East-Asian Monsoon Experiment (EAMEX): Summer and Winter

I. Summer Monsoon Rainstorm II. Winter Monsoon Rainfall

International Collaboration

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Scientific goal:

1) To explore genesis mechanisms, and structure/ dynamics of weather disturbances

generating

heavy rainfall in East Asia during the summer and winter monsoon seasons.

2) To improve forecasts of weather disturbances in East Asia during both seasons, particularly heavy rainfall events for reducing flood damage.

Summer

I. Scientific issues

1. Importance of rainstorms



East Asian Monsoon Life Cycle

Taiwan rainfall



Seasonal rainfall contributions from rainstorms and TCs



5

2. Rainstorm genesis mechanism



May-June, **2006**







3. Diurnal variation in genesis

Genesis location/timing of rainstorm

6Z, **12Z** \rightarrow Afternoon/Evening **0Z**, **18Z** \rightarrow Midnight/Morning





II. Scientific objectives

- **1. Late spring/early summer rainstorms**
- 2. Hydrological processes
- 3. Impact of multiple-scale process on rainstorm activity
- 4. Effect of the midlatitude-tropical interaction on rainstorm activity

III. Science plan



IV. Rainstorm Experiment



V. International Collaboration Facilities



<u>Tibetan Plateau</u>

provided by T. Koike

China-Japan Cooperative Project On Weather Disaster Reduction



Radar Network in China



Available satellite observations:

1. FORMOSAT-3 Multi-level T, q, Z (~2.5°x2.5°)

2. MTSAT / GOES9

VIS (1x1 km), IR(4x4 km), Water vapor channel (4km)

3. QuikSCAT

Sea surface winds (0.25°x0.25°)







4. AVHRR (NOAA)

Occultation Locations for COSMIC, 6 S/C, 6 Planes, 24 Hrs



Other research facilities (Japan)

Mobile X-band Doppler Radar



3D-scannning Coherent Doppler Lidar







19

Real-time observation provider:

- HKUST: GTS surface/upper-air soundings
- http://envf.ust.hk/
- CWB: Satellite/Radar imagery, Surface analysis, Weather maps
- http://www.cwb.gov.tw/
- JMA: Satellite imagery, Surface analysis, Weather maps
- http://http://www.jma.go.jp/en/warn/index.html/

Observation data provided by Japan

- JMA rawinsonde stations: Ishigaki-jima, Naha and Munamidaitou-jima
- http://www.okinawa-jma.go.jp/syokai/kansoku/kousou/koso/station.htm JMA radar stations: Ishigaki-jima, Okinawa(Itokazu)
- http://www.data.kishou.go.jp/inform/radar.html
 JMA wind profiler: Yonaguni-jima
- http://www.data.kishou.go.jp/inform/windpro.html Aviation meteorology station (basically surface obs.)
- http://www.jma.go.jp/jp/kuko/
 NICT
- http://www2.nict.go.jp/y/y222/okinawa/index.html NICT Radar: Okinawa (Three sites), Ishigaki-jima, Yonaguni-jima
- http://www2.nict.go.jp/y/y222/okinawa/DNS/index.html

Information provided by Manabu Yamanaka.



Applicable aero-platforms in Taiwan



Platform Gulfstream-100 Ultralight A22 UAV Jack

Range / Ceiling 200 km / 3 km 40 km / 2 km

Duration Runway 4800 km / 14 km 6 hours 2000m 3 hours 400m 2 hours 100m

Observing instruments

	Manufacturer	Measurement	Tresolution-val
		variables	
Dropsonde	Vaisala	P,T,RH,U,V	0.5 second
RSS901	Vaisala	P,T,RH	0.5 second
ASP	NTU/COOK	P,T,RH,SW	1 second
radisonde	Vaisala RS-80	P,T,RH,U,V	2 seconds
	Vaisala RS-92		
Digital Camera		Visible image	5 seconds

22

Applicable research vessels in Taiwan



Ocean research vessel 1





Ocean research vessel 2



Fishery research vessel

Winter

I. Scientific issues

1. Importance of synoptic disturbances in winter rainfall









CWB stations



2. Genesis mechanisms of winter synoptic disturbances

Taiwan Low case



South China front



Taiwan low: Genesis mechanism









II. Scientific objectives

- **1. Taiwan lows**
- 2. AMTEX storm
- 3. Impact of multiple-scale process on genesis of Taiwan low
- 4. Regional hydrological cycle

III. Science Plan



IV. Winter Rainfall Experiment



V. International Collaboration: Vietnam



International Collaboration: Southeast Asia

Example case 99/00 (Cold)

rainfall produced by cold-surge [₽] vortices in tropical ₄0[•] Southeast Asia



Rainfall contribution of cold surge vortices



39

International Collaboration: MAHASRI



Thank you

V. International Collaboration Facilities



II. Scientific objectives

Basic directions:

- 1. Multiple-scale process/interaction
- 2. Tropics-midlatitude interaction
- 3. Regional hydrological cycle
- **Detailed issues:**

1. Late spring/early summer rainstorms

- Genesis mechanism (including the diurnal cycle)
- Structure/dynamics and propagation mechanism
- Diurnal variation in regional circulation
- Impact of the circulation pattern transition during the monsoon onset on rainstorm genesis/development
- 2. Hydrological processes
 - Diurnal variation in regional hydrological cycle: continental and local scale
 - Impact of rainstorm on the local water budget, particularly over Vietnam, Taiwan, and southern Japan
 - Impact of the global diurnal cycle on the regional water budget

continued...

3. Impact of multiple-scale process on rainstorm activity:

- Effect of the multiple-scale interaction (through ENSO, intraseasonal monsoon modes, synoptic/meso-scale disturbances) on rainstorm genesis/development
- Orographic effect on the rainstorm genesis/development over northern Vietnam, southeast China, and Taiwan.

4. Effect of the midlatitude-tropical interaction on rainstorm activity:

- Effect of the interaction between midlatitude synoptic short wave and the southwesterly monsoon flow on rainstorm genesis/development
- Impact of onset and life cycle of the East-Asian monsoon on the rainstorm population

II. Scientific objectives

Basic directions:

1. Multiple-scale process/interaction

- 2. Tropics-midlatitude interaction
- 3. Regional hydrological cycle

Detailed issues:

1. Taiwan lows

- Genesis / Development mechanism
- Structure / Dynamics and propagation mechanism
- Taiwan low redeveloped from South China front
- Effect of the air-sea interaction on the Taiwan low activity
- Impact of Taiwan low on the large-scale circulation

2. AMTEX storm

- Climatology
- Transition from Taiwan low to midlatitude cyclone through the tropicmidlatitude synoptic interaction

continued...

3. Impact of multiple-scale process on genesis of Taiwan low

- Effect of the ENSO short-wave train on cold surge activity
- Delayed effect of ENSO on Taiwan low genesis caused by the eastward propagation of SST anomalies
- Modulation of Taiwan low genesis by the 12-24 day mode (cold surge)

4. Regional hydrological cycle

- Water vapor budget of Taiwan low and its role in the winter rainfall generation in northern Taiwan and southern Japan
- Impact of the ENSO and 12-24 day mode on the regional water cycle through Taiwan low
- Climatology of the East-Asian rainfall maximum/center