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The Air-Sea Heat Flux Exchange under the Typhoon in the offshore of South China Sea

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Outline

- Introduction
- Experimental station
- The formation of typhoon
- Air-Sea fluxes

Introduction

- Typhoon is a strong process of air-sea interaction which occur in tropical oceans, it is a kind of extremely serious severe weather for bringing rainstorm, gale, and storm surge, which effect the safety of people's life and properties (Chen et al., 1979).

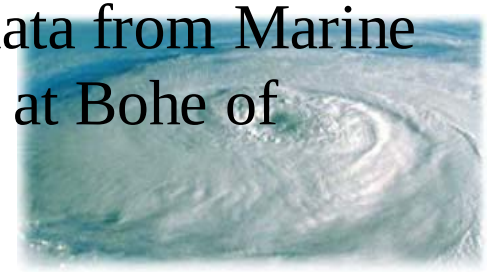
- The air-sea exchange of heat (including radiation flux, latent heat and sensible heat flux) determines how typhoons gain their strength and intensity from the ocean. And the main contributions are latent heat and sensible heat flux. At the same time, typhoon will affect the upper ocean and the structure of atmospheric boundary layer (Chen et al., 1979; K.A.Emanuel, 1986).

Introduction

- Up to now, there is an increasing number research on the air-sea flux and most of them study the air-sea heat fluxes by some air-sea heat flux products (such as NCEP (Chou et al., 1995), OAFLUX (Yan et al., 2007)).

- The South China Sea is one of the most sea areas where typhoon occur, especially in guangdong. So studying the air-sea heat flux exchange under the typhoon over the South China Sea is very important for forecasting typhoon intensity, typhoon track, etc.

- This study will study air-sea heat fluxes under the typhoon in the offshore of South China Sea based on the observed data from Marine Meteorological Science Experiment Base (MMSEB) at Bohe of ITMM.



Experimental station

- Marine Meteorological Science Experiment Base (MMSEB) at Bohe of ITMM

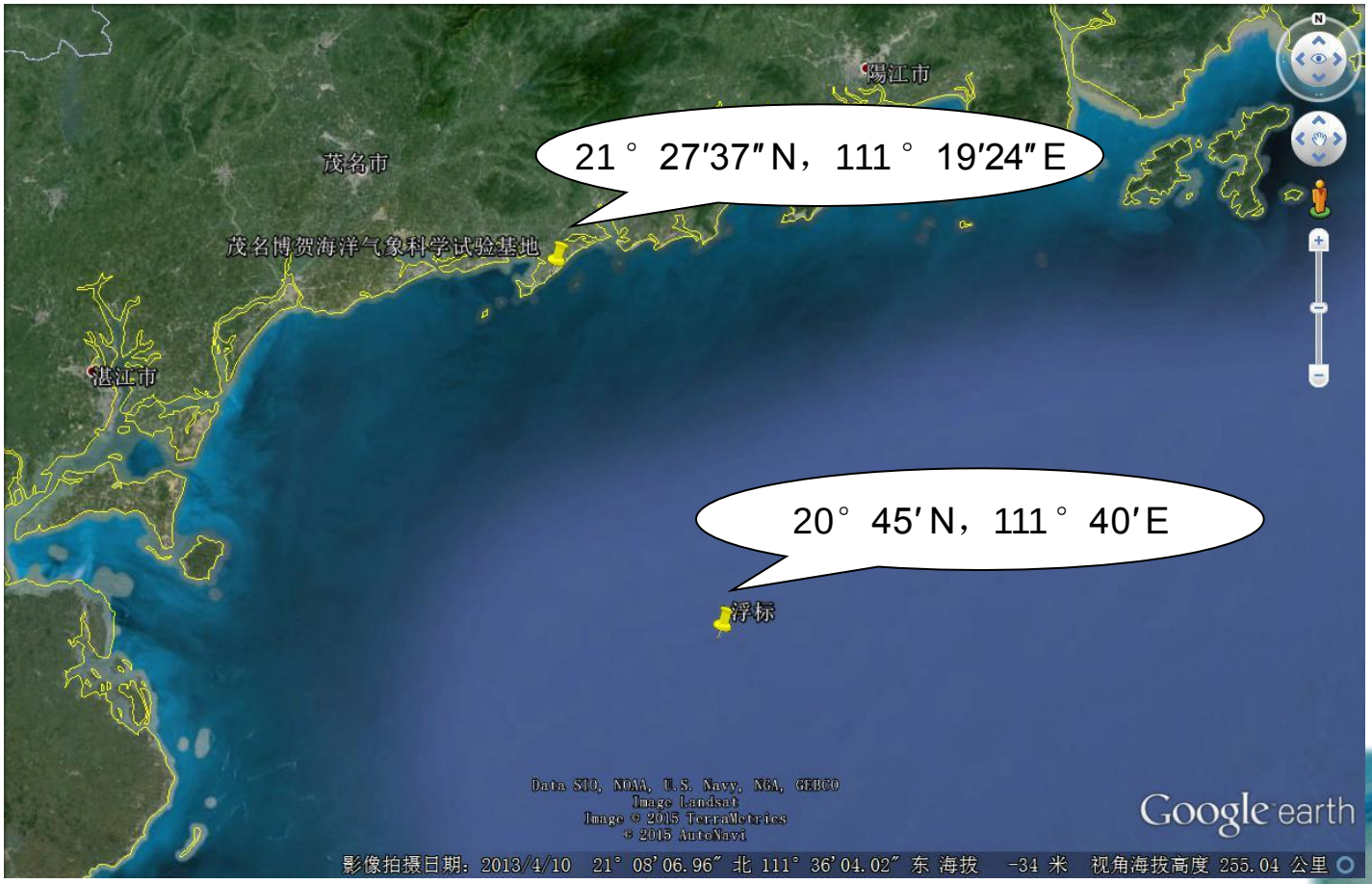


Fig1. The site of MMSEB

Experimental station

- Marine Meteorological Science Experiment Base (MMSEB) at Bohe of ITMM

- ✓ Beishan observatory
- ✓ Comprehensive observation platform at sea
- ✓ 100 m observation tower
- ✓ Buoy

Fig2. The main facilities of MMSEB (http://www.itmm.gov.cn/StationInfo.aspx?id=2)

Experimental station

- A system for observing air-sea fluxes

Items to measure include:

✓ Three-dimensional wind speed fluctuations, water vapor and CO_2 fluctuations.

✓ Vertical gradients of wind speed, temperature and humidity at six layers and wind direction at one layer.

- Wave buoys:

Items to measure include:

✓ wave height

✓ wave direction

✓ wave period and water temperature in offshore areas.

Experimental station

✓ Beishan observatory:

Table1. The facilities of Beishan observatory (Chen et al., 2011)

设备名称	产地，型号	数量	观测项目
风廓线雷达	日本 Sumitomo WPR LQ-7(带 RASS)	1 台	风廓线、信噪比、湍流结构常数等
微波辐射计	美国 Radiometrics WP3000A	1 台	温度、水汽、液态水廓线
测波雷达	德国 WaMoS Ⅱ 波浪探测仪	1 台	波浪、表面流等参数
测波浮标	国产 SBF3-1 型测波浮标	1 个	波浪、波向和波周期等
四分量辐射仪	荷兰 Kipp-zonen, CMP22/CGR4，CNR-1	各 1 套	向上、向下短波和长波辐射
自动气象站	芬兰 Vaisala MAWS301，MAWS201	各 1 套	风、温、湿、气压和降水
GPS 探空系统	芬兰 Vaisala Digi-CORA MW31	1 套	风、温、湿廓线
雾滴谱仪	美国 DMT FM-100	1 套	雾/低云粒子数浓度和滴谱尺度等参数
能见度仪	美国 BELFORT M6000	1 台	大气散射系数、能见度

Experimental station

✓ Beishan observatory:

Table 2. The facilities of Comprehensive observation platform at sea (Chen et al., 2011)

设备名称	产地，型号	数量	观测项目
超声风温仪	美国 Campbell CSAT3 英国 Gill R3-50	各 1 台	三维风、虚温脉动量
水汽与二氧化碳分析仪	美国 Li-cor 7500	2 台	水汽和二氧化碳脉动量
风、温、湿梯度观测系统	美国 RM. Young 05106 芬兰 Vaisala HMP45C	5 层	风、温、湿梯度分布
雨量计	美国 RM. Young	1 个	降水量
红外温度遥测仪	美国 Everest Interscience 4000.3ZL	1 个	海表皮温
温盐梯度观测系统	日本 ALEC INFINITY-CTW	4 层	海洋温、盐梯度分布
多普勒流速剖面仪	美国 FLOWQUEST 1000	1 台	海洋流速廓线
重力式波浪探测仪	美国 FLOWQUEST	1 台	波浪参数

The formation of typhoon

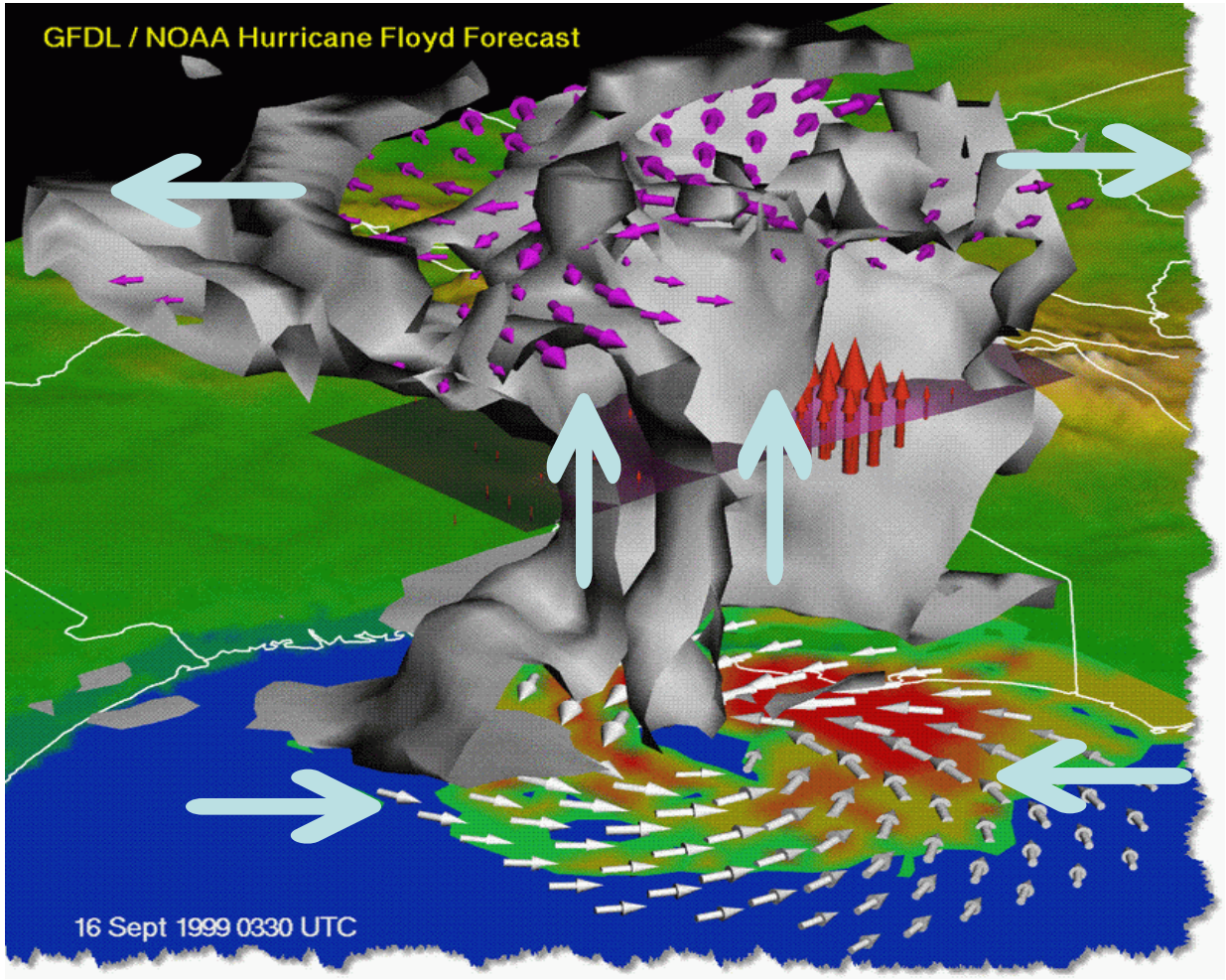


Fig3. The formation of typoon (NOAA)

Flow out

Uplift

Flow into

The formation of typhoon

- ✓ CMA-ATI Best Track Dataset for Tropical Cyclones over the Western North Pacific

Table 3 The number of typhoon influencing Maoming

年份	2008	2009	2010	2011	2012	2013	2014	总计
台风个数	4	3	1	2	2	1	2	14

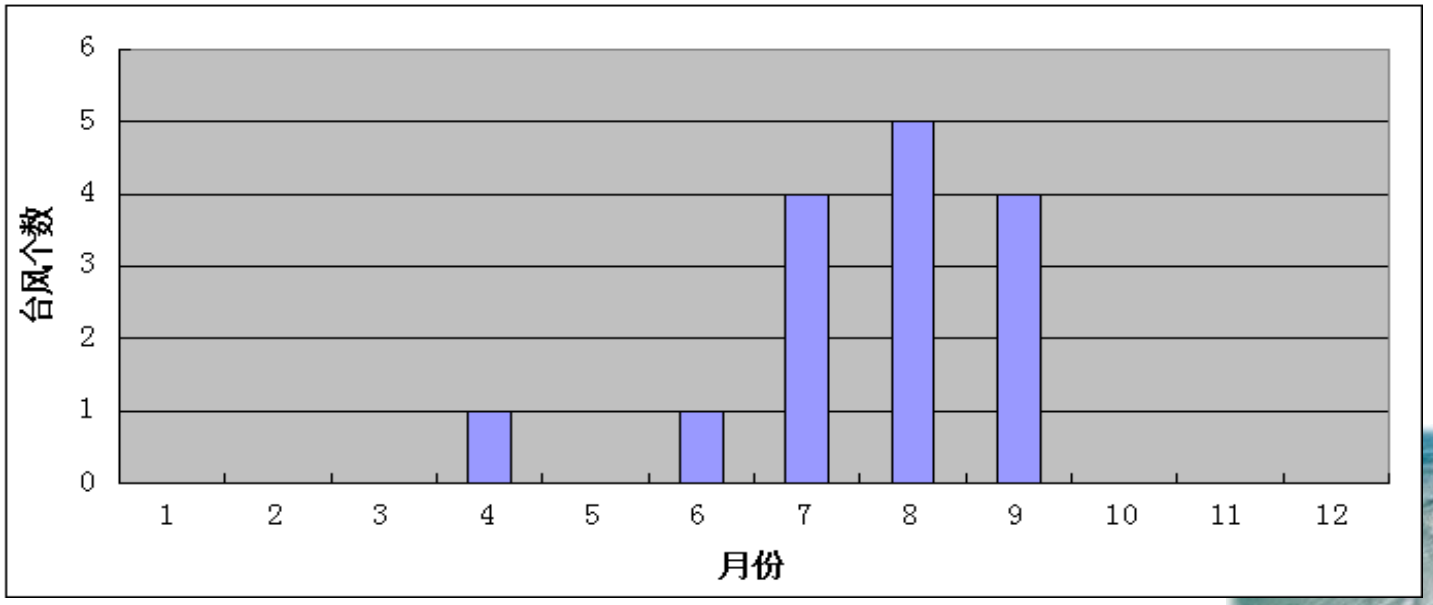


Fig4. The number of typoon in each month

Air-sea fluxes

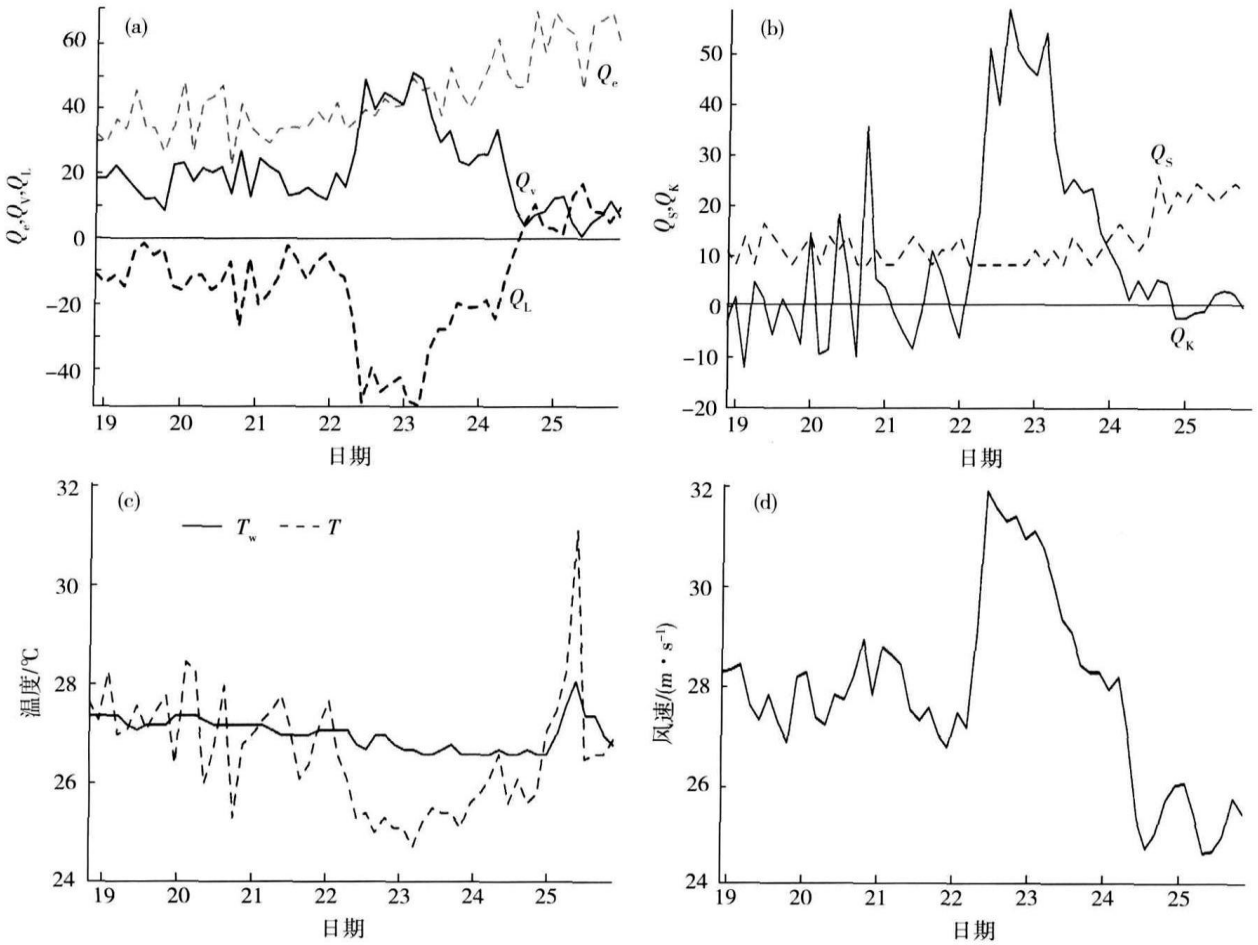


Fig5. The distribution of latent heat and sensible heat flux (Wu et al., 2009)

Air-sea fluxes

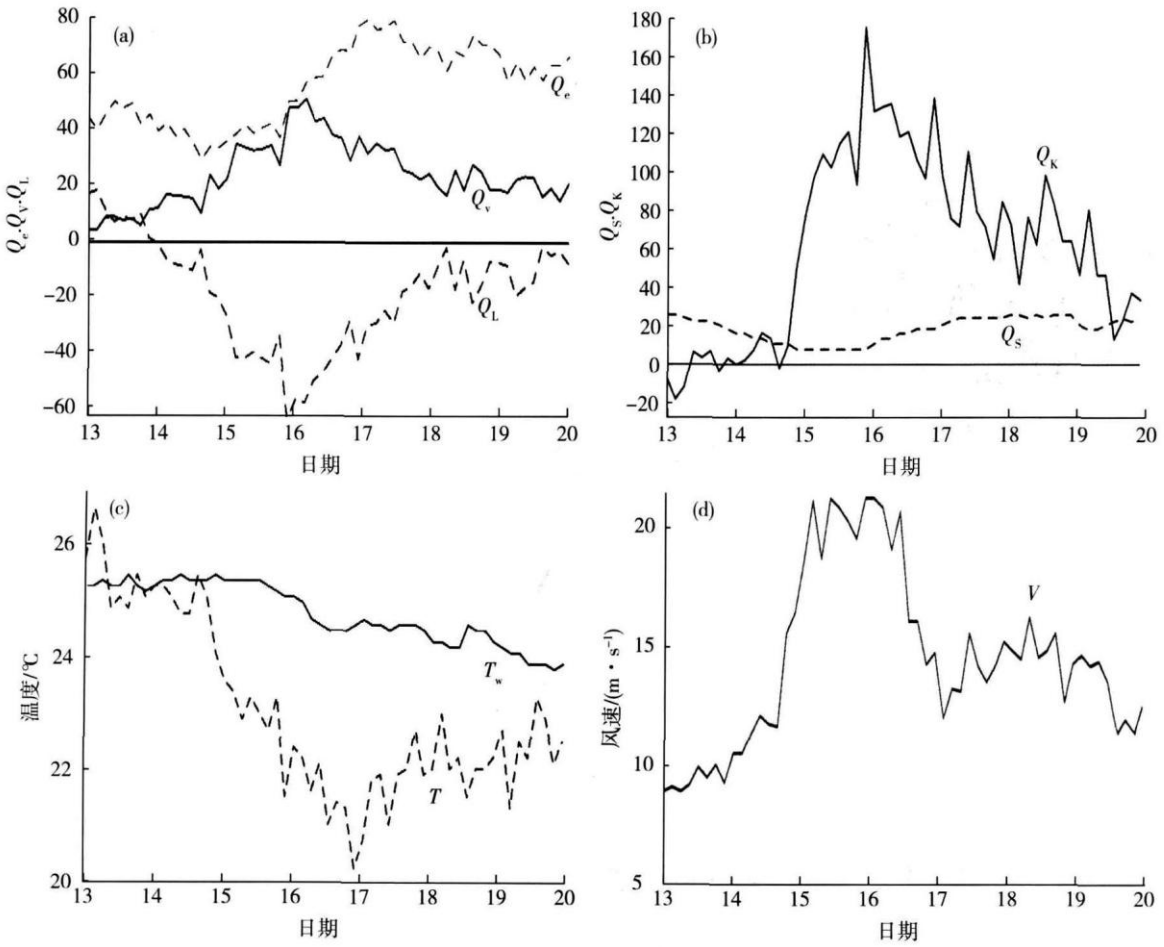


Fig6. The distribution of latent heat and sensible heat flux (Wu et al., 2009)

Air-sea fluxes

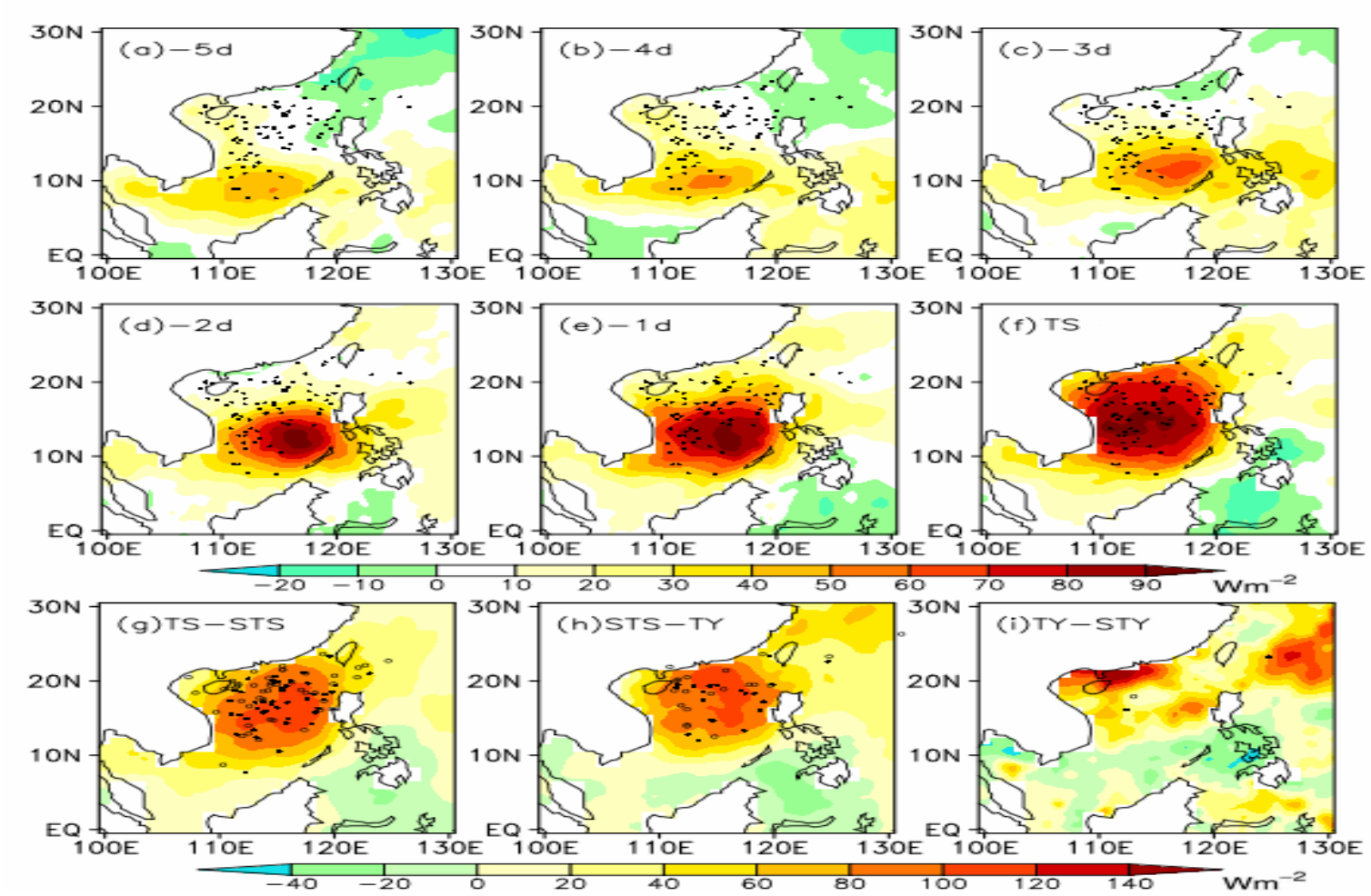


Fig7. The distribution of Net heat flux (Jiang et al., 2012)

Air-sea fluxes

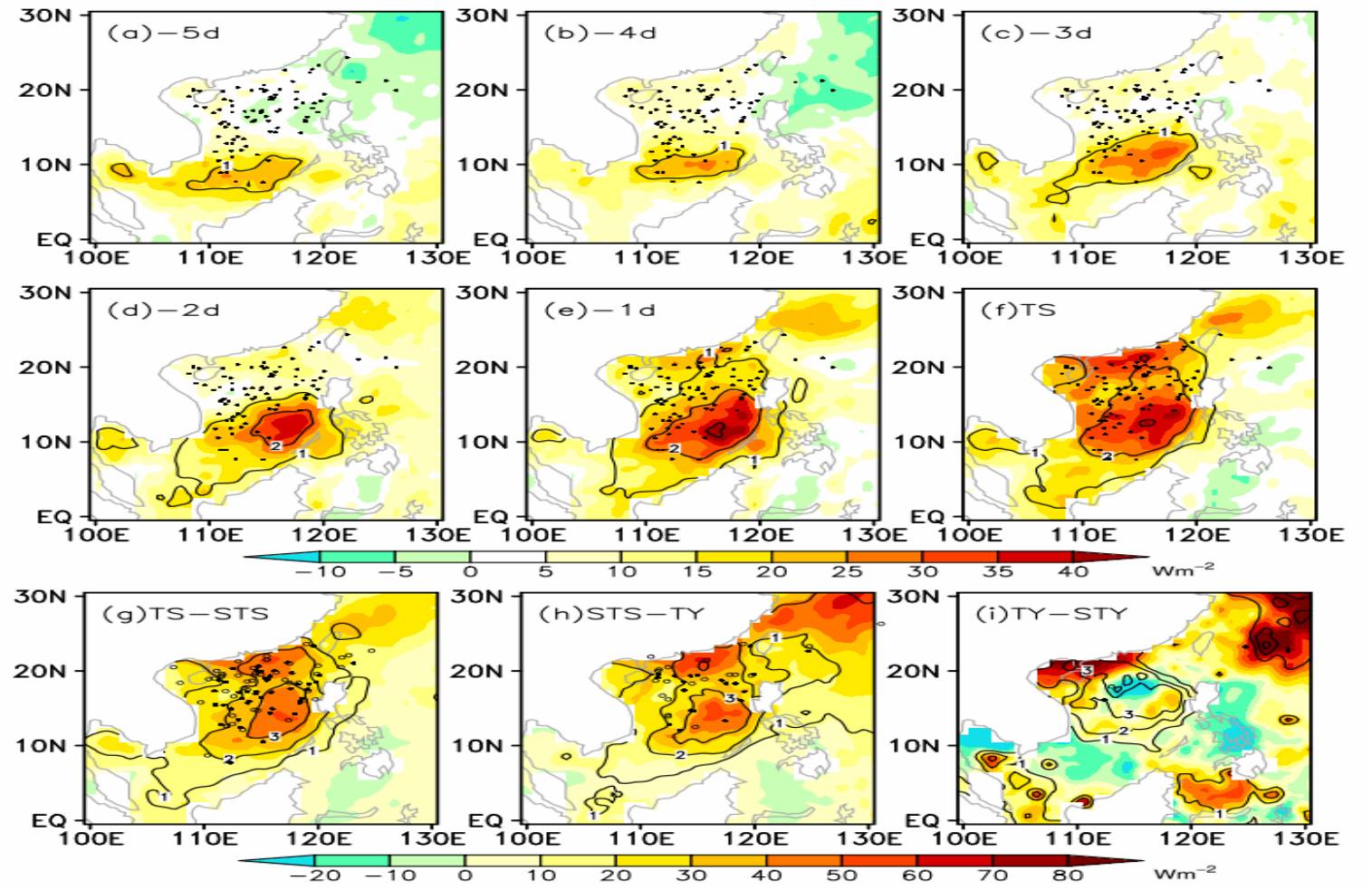


Fig8. The distribution of latent heat flux (Jiang et al., 2012)

Next work

- ✓ Draw the charts of the typhoon wind speed, pressure, atmospheric temperature, sea-surface temperature, air-sea temperature difference.
- ✓ Draw the charts of wind speed from different height of observation tower.
- ✓ Calculate and analyze the air-sea fluxes based to the observation data.

Thank You