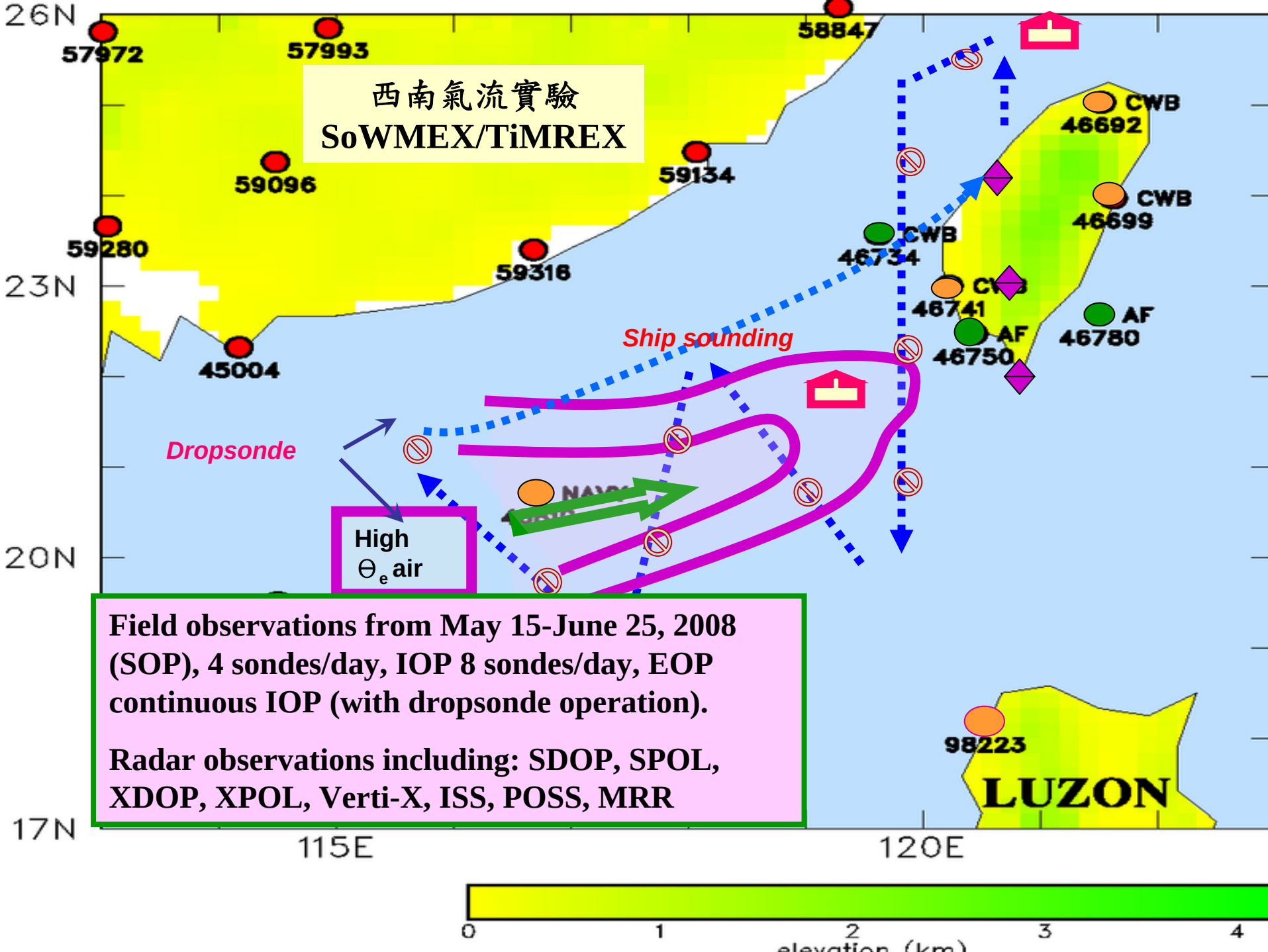
Through advancing basic understanding of **the southwest monsoon flows in the open ocean** and **the orographic precipitation processes over monsoon environment** to improve current capability of severe weather nowcasting and quantitative precipitation estimation and forecasting in the Taiwan area.



Scientific objectives of SoWMEX/TiMREX

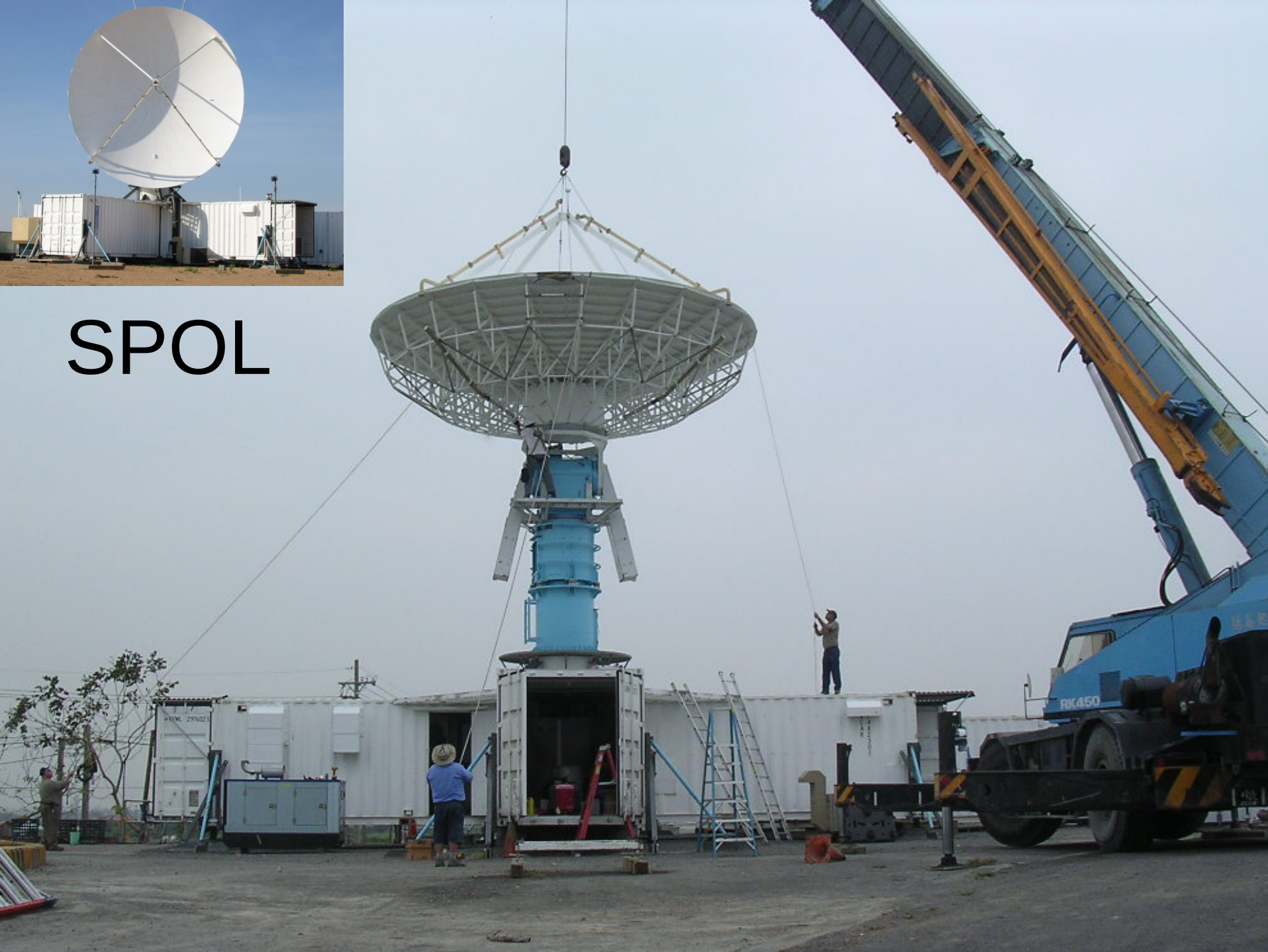
1. Terrain effect on the flow and MCSs
2. MCSs dynamics, microphysics, and predictability
3. Mesoscale data assimilation/QPF
4. Convection initiation/diurnal cycle/boundary layer processes

Multiscale interaction problem



Field observations from May 15-June 25, 2008 (SOP), 4 sondes/day, IOP 8 sondes/day, EOP continuous IOP (with dropsonde operation).

Radar observations including: SDOP, SPOL, XDOP, XPOL, Verti-X, ISS, POSS, MRR


SPOL
RK450


POSS
Supersite
2DVD
ISS
.1mm gauge
Verti-X
JWD
MRR


Dropsonde
briefing


Operation control
center/SPG meeting


SPOL and TEAMR


Japan XDOP


Ship sounding

Scientific results of SoWMEX/TiMREX

1. **Environment and MCSs**: Richard **Johnson**, Paul Ciesielski, Yi-Leng **Chen**, Chun-Chieh **Wang**, Koung-Yin **Liu**, Hsiao-Wei **Lai**, Chris Davis, Weixin **Xu**, Edward Zipser, Jong-Hoon **Jeong**
2. **Storm initiation**: Jim **Wilson**, Rita Roberts, Ping-Feng Lin, Pao-Liang Chang, Cheng-Ku **Yu**, Weixin Xu, Ching-Hwang **Liu**, Shao-Ching Hwang, Radian **Hsiu**
3. **Storm microphysics**: Angela **Rowe**, Dong-In **Lee**, Sung-A **Jung**, Pay-Liam **Lin**, Taro **Shinoda**, Wenhua **Gao**
4. **SPOL and QPE**: John **Hubbert**, J **Vivek**, Tai-Chi C **Wang**, Xin-Hao **Liao**, Angela Rowe, Wei-Yu **Chang**, Ultimate **Jung**
5. **Data assimilation and QPF**: Jenny **Sun**, Amanda **Anderson**, Yu-Chieng **Liou**, Fang-Ching **Chien**, Ming-Jen **Yang**, Yi-Yun **Chen**
6. **Tropical cyclones and others**: YQ **Wang**, Mayumi Yoshioka, Jim **Moore**, L **Feng**, CC Wang, Nan-Ching **Yeh**, WJ **Chen**

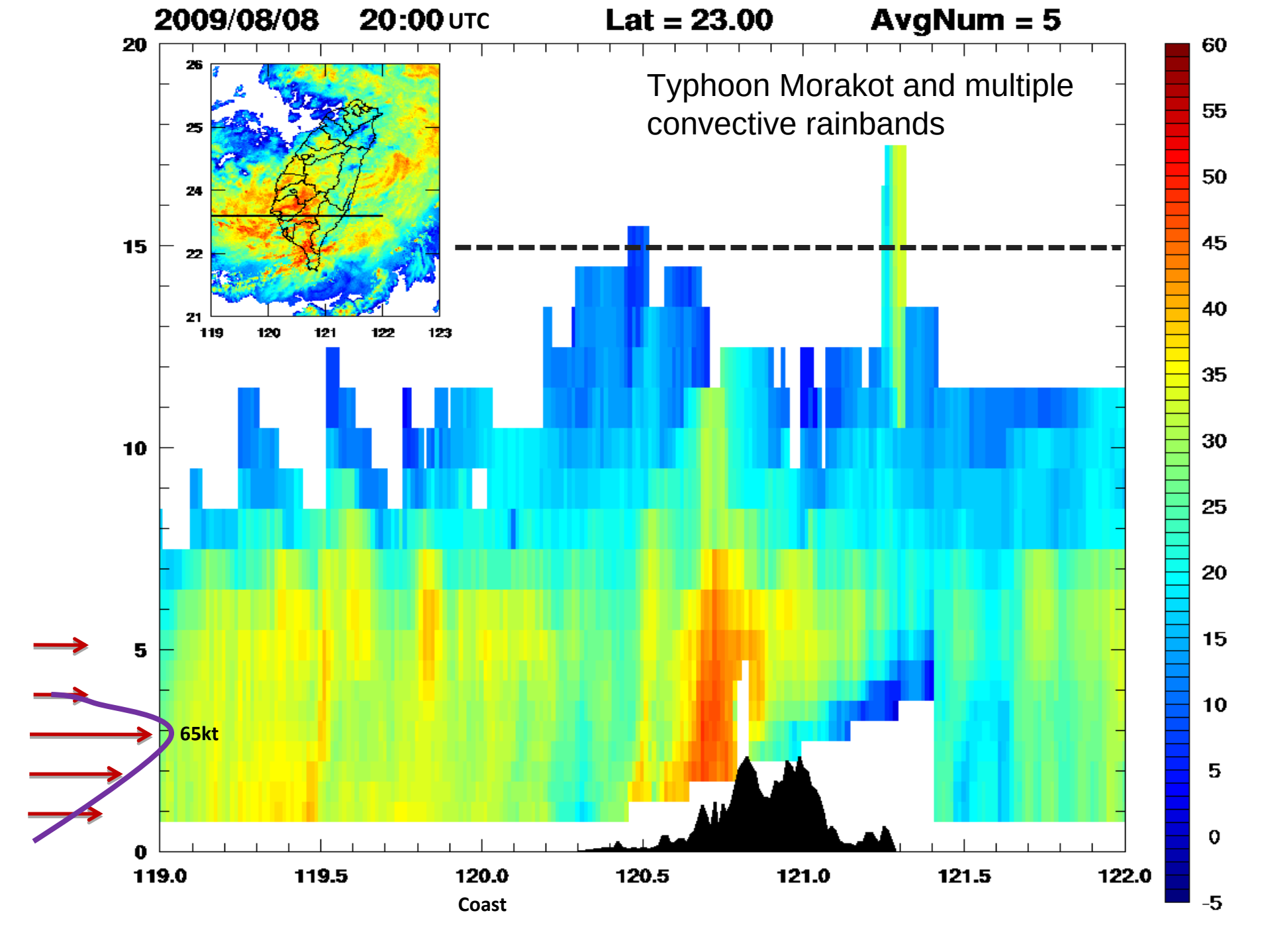
Tragedy in Shiao-Lin, South Taiwan

- In Jiasian Township of Kaohsiung County
- More than 400 died and many missing
- Landslide, barrier lake and mountain collapse

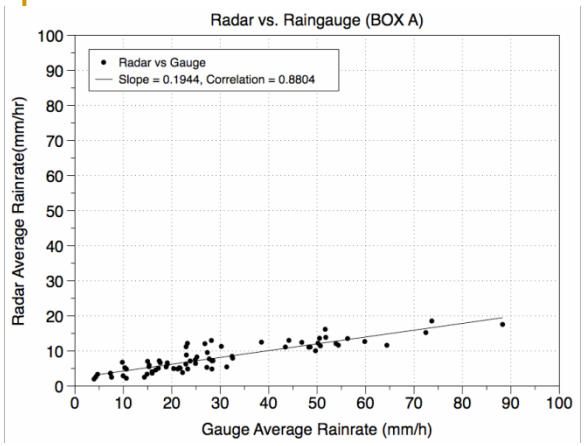
Buried Area

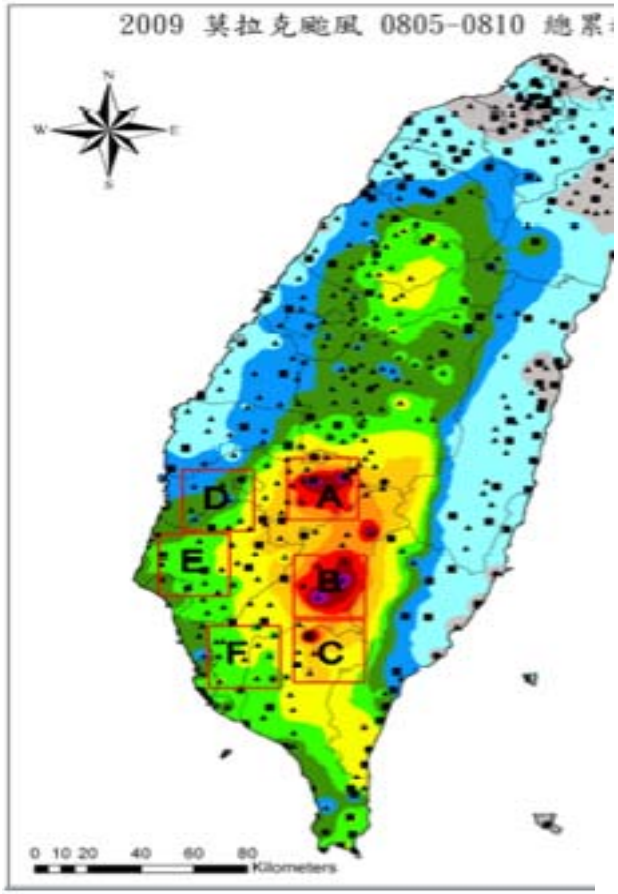
Before

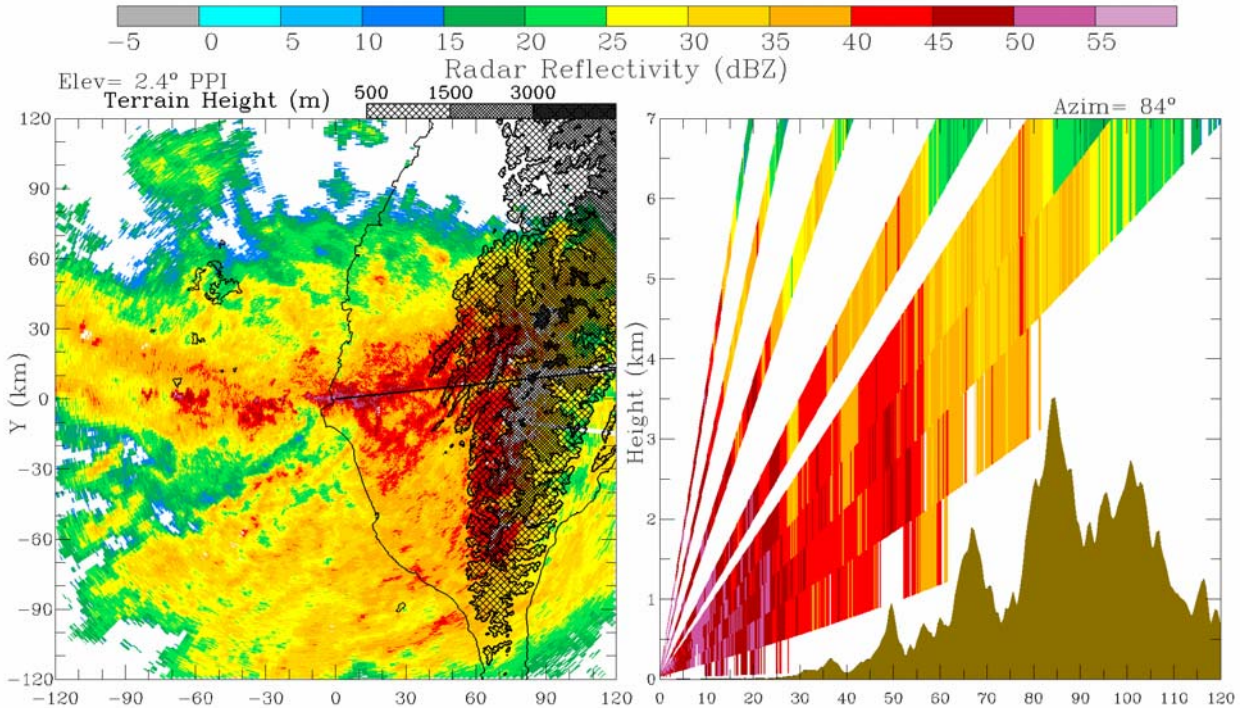
After


2009/08/08 20:00 UTC
Lat = 23.00
AvgNum = 5
Typhoon Morakot and multiple convective rainbands
65kt
Coast
119.0
119.5
120.0
120.5
121.0
121.5
122.0
0
5
10
15
20
60
55
50
45
40
35
30
25
20
15
10
5
0
-5

Terrain effect on radar QPE







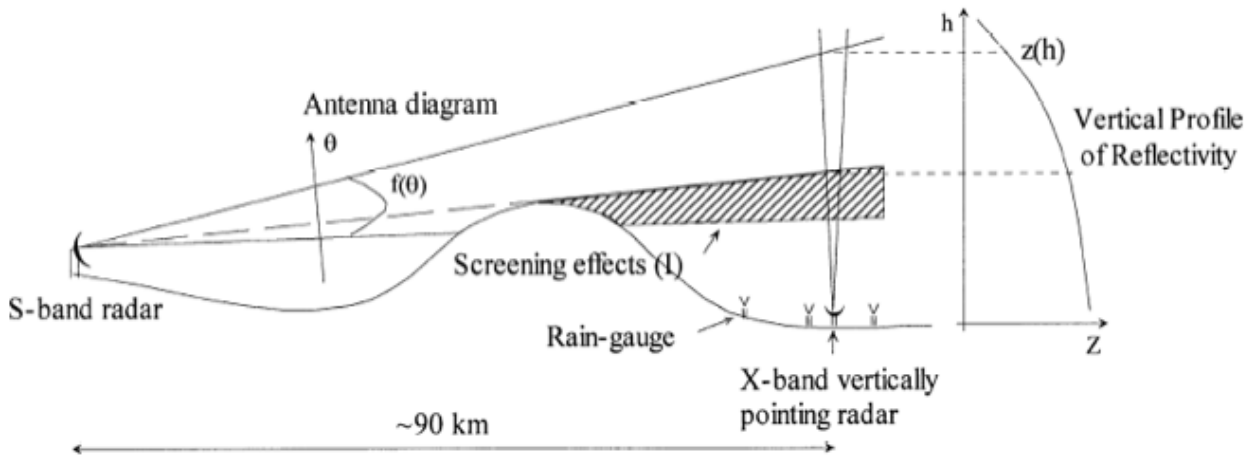
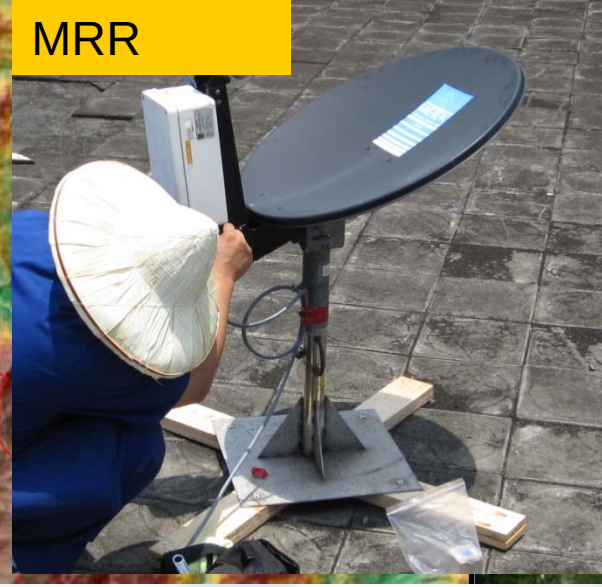


FIG. 2. Illustration of the experimental setup.

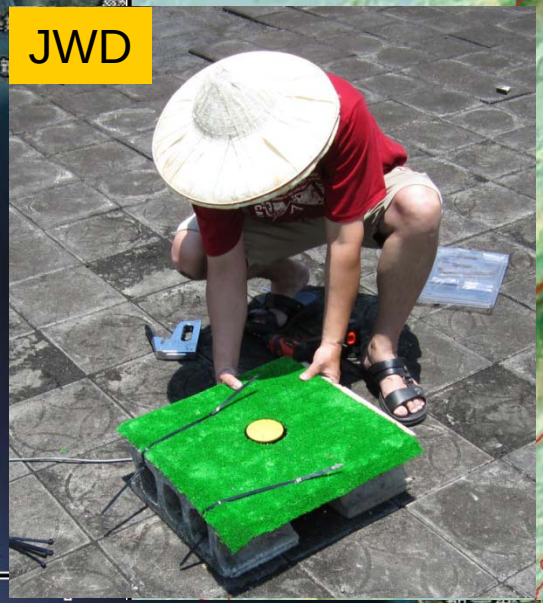
2010 SoWMEX/TiMREX rain measurement site map SOP: May 27-June 16, 2010

XDOP

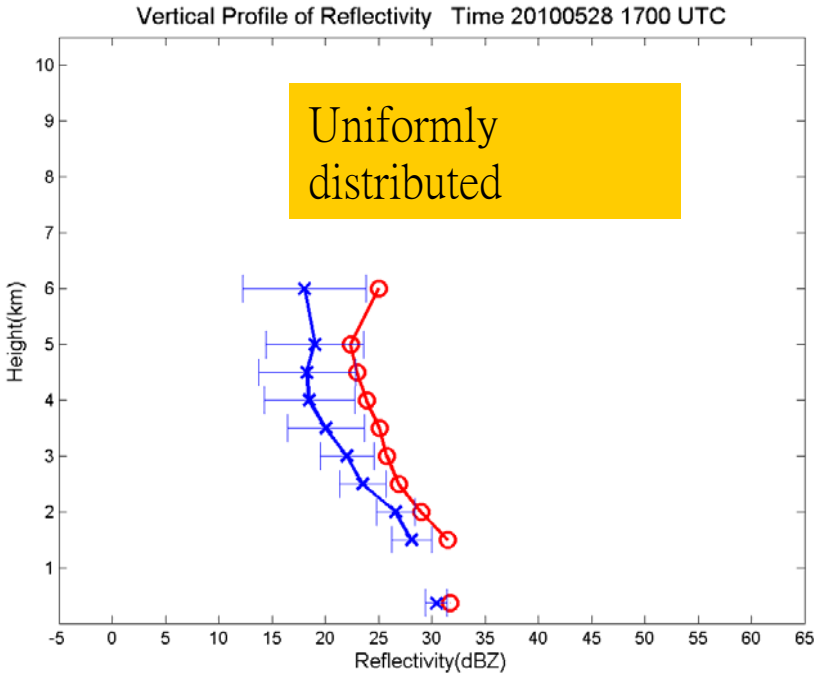
MRR

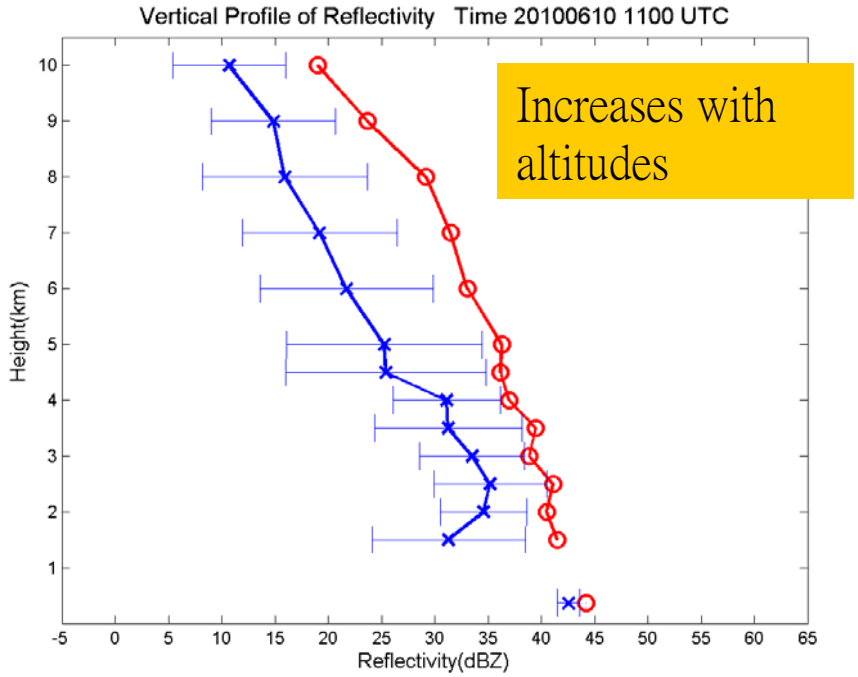


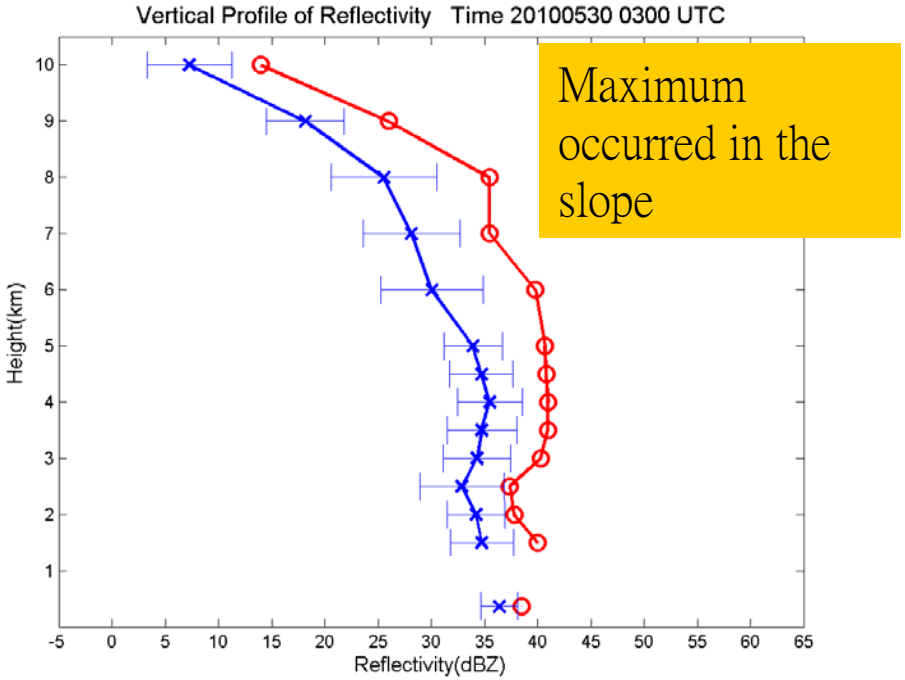
JWD

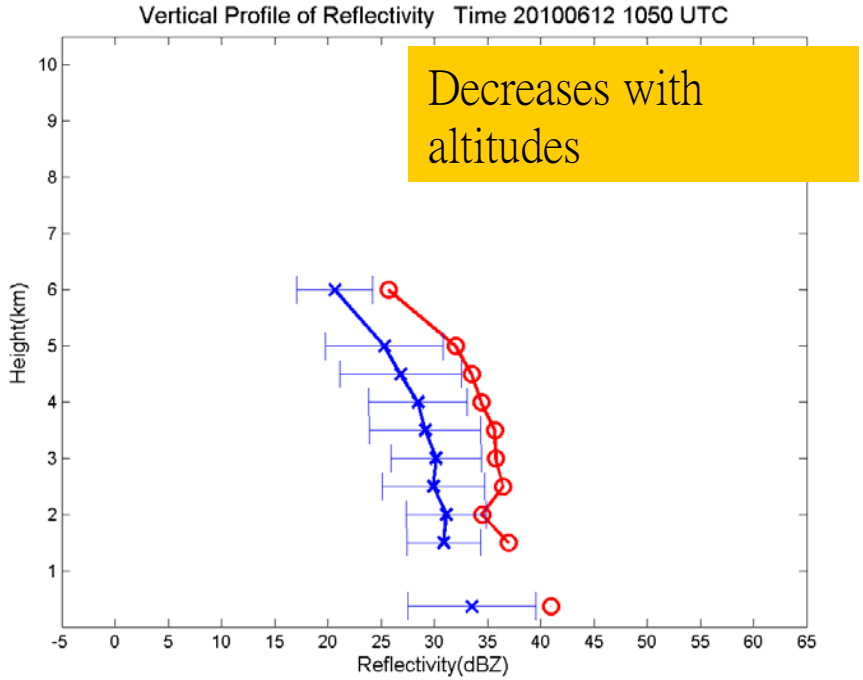


MAWS

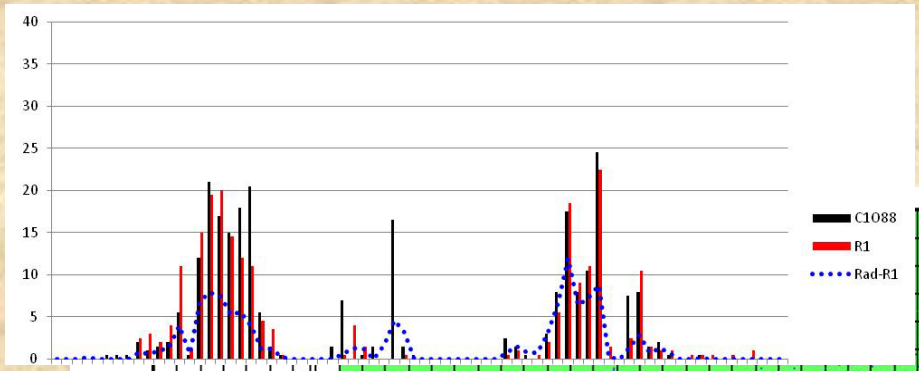

Vertical Profile of Reflectivity Time 20100528 1700 UTC
Uniformly distributed
Height(km)
Reflectivity(dBZ)

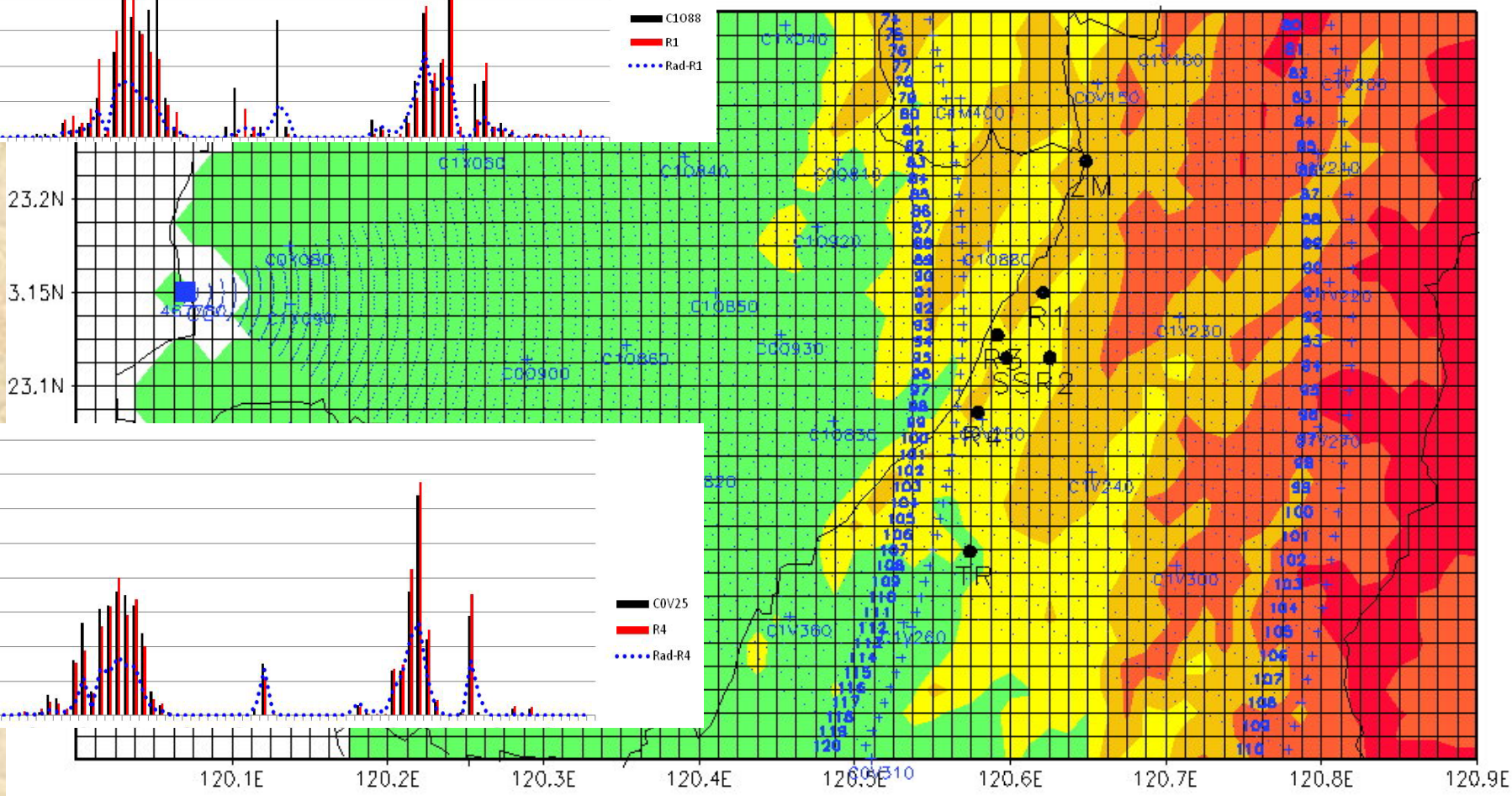

Vertical Profile of Reflectivity Time 20100610 1100 UTC
Increases with altitudes
Height(km)
Reflectivity(dBZ)


Vertical Profile of Reflectivity Time 20100530 0300 UTC
Maximum occurred in the slope
Height(km)
Reflectivity(dBZ)


Vertical Profile of Reflectivity Time 20100612 1050 UTC
Decreases with altitudes
Height(km)
Reflectivity(dBZ)

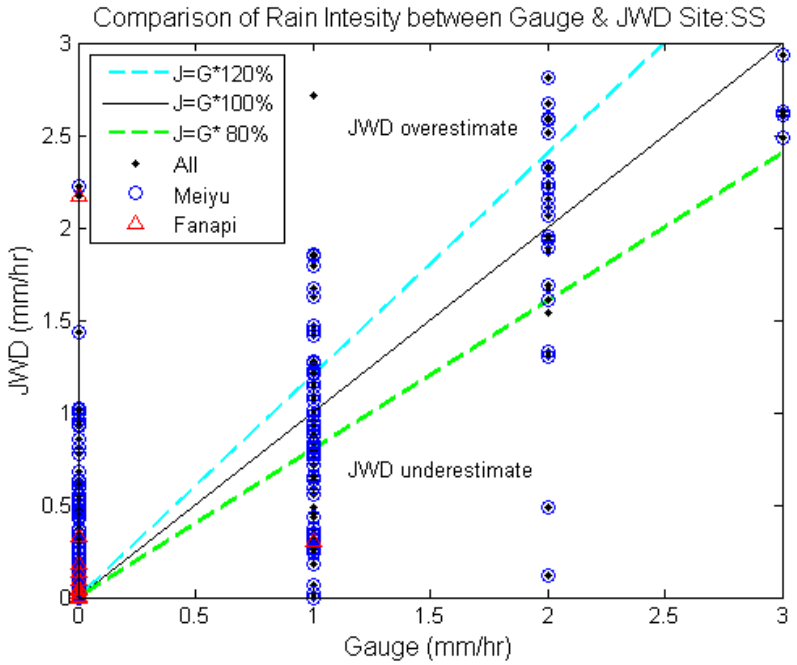
QPESUMS grid and comparison with rain gauges
28-30 May 2010 (72hrs)

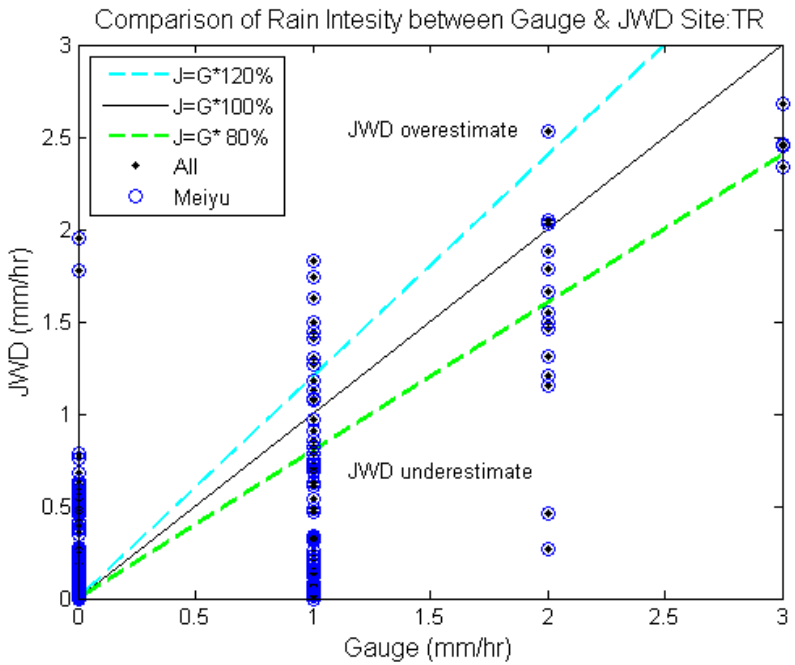


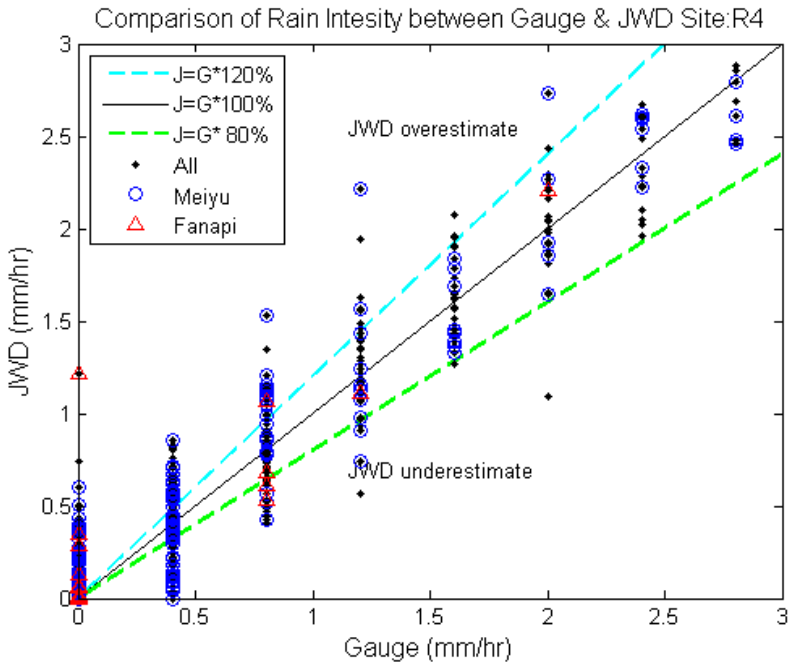


	SS	R1	R2	R3	R4
Obs. AccPpn	258.0	222.0	279.8	117.0	233.4
Rad. AccPpn	133.1	115.7	113.4	123.1	117.3

	SS	R1	R2	R3	R4
RAD-CorCoef	0.95	0.90	0.94	0.50	0.96
RAD-Error rate(%)	-48.41	-47.88	-52.67	5.21	-49.74

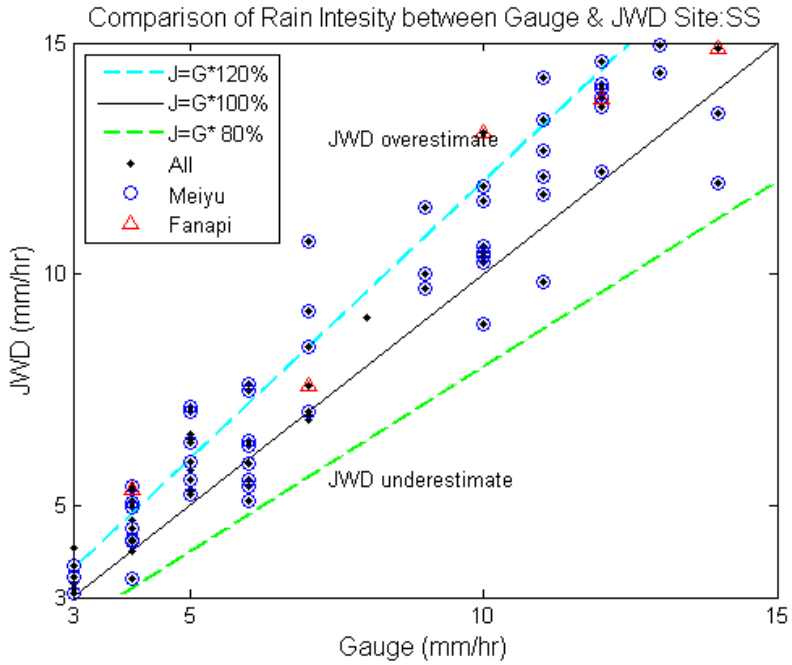


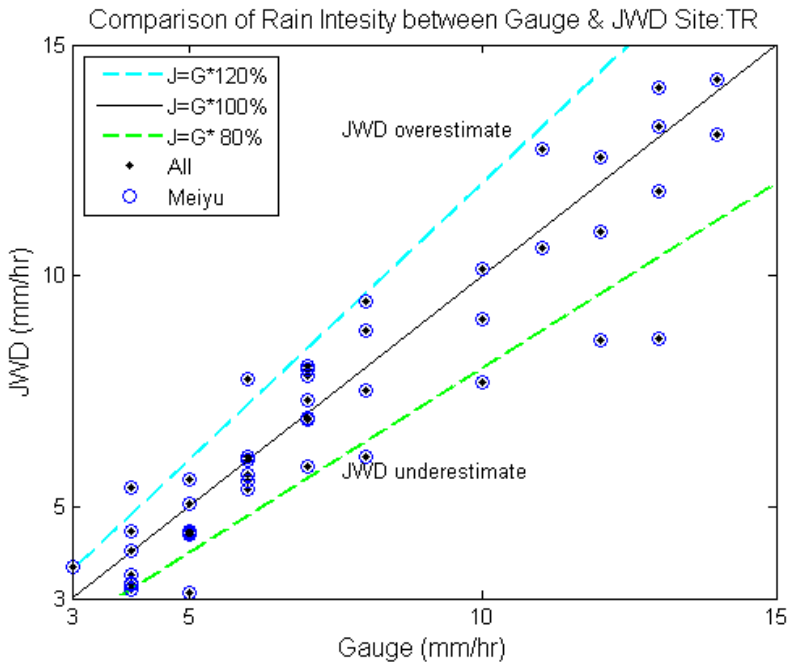


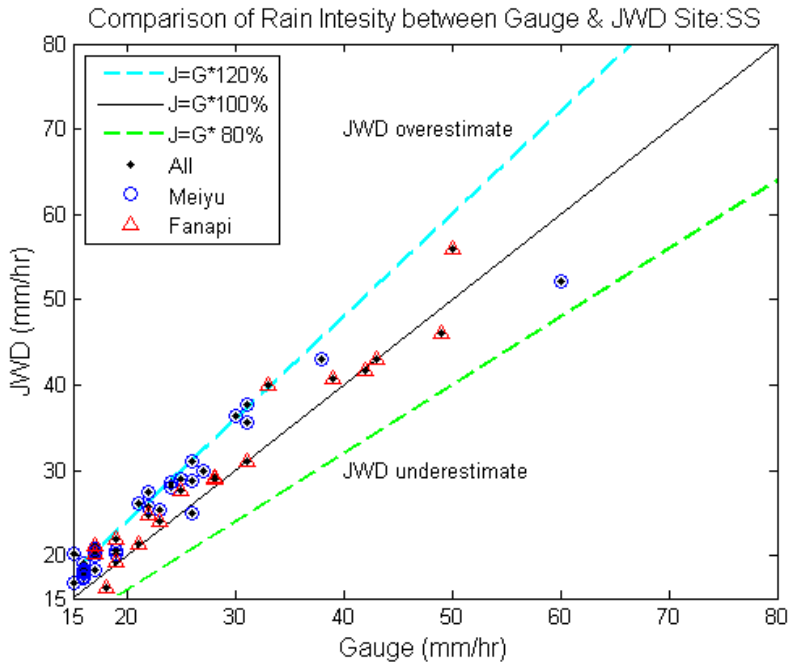


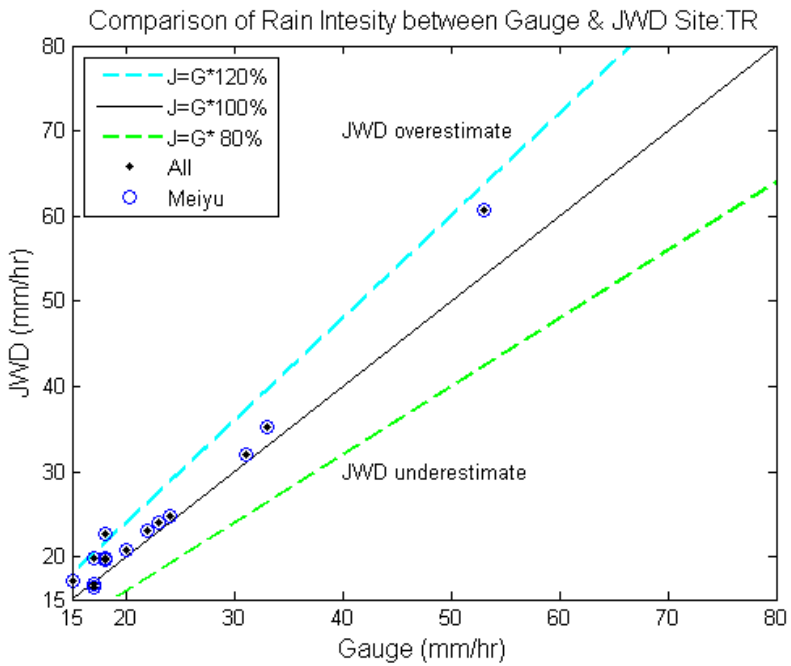
Tipping bucket rain gauge accuracy
SS: 0.5mm
TR: 0.5mm
R4: 0.2mm

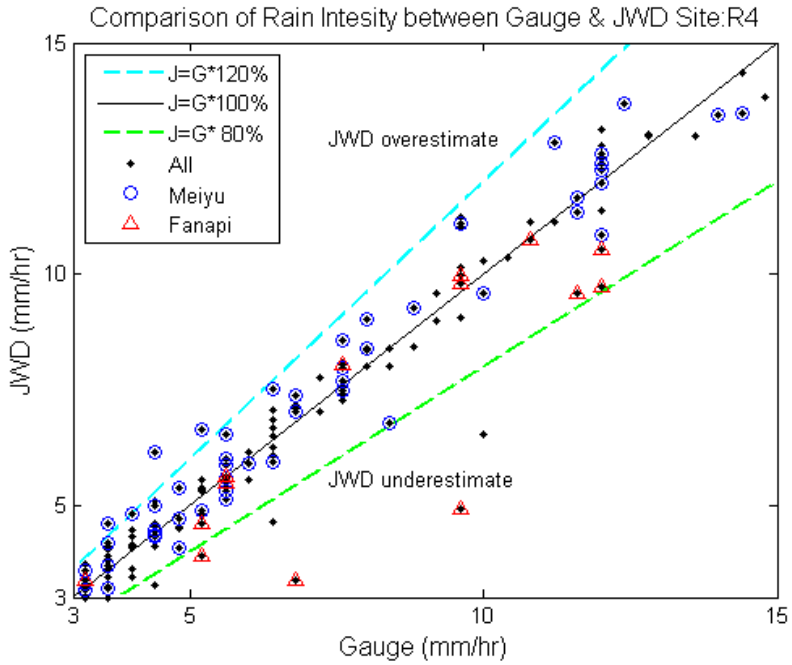
Three different classes of rain rates: weak, moderate, and heavy 0-3 mm/hr, 3-15 mm/hr, >15 mm/hr

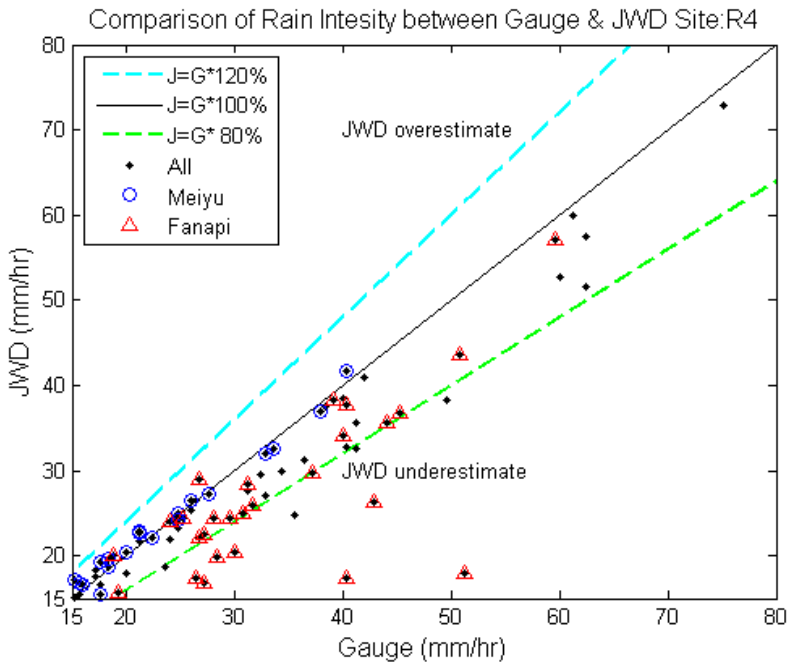

Comparison of Rain Intesity between Gauge & JWD Site:SS
J=G*120%
J=G*100%
J=G* 80%
All
Meiyu
Fanapi
JWD overestimate
JWD underestimate
JWD (mm/hr)
Gauge (mm/hr)
3
5
10
15

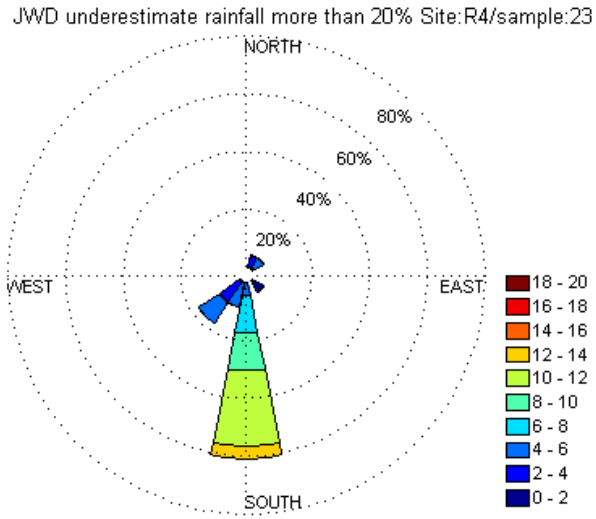

Comparison of Rain Intesity between Gauge & JWD Site:TR
J=G*120%
J=G*100%
J=G* 80%
All
Meiyu
JWD overestimate
JWD underestimate
JWD (mm/hr)
Gauge (mm/hr)
3
5
10
15

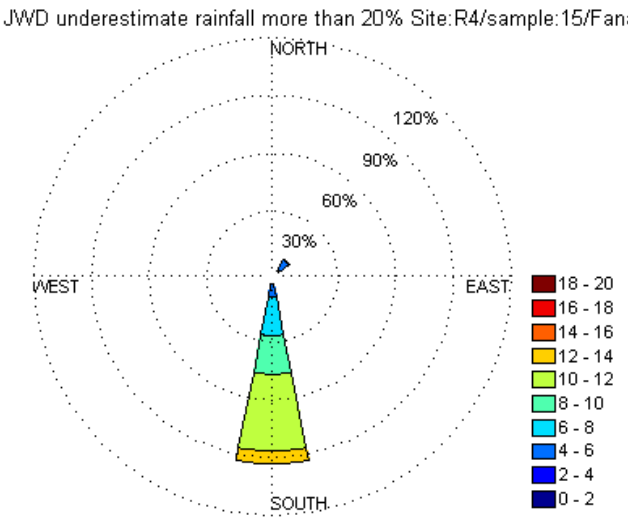

Comparison of Rain Intesity between Gauge & JWD Site:SS
J=G*120%
J=G*100%
J=G* 80%
All
Meiyu
Fanapi
JWD overestimate
JWD underestimate
JWD (mm/hr)
Gauge (mm/hr)
15
20
30
40
50
60
70
80

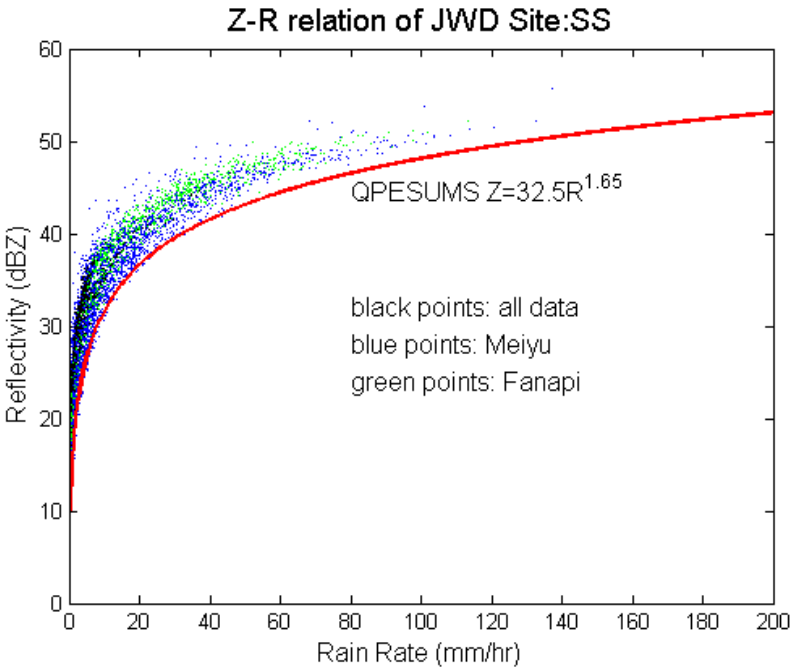

Comparison of Rain Intesity between Gauge & JWD Site:TR
J=G*120%
J=G*100%
J=G* 80%
All
Meiyu
JWD overestimate
JWD underestimate
JWD (mm/hr)
Gauge (mm/hr)
15
20
30
40
50
60
70
80

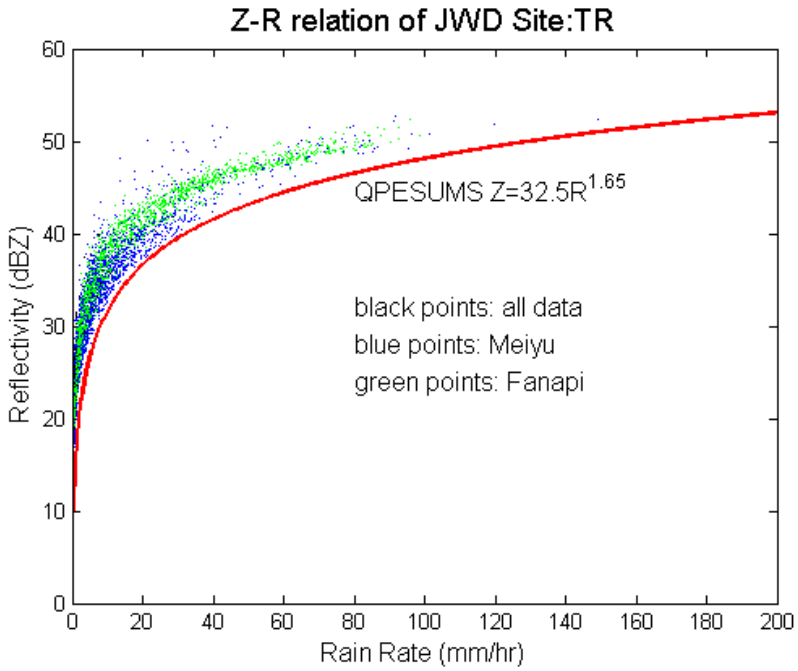

Comparison of Rain Intesity between Gauge & JWD Site:R4
J=G*120%
J=G*100%
J=G* 80%
All
Meiyu
Fanapi
JWD overestimate
JWD underestimate
JWD (mm/hr)
Gauge (mm/hr)
3
5
10
15

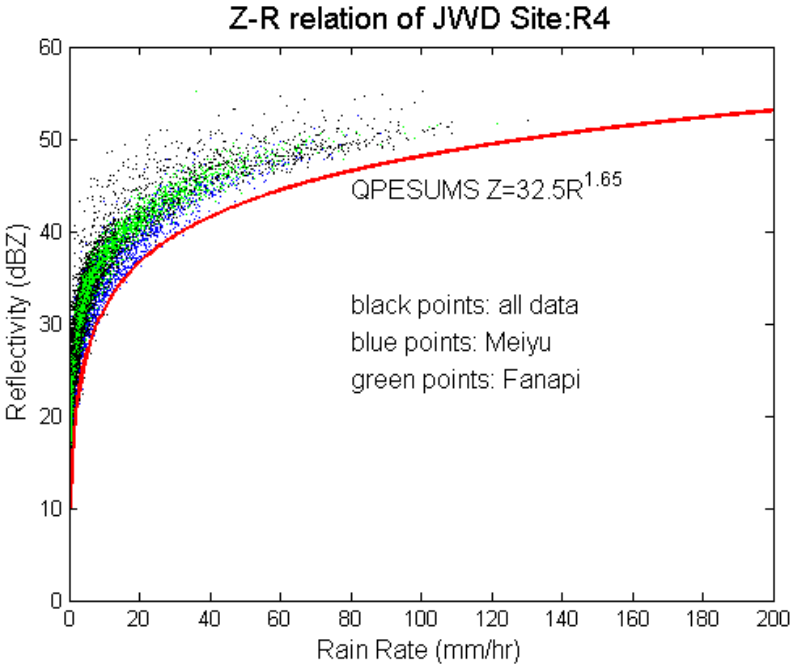

Comparison of Rain Intesity between Gauge & JWD Site:R4
J=G*120%
J=G*100%
J=G* 80%
All
Meiyu
Fanapi
JWD overestimate
JWD underestimate
JWD (mm/hr)
Gauge (mm/hr)
15
20
30
40
50
60
70
80


JWD underestimate rainfall more than 20% Site:R4/sample:23
NORTH
EAST
SOUTH
WEST
20%
40%
60%
80%
18 - 20
16 - 18
14 - 16
12 - 14
10 - 12
8 - 10
6 - 8
4 - 6
2 - 4
0 - 2


JWD underestimate rainfall more than 20% Site:R4/sample:15/Fanapi
NORTH
EAST
SOUTH
WEST
30%
60%
90%
120%
18 - 20
16 - 18
14 - 16
12 - 14
10 - 12
8 - 10
6 - 8
4 - 6
2 - 4
0 - 2







All data means all other data.

Rainfall statistics for the Taiwan Meiyu season of 2008/2009/2010

Station/ Rainfall (mm)	**Tai-pei (N)**	**Tai-chung (C)**	**Kao-hsiung (S)**	**Heng-chuun (P)**	**A-li-shan**	**Sun-Moon Lake**	**I-Lan (E-N)**	**Hwa-lien (E-C)**	**Tai-tung (E-S)**
May (mean)	258	225	177	164	531	354	264	195	157
May (08/ 09/10)	**319**/25/ 184	**332**/ 21/ 145	107/ 14/ **188**	32/ 02/ **254**	378/ 95/ 523	**409**/ 70/ 238	132/ 41/ 95	72/ 142/ 95	55/ 78/ 121
June (mean)	319	343	398	371	711	483	252	220	248
June (08/09/10)	361/ 277/ **420**	183/ **422**/ **530**	**1200**/ 312/ 257	**653**/ 87/ 197	496/ 613/ 458	440/ 283/ 474	173/ 216/ 154	170/ **320**/ 61	**327**/ 100/ 53

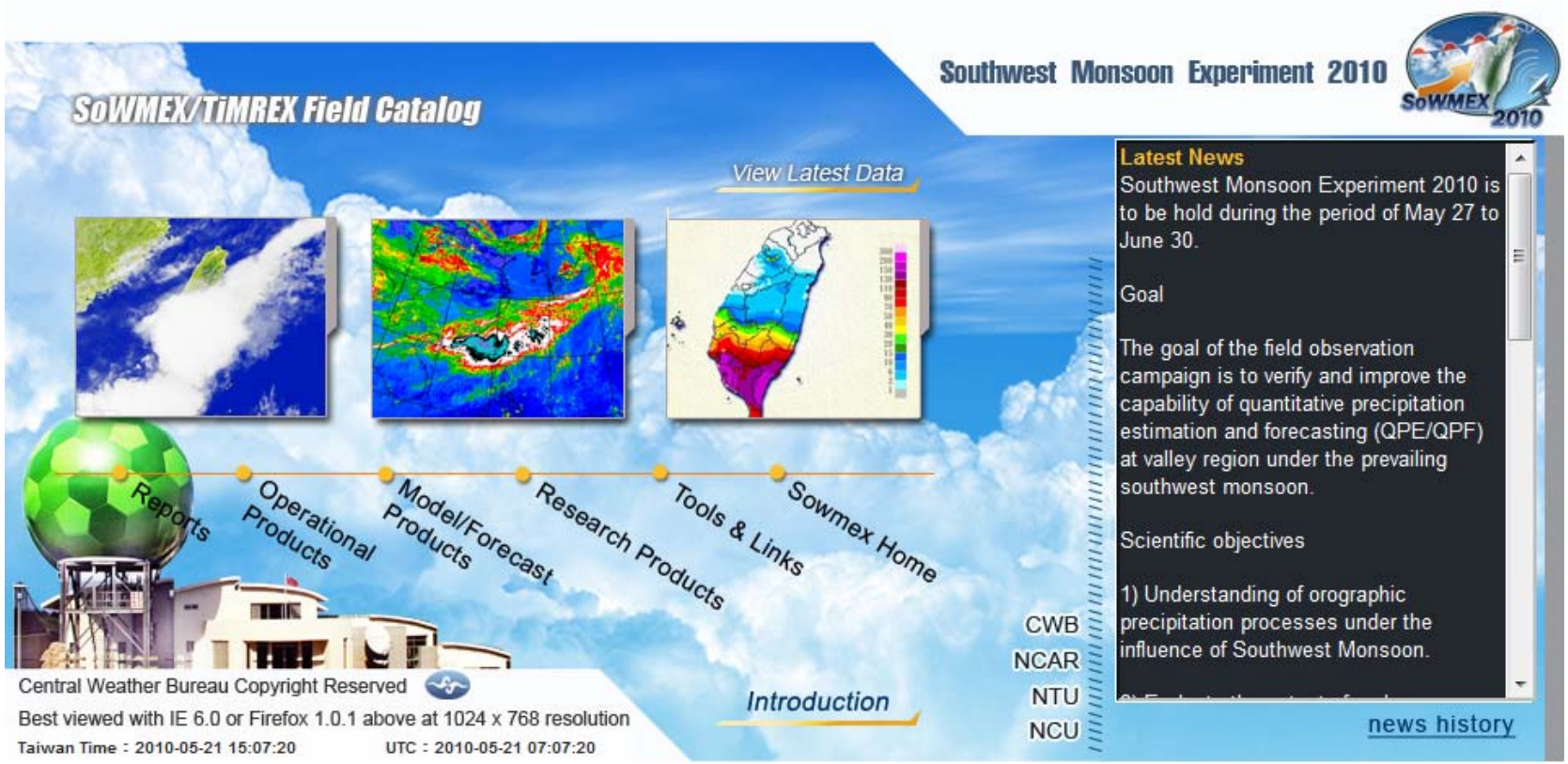
Chiayi 189/351 (Mean), 68/09/104 (May), 288/256/270 (June)

(2008) In May, N Taiwan has more rainfall than climate (1971-2000). In June, S Taiwan has much more rainfall than climate. The mountain rainfall is much less than the climate mean (A-Li-Shan)

(2009) In May, Taiwan was very dry. In June, Tai-Chung has more rain than climate mean.

(2010) In May, S Taiwan has more rainfall than climate. In June, N Taiwan has more.

Webpage of SoWMEX-2010 http://sowmex.cwb.gov.tw/2010/



Concluding remarks

- SoWMEX/TiMREX is an ongoing program. In 2009 and 2010, field observations with dropsondes and rain measurement are conducted and will continue to 2012.
- Thanks to professors and students from the Universities of Taiwan, USA, Japan, and Korea, and Agencies: NCAR/NSF, CWB + NSC + WSCB + NCDR for funding support and dedicated contribution to the success of SoWMEX/ TiMREX. Scientific results from the experiment are coming out.
- Further collaborations are anticipated.