Interaction of Convection over the Maritime Continent – South China Sea with Large-Scale Flow

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Interaction of Convection over the MC-SCS with Large-Scale Flow

**Large Scale Processes**
- Siberia-H & Tropical interaction
- Summer/Winter ISO
- TCs and severe rainfall

**Interactions**
- Extreme weather in Taiwan & neighboring areas

**Convective Processing**
- GCM
- Mesoscale Modeling
- Diurnal Convection

**SCSTIMX*** Observation**
- Cloud/Rain Systems
- Air-sea Fluxes
- High-res Satellite

**YMC:**
1. RV Investigator radio sounding
2. Land-air observation over Borneo

SCSTIMX:
South China Sea Twin Islands Monsoon Experiment
Two Types of Observational Tasks during SCSTIMX: First Type

- Special observations during intensive observation periods (IOPs: May~Jun, 2018, Dec 2018 ~ Jan 2019) at Taiping Island and Dongsha Island, and during the extended observation periods (EOP: Jul 2018 ~ Feb 2019)
  - In coordination with the international YMC project
  - During the IOPs, we propose to set up an integrated observing system for cloud, precipitation and aerosol at Taiping (by MOST, EPA) and Dongsha (by CWB, EPA), consisting of upper-air sounding (4 times a day) and a suite of instruments including X-POL and C-POL Radars, ceilometers, disdrometer, passive microwave radiometer and wind profiler (Taiping as a supersite).
  - During the EOP, data will be collected regularly by surface weather station, wind profilers, and upper-air balloon soundings.
  - The observed structures and properties of convection are essential for studying convective processes, including organization and diurnal cycle.
Two Types of Observational Tasks during SCSTIMX: Second Type

• Special atmospheric observations in the EOP and IOP with the oceanic measurements to provide in-situ measurements of upper air (radiosonde) and air-sea fluxes:
  – The buoy that will be deployed near Taiping Island
  – Existing buoys in the SCS (Dongsha, SEATS)
  – Research vessels (NTU OR-1 / TTFRI LEGEND)
TTFRI C-POL
MOST TEAMR
RS41 radiosonde

FORMOSAT-7 Occultations - 3 Hrs Coverage
NSPO GPS-RO

MOST RV_ OR-1

TTFRI wind profiler
Microwave radiometer

DATA BUOY
TTFRI UAV (Aerosonde)

TORI RV_ LEGEND
SCSTIMX time schedule (updated: 2017/Feb.)

1st Year
- Site Survey-1
- PILOT-1 NTU OR1 (Dec 11-20)
- 3/8-21 (OR1) Taiping Island
- 5/10-5/12 (C130) Dongsha Island
- International workshop 5/18 TGA, Taipei

2nd Year
- PILOT-2 Obs. at Dongsha (May-Jun)
- NTU OR1 TORI-Legend TTFRI UAV CWB ASTRA
- International workshop 6/4-6/5, KaoHsiung

3rd Year
- PILOT-3 Obs. at Taiping (Dec-Jan)
- IOP-1 SCSTIMX (May-Jun)
- IOP-2 SCSTIMX (Dec-Jan)
- EOP (Dongsha, Taiping)
- C-POL, X-POL at Taiping
- OR-1 TORI-Legend TTFRI UAV CWB ASTRA

YMC international field campaigns
PILOT -1 in 2016

December, 2016
• diagnosis on large scale flow in MC-SCS region
• 10-day RV cruise in SCS region

May, 2016
• Diagnosis on summer monsoon onset
Dec. 1~5, 2016

A: TC Vardah
B: TD 91W
C: MRG wave
D: TY Nock-ten

Shading: OLR
Contour: 925hPa winds
Dec. 6~10, 2016

A: TC Vardah
B: TD 91W
C: MRG wave
D: TY Nock-ten

Shading: OLR
Contour: 925hPa winds
Dec. 11~15, 2016
A: TC Vardah
B: TD 91W
C: MRG wave
D: TY Nock-ten

Shading: OLR
Contour: 925hPa winds
Dec. 16~20, 2016

A: TC Vardah
B: TD 91W
C: MRG wave
D: TY Nock-ten

Shading: OLR
Contour: 925hPa winds
Intra-seasonal waves and Synoptic Systems during Dec. 2016 IOP

Three Kelvin Waves:
- 11.97 ms$^{-1}$
- 12.11 ms$^{-1}$
- 15.44 ms$^{-1}$

Tropical disturbances and Tropical Rossby Waves
- A: TC Vardah
- B: TD 91W
- C: MRG wave
- D: TY Nock-ten

Two cold surges
(Taipei 13.9$^\circ$C & 12.6$^\circ$C)

Shading: OLR
Contour: U-wind @ 925hPa
PILOT-1: 1st Winter Cruise of NTU OR1 (Dec 11-21, 2016)

Balloon radiosonde sounding
Vector: 925 hPa wind field
Contour: total precipitable water
PILOT-2: 1st Summer Observation
Dongsha Island (May 08-June 15, 2017)

- Vaisala RS41 radiosonde
- Vaisala CL31 Ceilometer Lidar
- Radiometrics MP-3000A microwave radiometer
PILOT-3: 2nd Winter Observation
Taiping Island (Dec 2017~ Jan., 2018)

CWB operation (regular) @ Dongsha
- Vaisala RS41 radiosonde
- Radiometrics MP-3000A microwave radiometer
- Raptor FBS-ST wind profiler (16km)

SCSTIMX intensive site @ Taiping
- Vaisala RS41 radiosonde
- Vaisala CL31 Ceilometer Lidar
- Radiometrics MP-3000A microwave radiometer
- Raptor XBS-BL wind profiler (3km)
Existing Weather Radar Network at East Asia
CWB would like to work with BMKG on Radar data processing and mapping.

Weather Radar: Exist & Plan

Note: Radar's Coverage 150 Km

Existing 30 Sites Radar

Build 2014, 4 Sites Radar

2015-2019, 18 New Sites
SCSTIMX Major Scientific Topics:
Convection Organization and Diurnal Cycle During SCS Summer Monsoon Onset

- Process study of coastal MCSs during SCSSM onset by multi-year satellite data sets (TRMM, CloudSat) and idealized CRM simulations

Post-onset precip. contributed by conv. systems of different size scales (TRMM 1998-2014)

• Case study of 2016 SCSSSM onset using WRF and high-res satellite observations (Himawari-8, GPM)

Himawari-8 $T_B$, May 23-27, 2016
SCSTIMX Major Scientific Topics: Biases of SCSSSM onset and SCS-MC Diurnal Cycle in Global Climate Models

- Evaluate SCSSM onset in CAM5 using multi-year hindcast approach
- Understand the role of air-sea interactions to diurnal cycle and SCSSM using super-parameterized CAM5 with slab ocean

![Precipitation Maps](images)
Intra-seasonal wave from OLR signal (Dec. 2016)

**Kelvin Waves** 80~180E, 5S~5N

Kelvin Waves 80~180E, 5S~5N

K1

K2

K3

80~180E, 5N~15N

wh04_anomaly_olr_20161201_20161231_-5_5_hov

wh04_anomaly_olr_20161201_20161231_5_15_hov

-80 -60 -40 -20 0 20 40 60 80

-80 -60 -40 -20 0 20 40 60 80
SCSTIMX Major Scientific Topics:
Boreal Winter Intraseasonal Variability and Convection
Multiscale Interactions

• Multi-scale Interactions in the Tropics during Dec. 2016
  – Interannual Scale: La Nina, warm SST anomalies in Tropical Western Pacific, Eastern Indian Ocean and SCS.
  – ISV: Kevin waves with westerly anomalies and deep convection signal triggered at Eastern Indian Ocean and propagating eastward; dissipated at ~ 160E by cold SST
  – Synoptic: Multiple tropical disturbance generated by tropical waves and cold surge-topographic interactions, a few intensified into TC/TY.
SCSTIMX (South China Sea Twin Island Monsoon Experiment) 2016-2019
111.19 km/deg (on Eq)

~12.11 m/s

~11.97 m/s

12.11 m/s

~15.44 m/s

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