FY Meteorological Satellite data Application in Weather Analysis

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outline

- （1）Satellite imagery application and important weather system concept models using satellite data
- （2）Satellite derived product application： the AMVS and WV imagery to show the atmosphere dynamic process， FY-4A LMI product application
- （3）FY-4A multi-channel RGB composite product
- （4）Application of meteorological satellite data in international rainstorm disaster monitoring

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（1）Satellite imagery application and important weather system concept models using satellite data

- （2）Satellite derived product application：the AMVS and WV imagery to show the atmosphere dynamic process，FY-4A LMI product application
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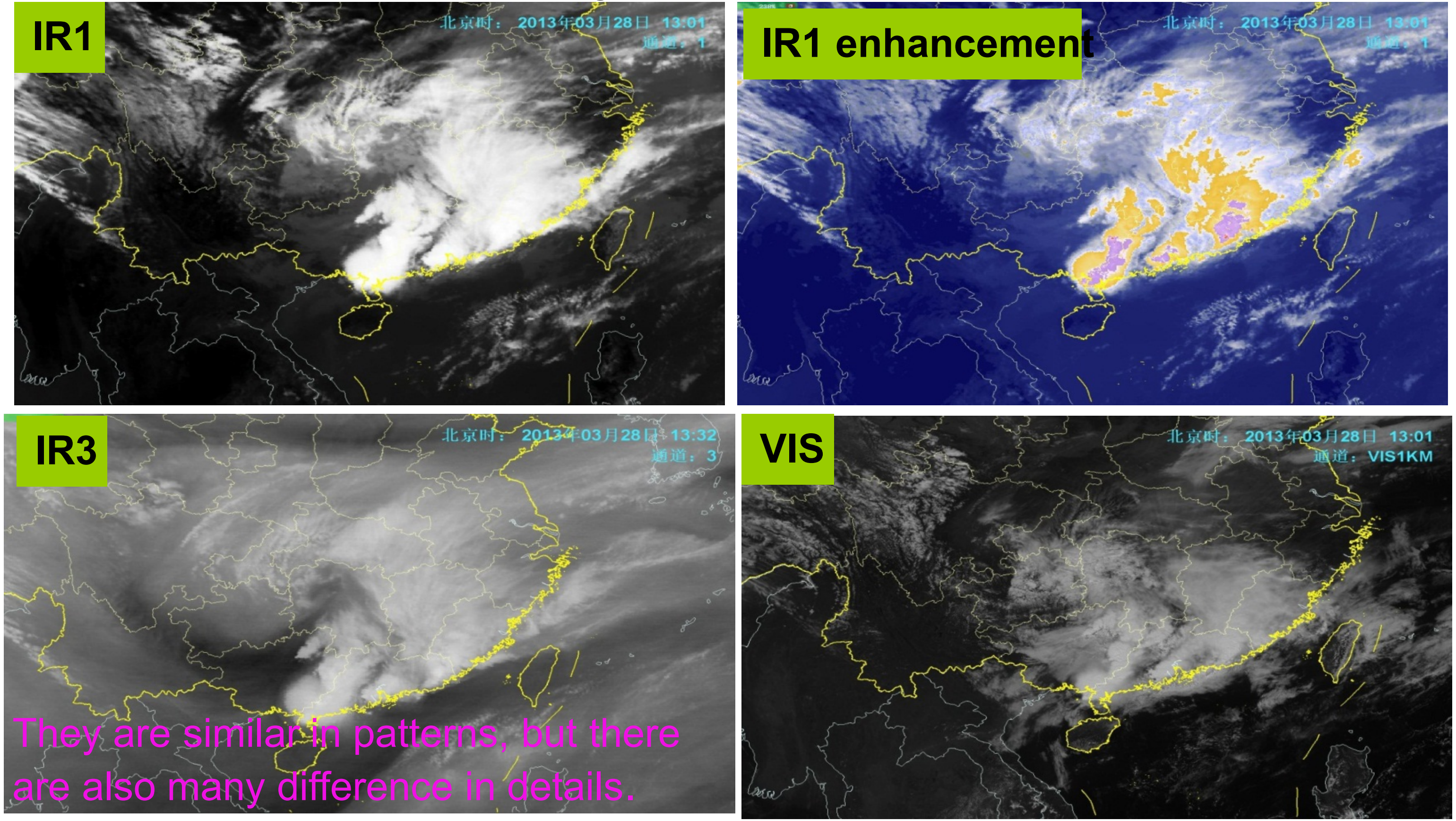
1

（1）Satellite imagery application

The comparison of a weather system GEO meteorological satellite images in different channels



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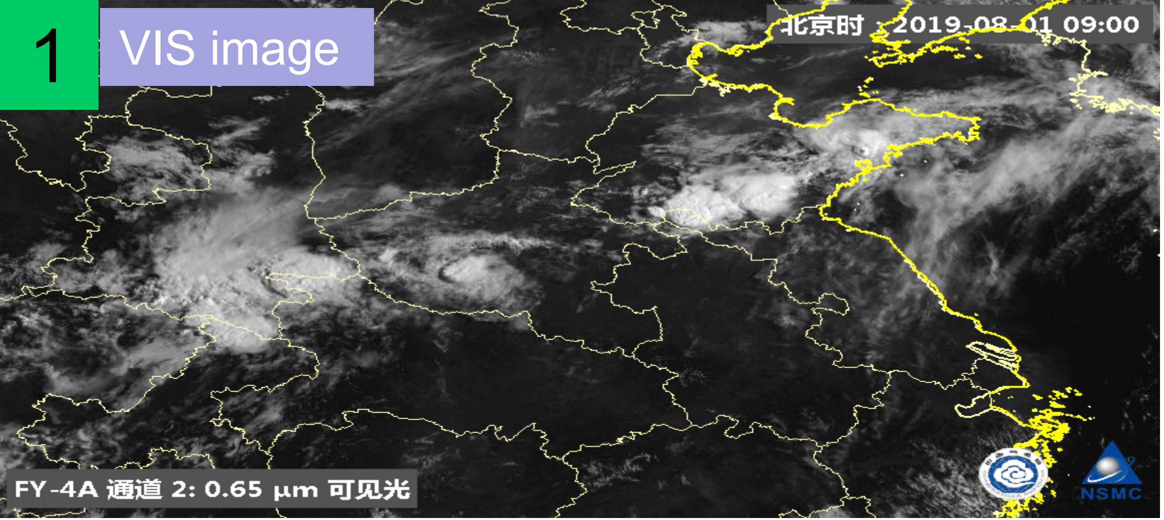
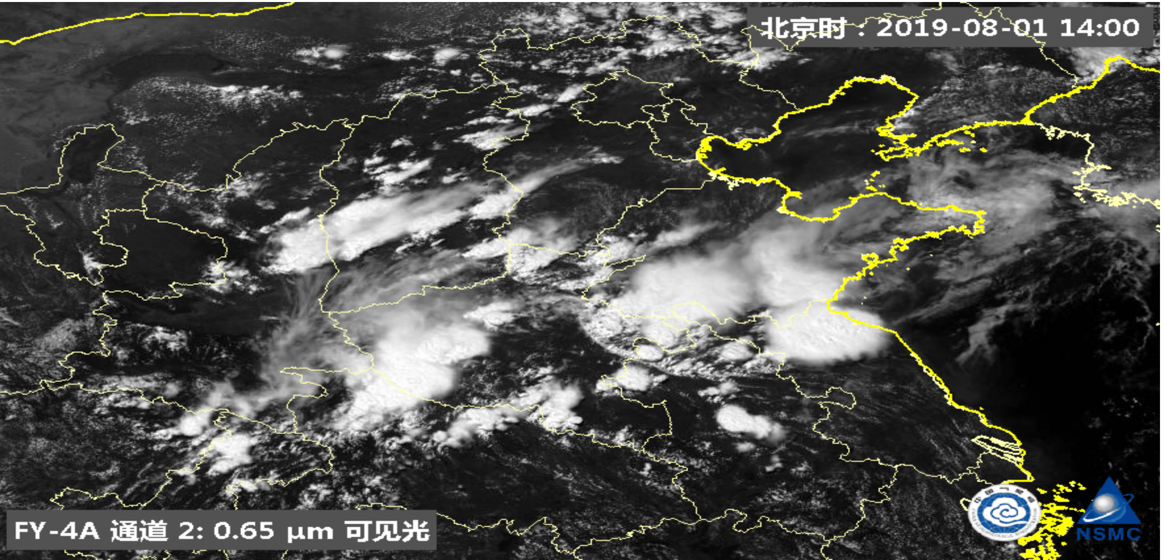
IR1 image： the cloud development especially at night, High cirrus clouds .

VIS image： new born convective cell , low-level cloud , cloud top characteristics, boundary convergence line.

WV image： the upper-troposphere atmosphere circulation, Synoptic-scale weather system, cold air activity, north-western Pacific subtropical high, the upper-troposphere cirrus outflow, et.al.

1 VIS image



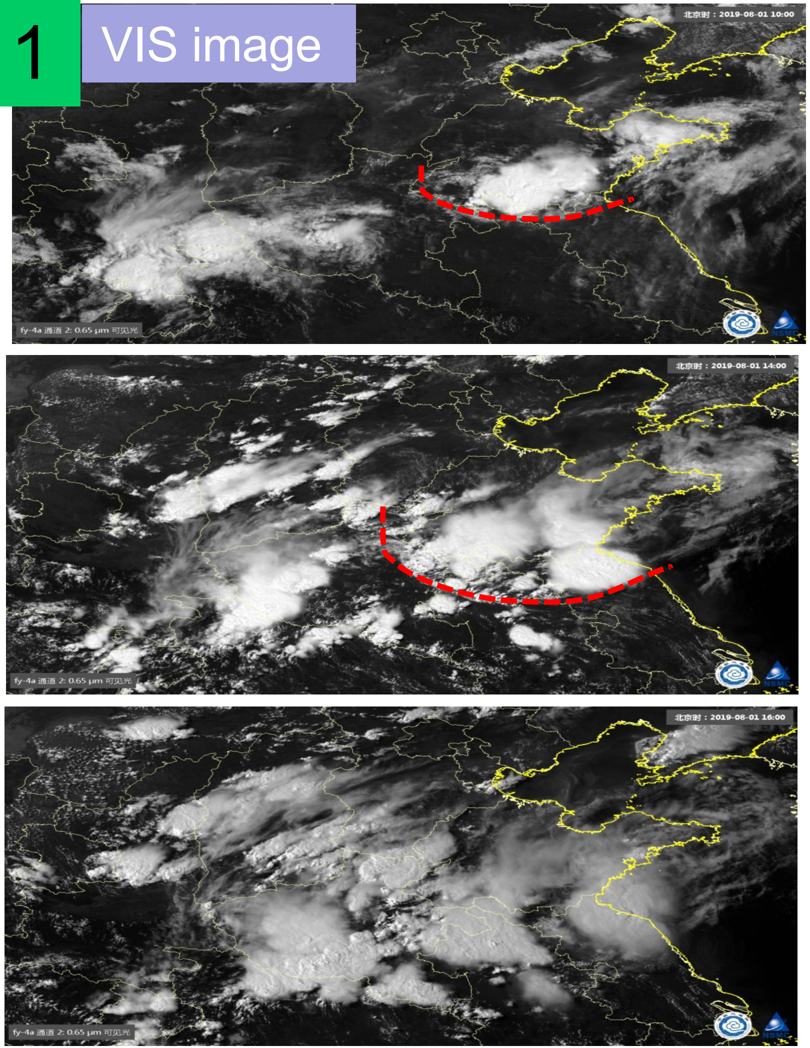


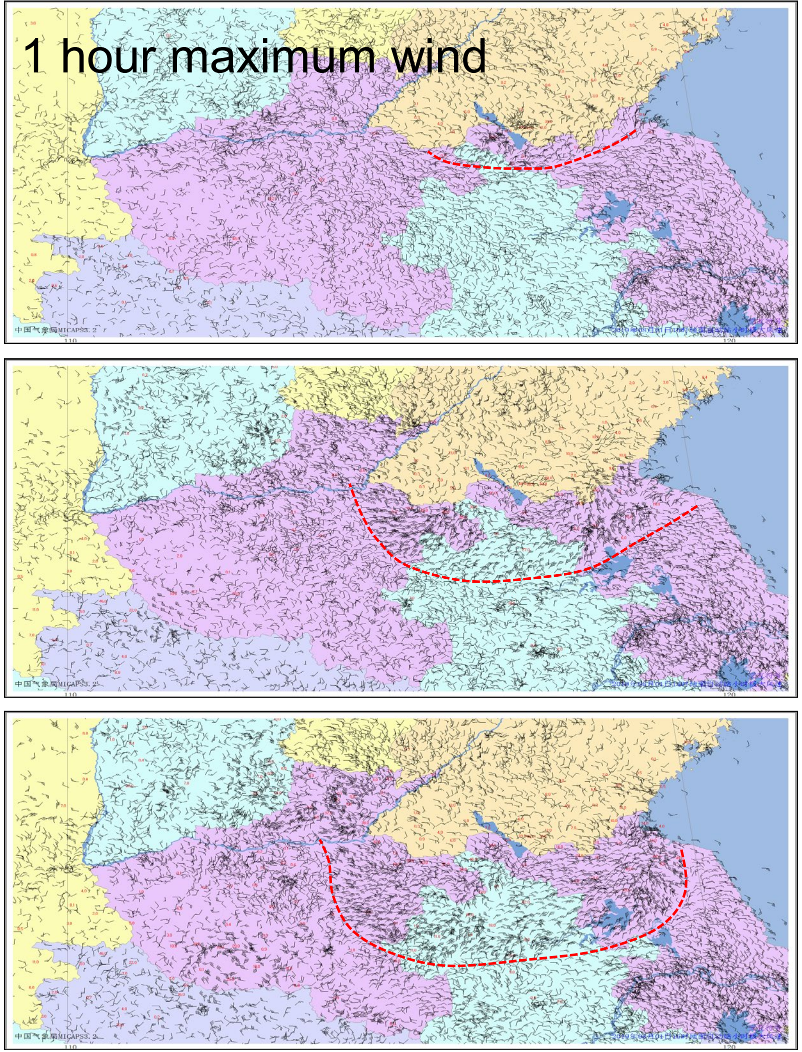
VIS images to show a boundary convergence line which induce the heavy rainfall in Henan province

FY-4A VIS, 02:00-06:00(UTC), 20190801

FY-4A VIS, 06:00-09:00(UTC), 20190801

1





02:00UTC

06:00UTC

08:00UTC

1

WV image

- In WV channel, the most information comes from the mid level of the troposphere.

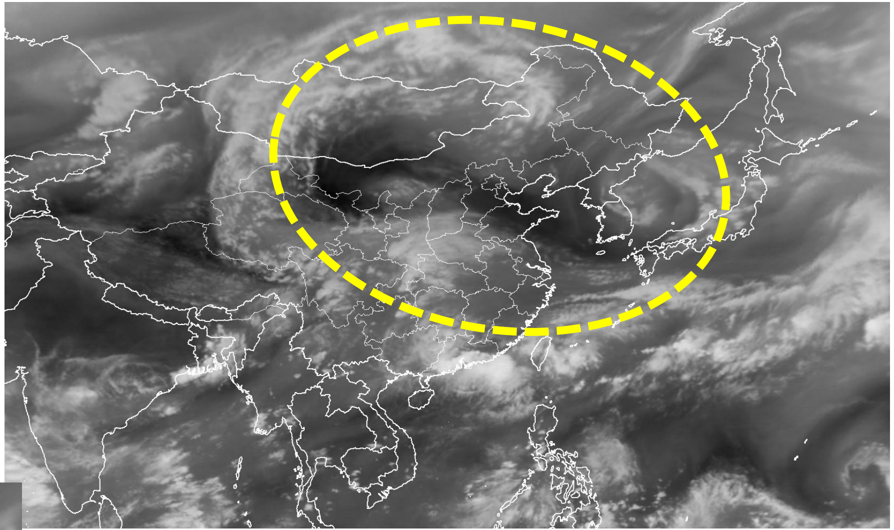
- It can not detect the 80% water vapor at low levels which is very important to the rainfall. But the WV images are still very useful in weather analysis.

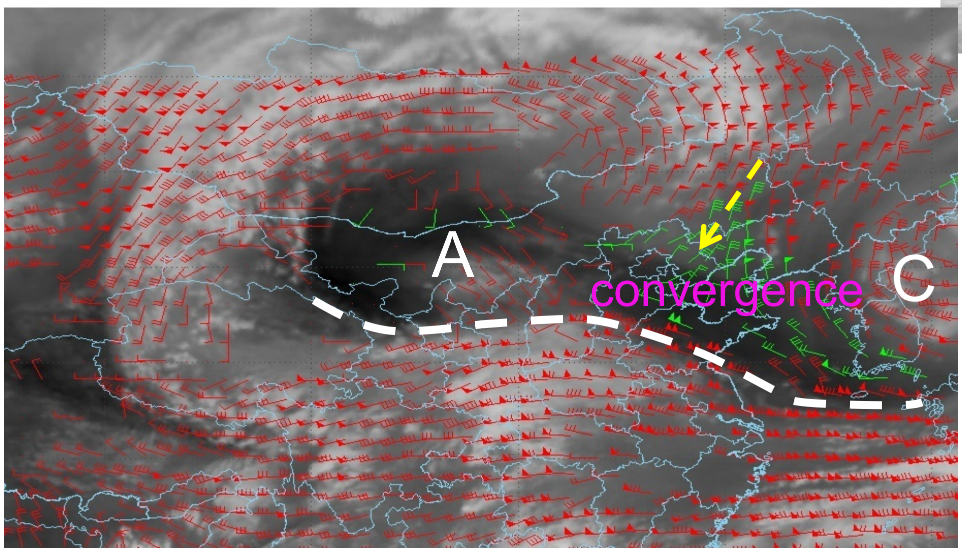
- The gray level change of WV images can show the updraft and downdraft of the atmosphere
- There are many kinds of boundaries on WV images which can show the dynamic process of the weather system

1

Inner boundary, June, 8 2007

There is an anti-cyclone. To the south of the anti-cyclone, there is a easterly with subsidence. This dry easterly meet the relative wet environmental current. An inner boundary forms.





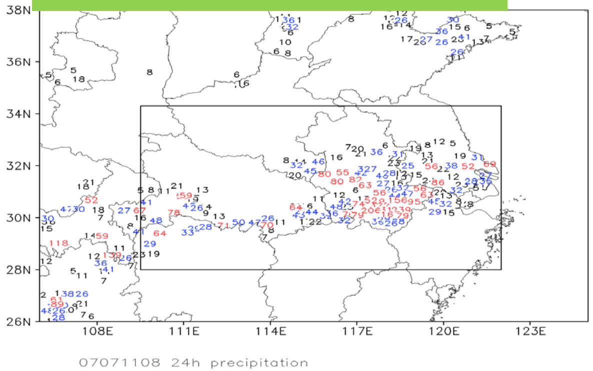
In wind field, a complex of anti-cyclone / cyclone is clearly seen.

When there is a inner boundary over mainland, the weather will be hot.

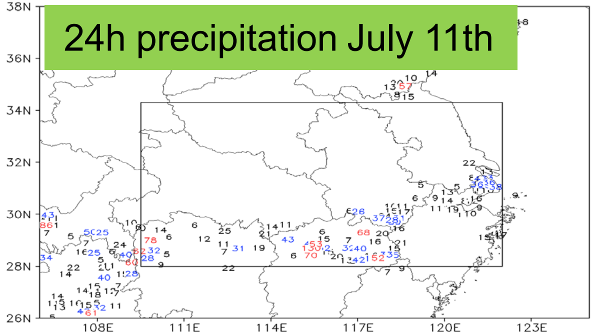
1

Base surg

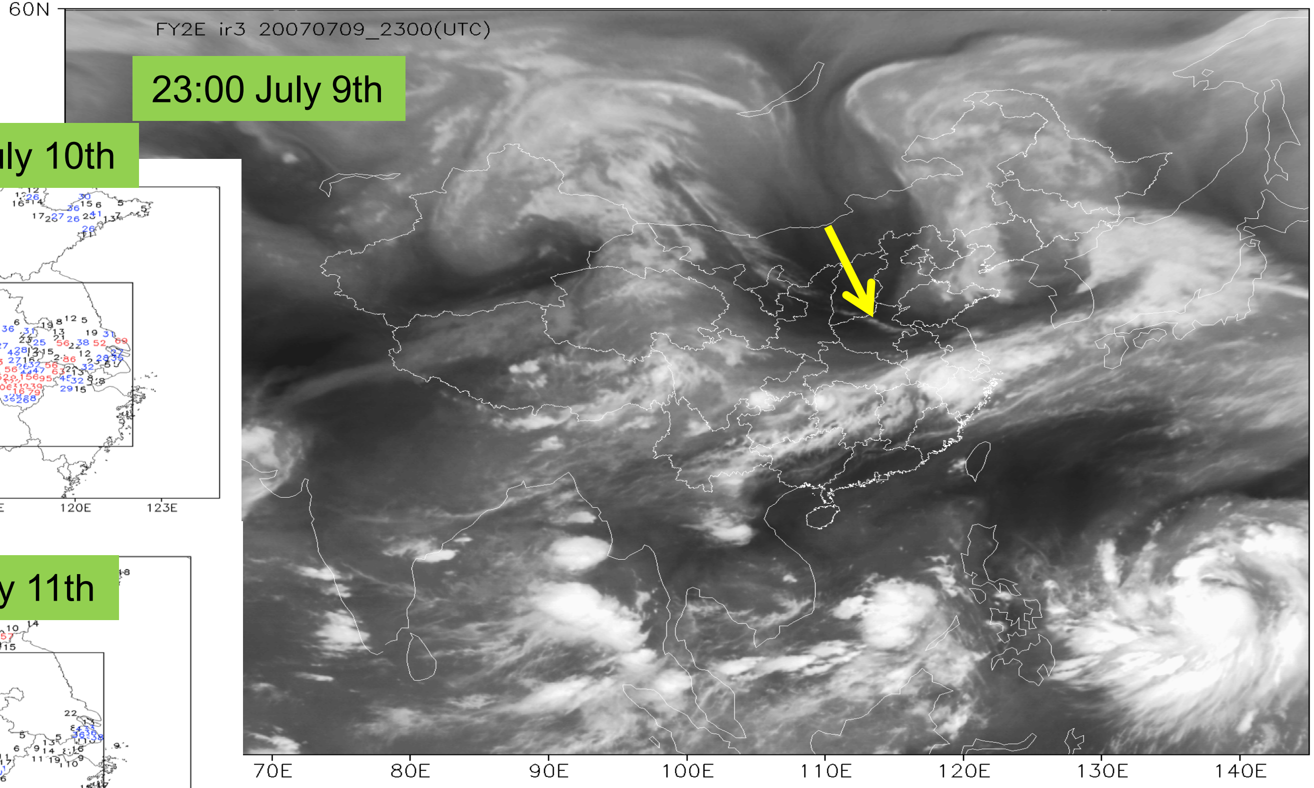
24h precipitation July 10th



24h precipitation July 11th

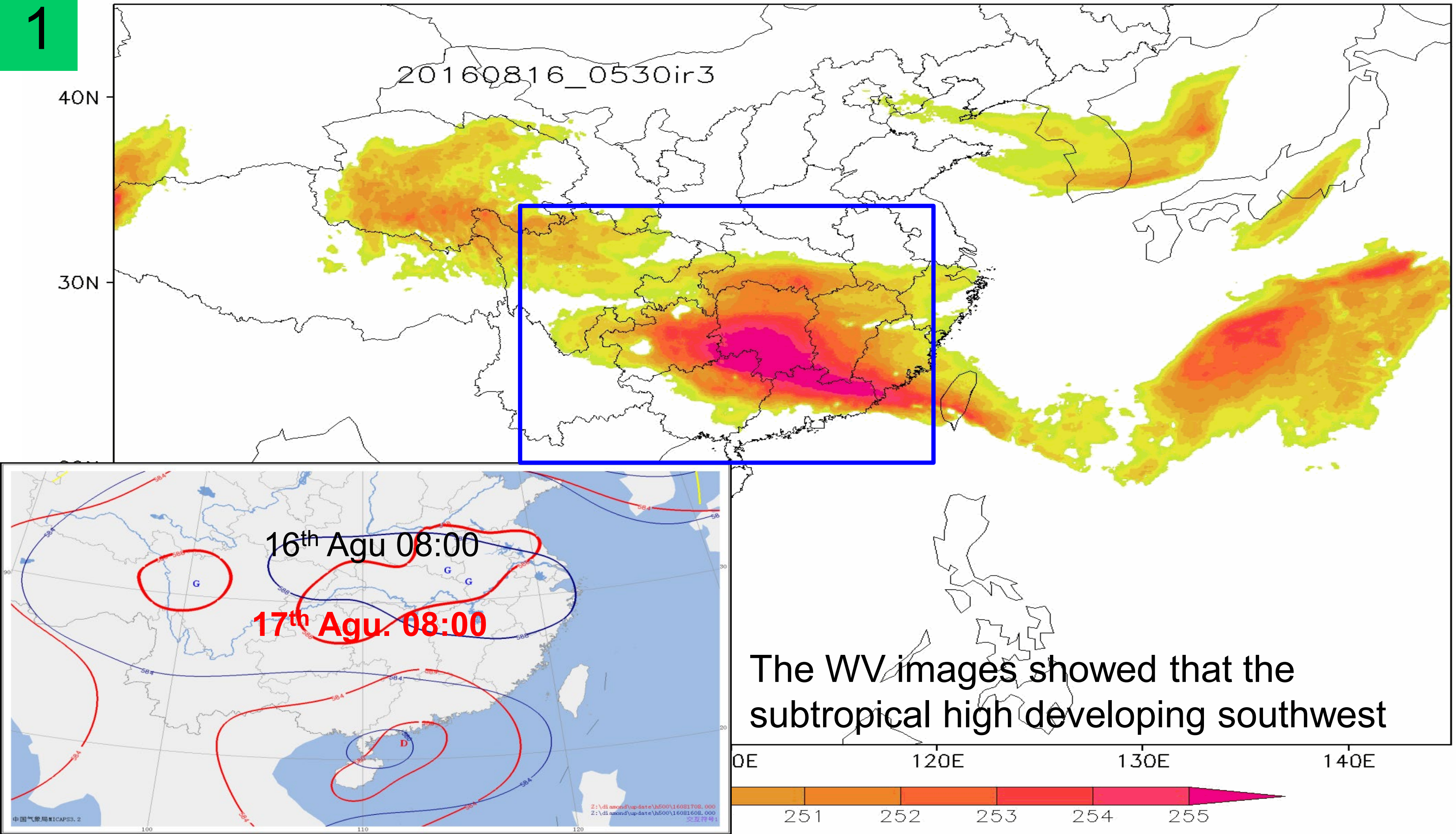


23:00 July 9th



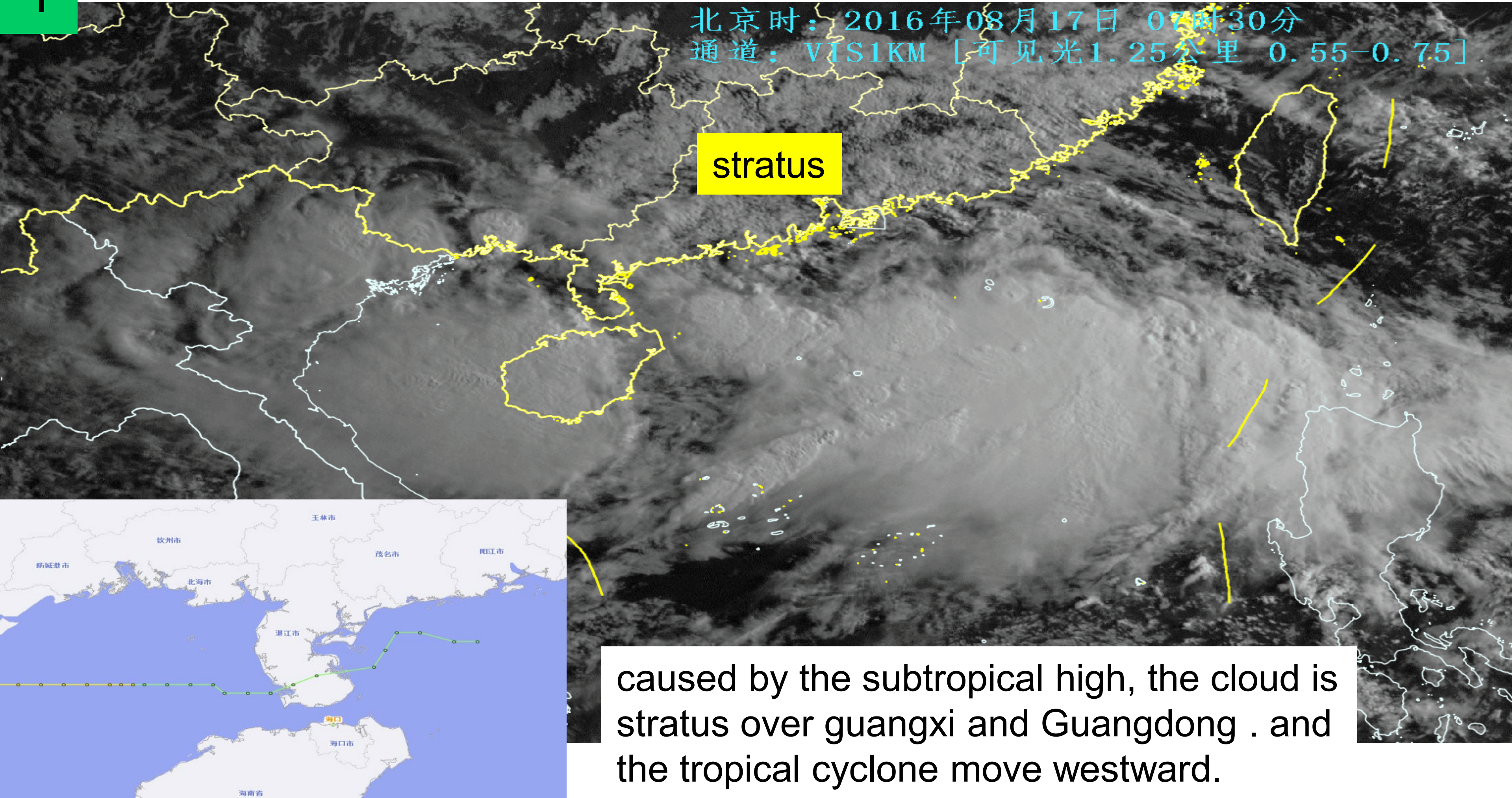
In front of a ridge, strong north wind, heavy precipitation in frond of the moving direction.
The rainfall can not last for a long time because of the fast movement of the system

1



The WV images showed that the subtropical high developing southwest

1



caused by the subtropical high, the cloud is stratus over guangxi and Guangdong . and the tropical cyclone move westward.

1 (1)important weather system concept models using satellite data

Characteristics of satellite cloud images of heavy rainfall

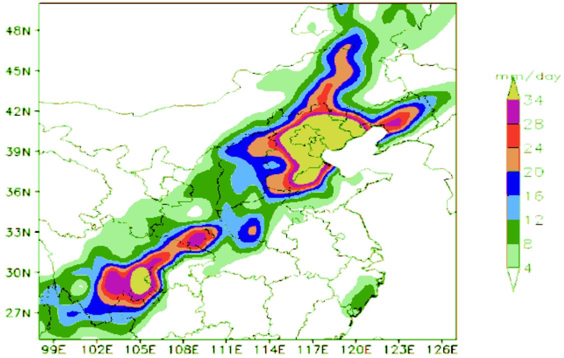
- North and Northeast China
- Middle-Lower Yangtze river region
- Hubei province
- Anhui province
- Sichuan province (Southwest China)
- Guangxi province (South China)

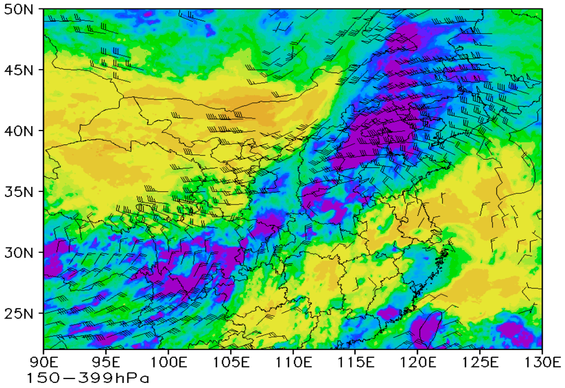
Using the more than 10 years satellite imagery and other data , heavy rainfall concept models are summarized by analyzing multiple examples in several regions of China.

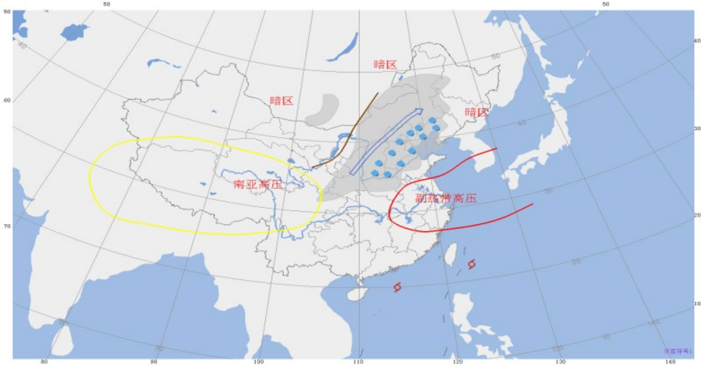
1 Concept models of satellite cloud images of heavy rainfall in North and Northeast China

Meridional leaf cloud type（northeast to southwest）

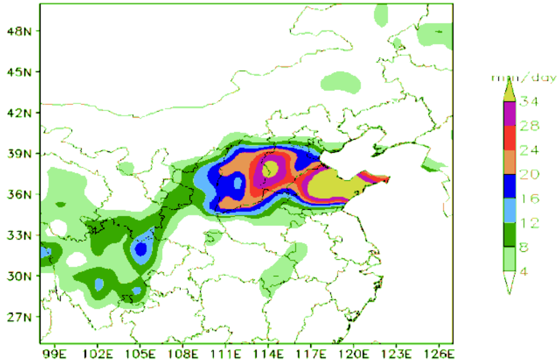
Composite average rainfall | Composite average WV image and AMVs | Concept model of mature stage

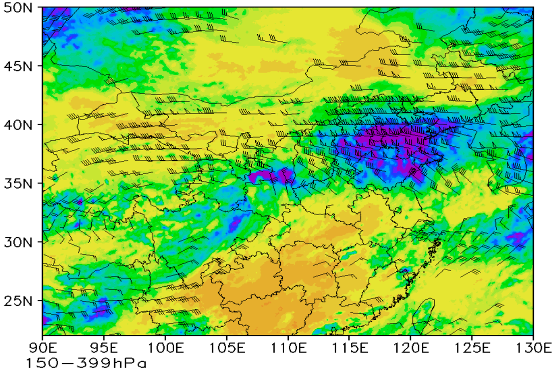


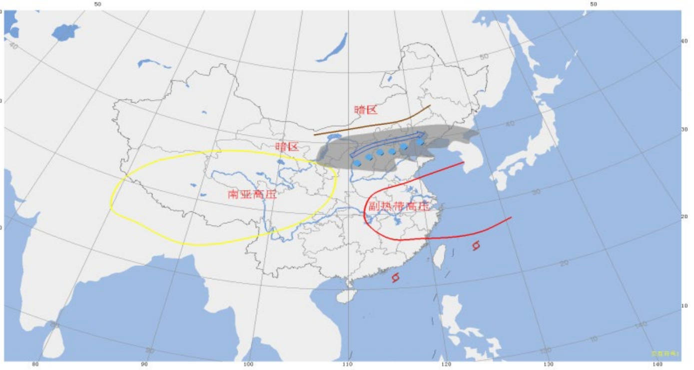




Zonal leaf cloud type

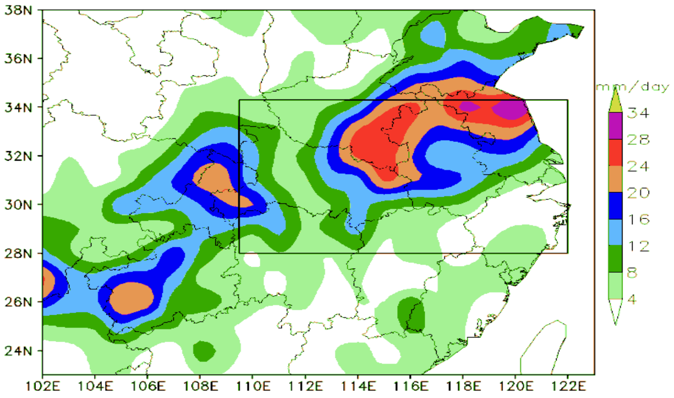




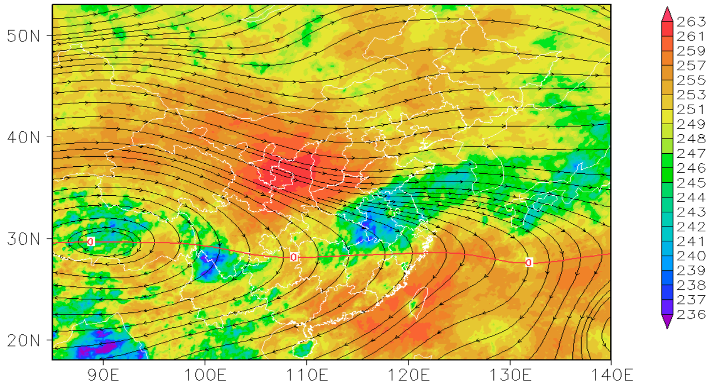


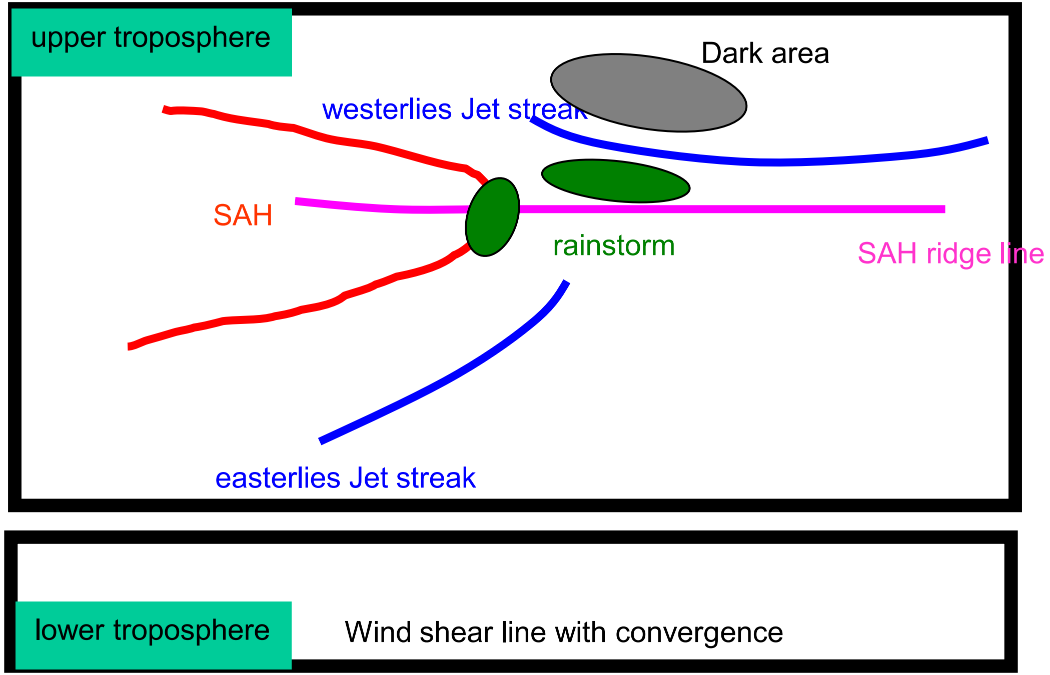
1 Concept models of satellite cloud images of heavy rainfall in Middle-Lower Yangtze river region

Composite average rainfall



Composite average WV image and AMVs

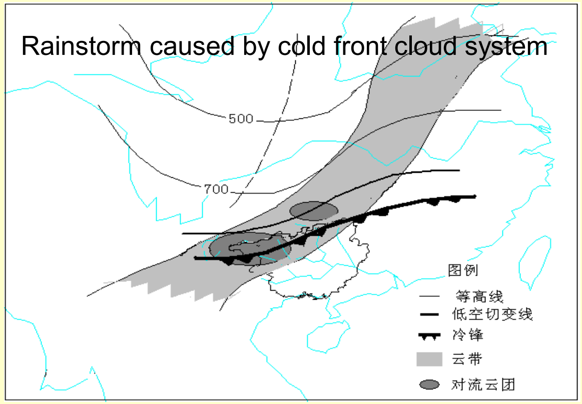




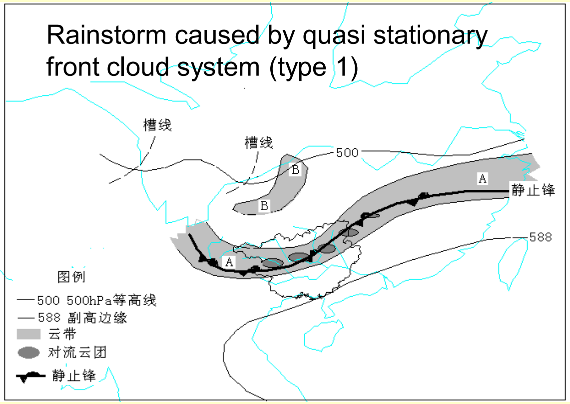
Concept model of a kind of heavy rainfall in south China

1 Concept models of satellite cloud images of heavy rainfall in Guangxi province

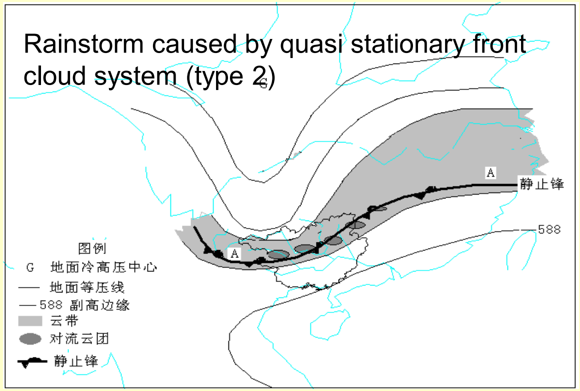
Synoptic scale



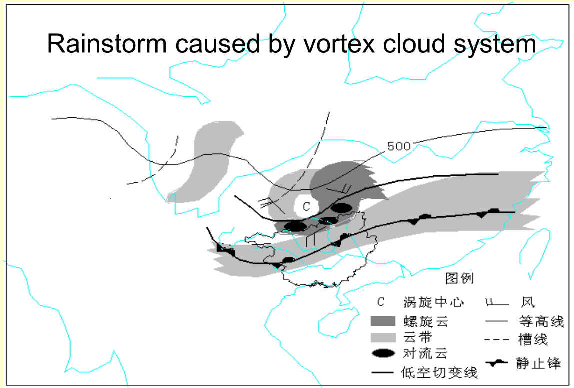
Rainstorm caused by cold front cloud system



Rainstorm caused by quasi stationary front cloud system (type 1)

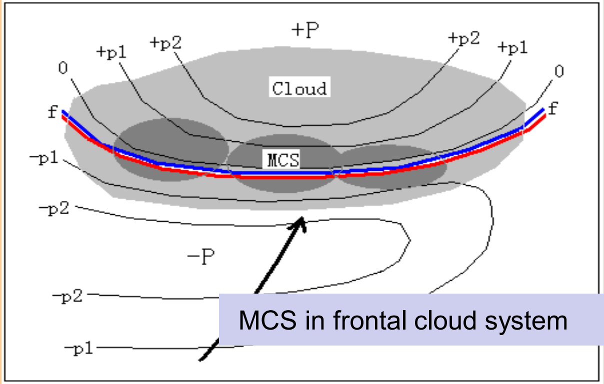


Rainstorm caused by quasi stationary front cloud system (type 2)

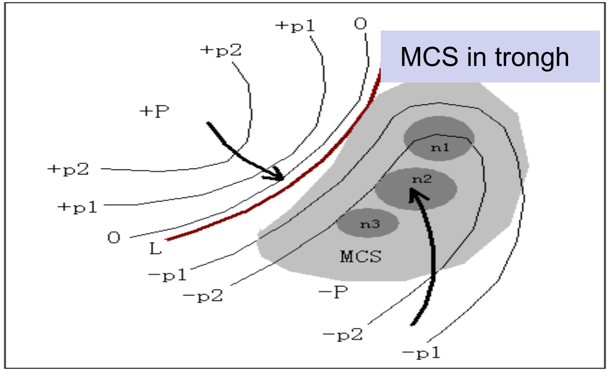


Rainstorm caused by vortex cloud system

Meso-scale: MCS



MCS in frontal cloud system

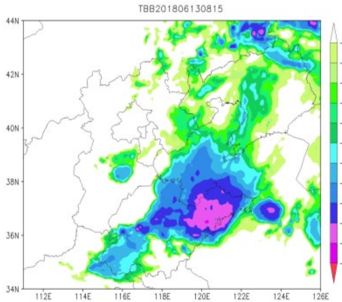


MCS in trongh

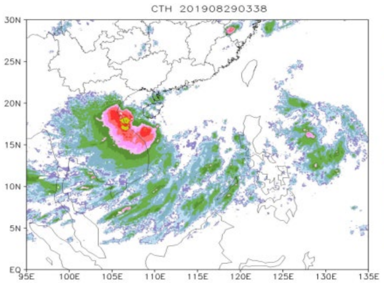
2 FY Satellite derived product application L2

More than 30 kinds of L2 products

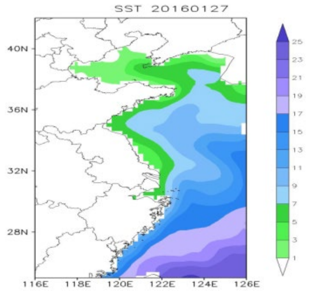
TBB



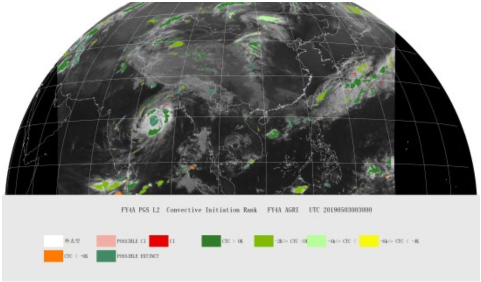
CTH: cloud top height



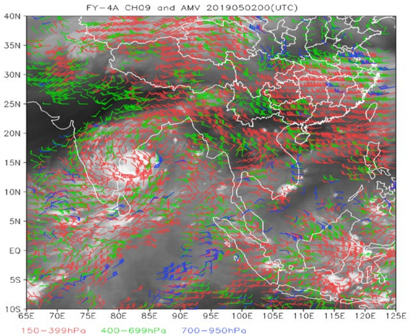
SST: sea surface temperature



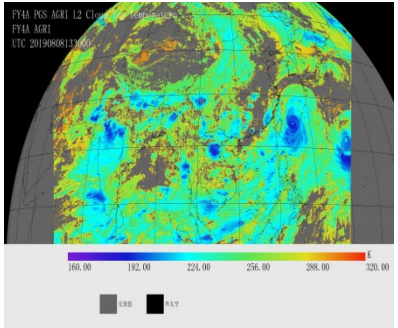
CIX: convective initiation rank



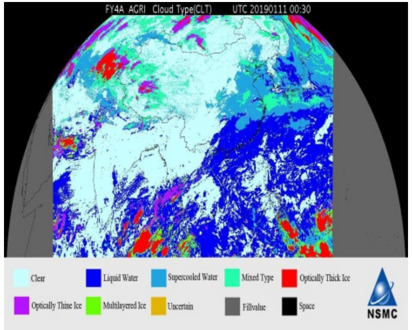
AMV: atmosphere movement vector



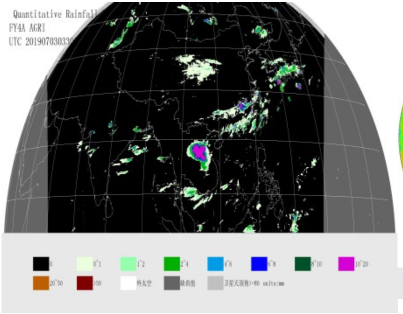
CTT: cloud top temperature



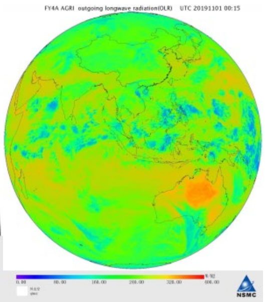
CLT: cloud type



QPE: quantitative precipitation estimation

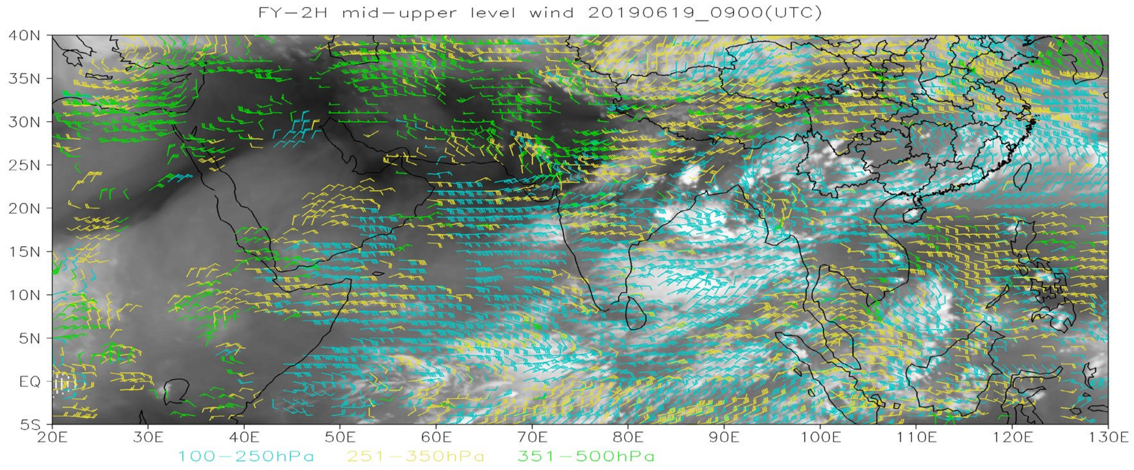


OLR

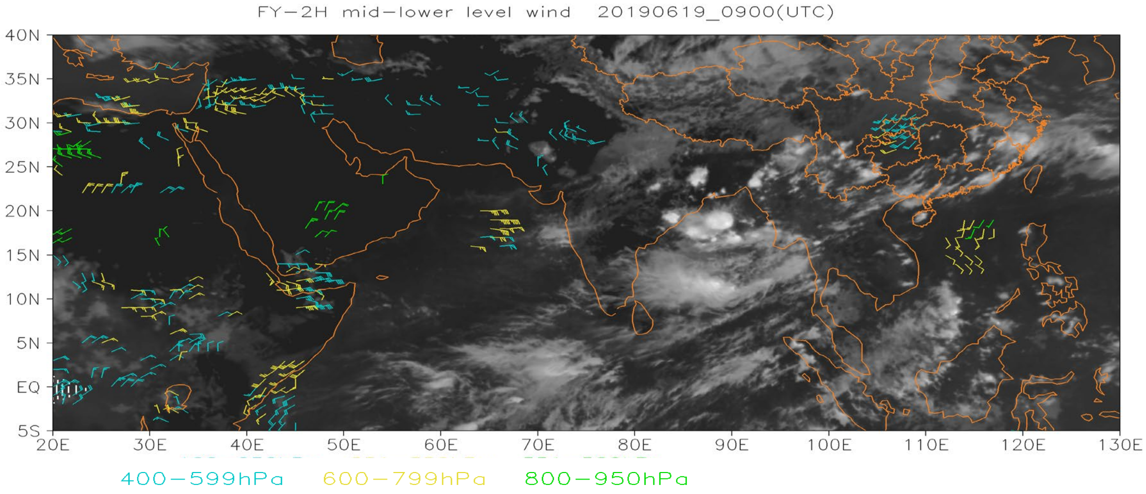


2

Upper-troposphere winds
yellow：251-350hPa
blue：100-250hPa

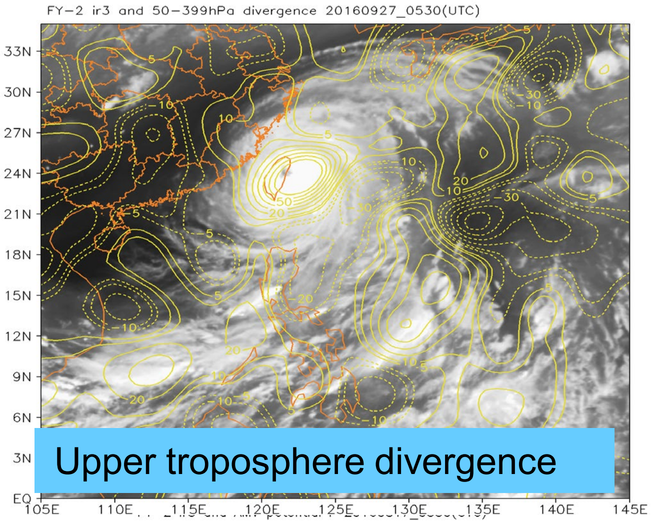


Lower-troposphere winds
yellow：600-799hPa
green：800-950hPa

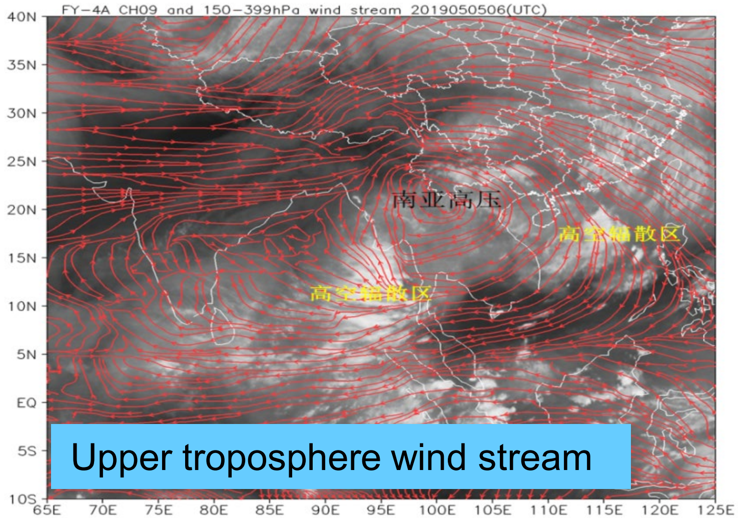


2

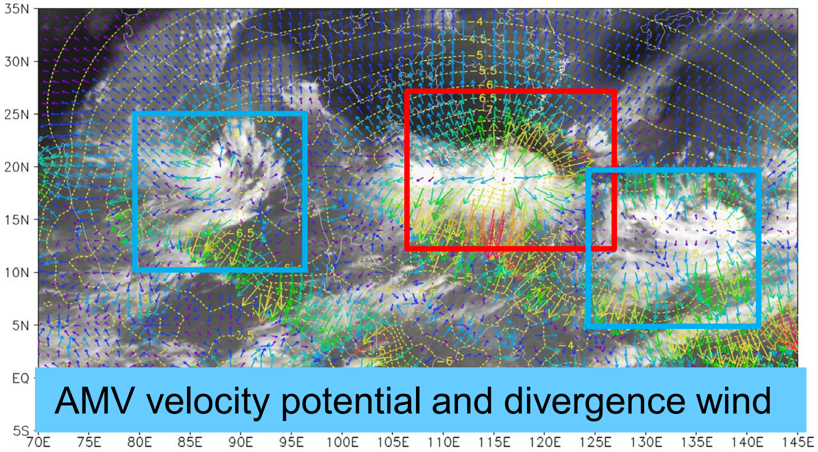
FY-4A AMV product



Upper troposphere divergence



Upper troposphere wind stream



AMV velocity potential and divergence wind

There is a velocity potential φ if the motion is irrotational, the velocity in different direction is the differential of the velocity potential φ. That is

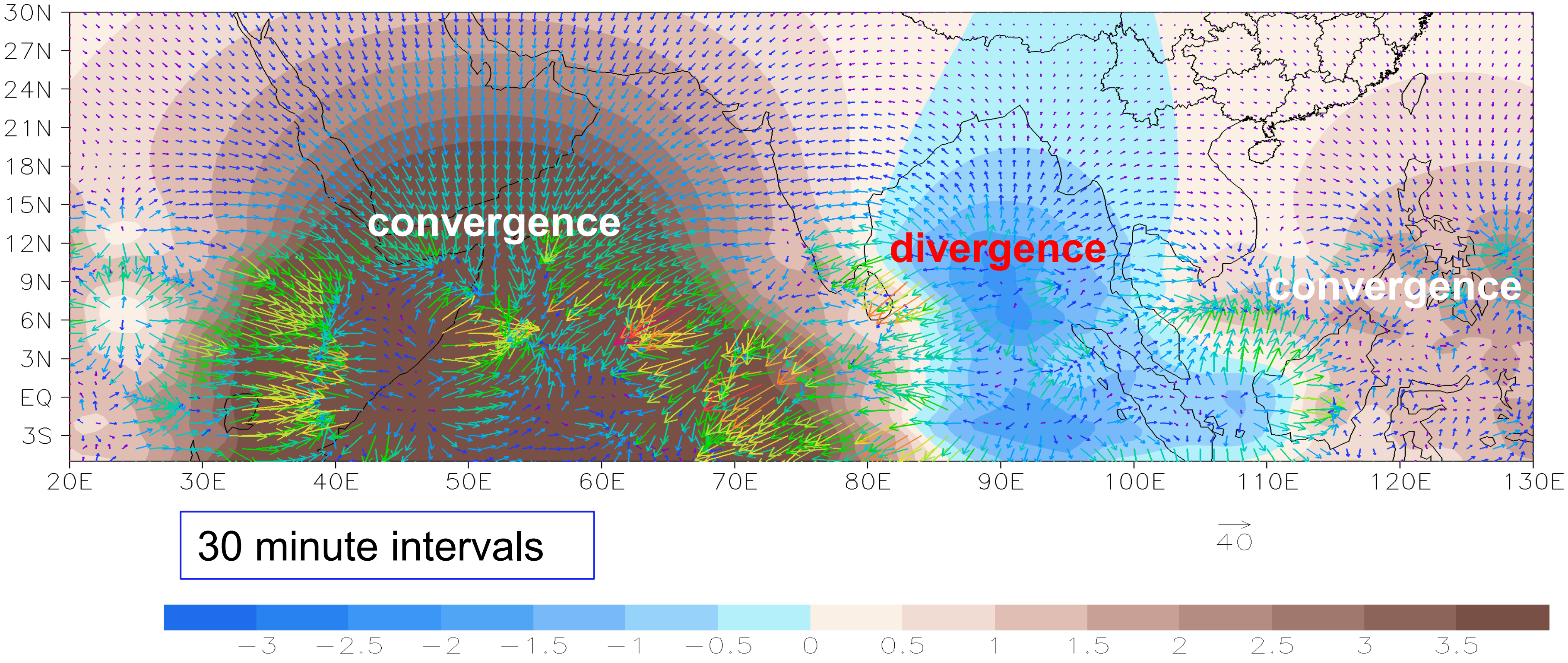
$$u_{\varphi} = \frac{\partial \varphi}{\partial x} \quad v_{\varphi} = \frac{\partial \varphi}{\partial y}$$

$$D = \frac{\partial u_{\varphi}}{\partial x} + \frac{\partial v_{\varphi}}{\partial y} = \left(\frac{\partial^2 \varphi}{\partial x^2} + \frac{\partial^2 \varphi}{\partial y^2}\right)$$

Divergence is the second-order differential of velocity potential φ

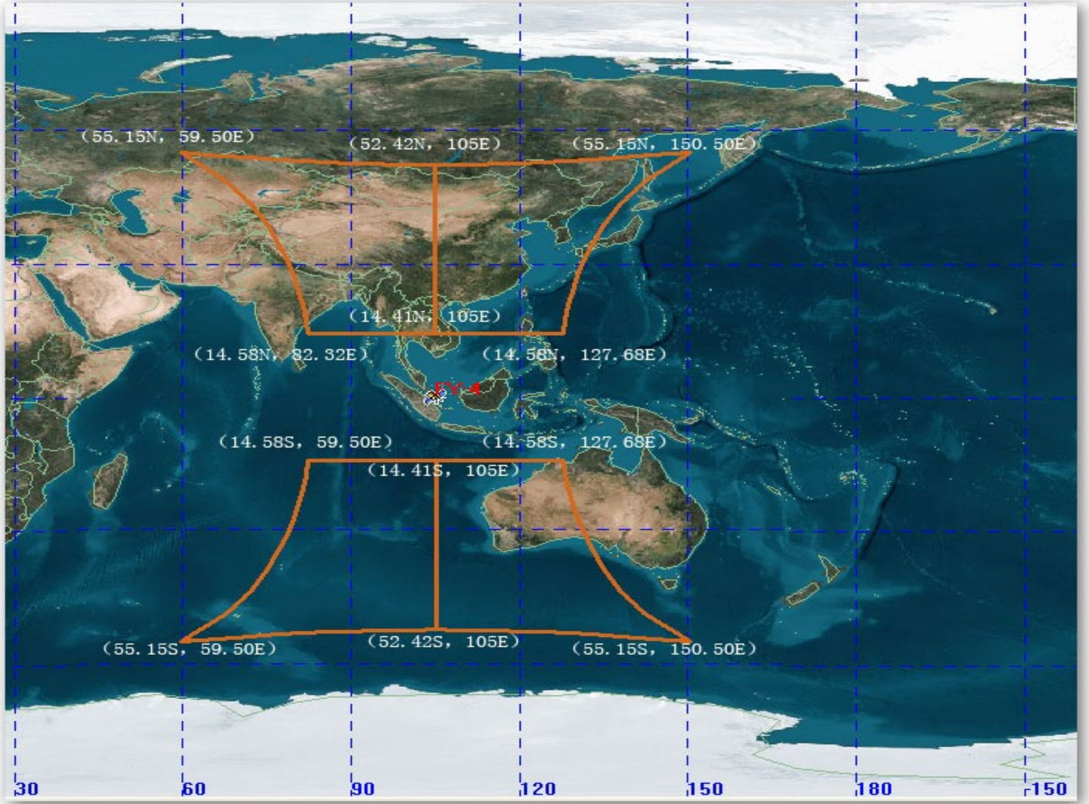
2

FY-2H AMV divergence wind and velocity potential

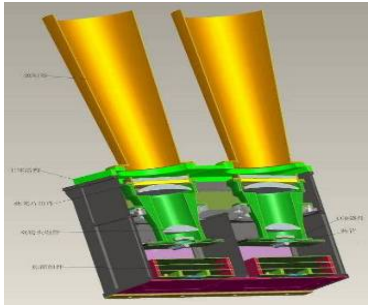


30 minute intervals

2 FY-4A LMI product application

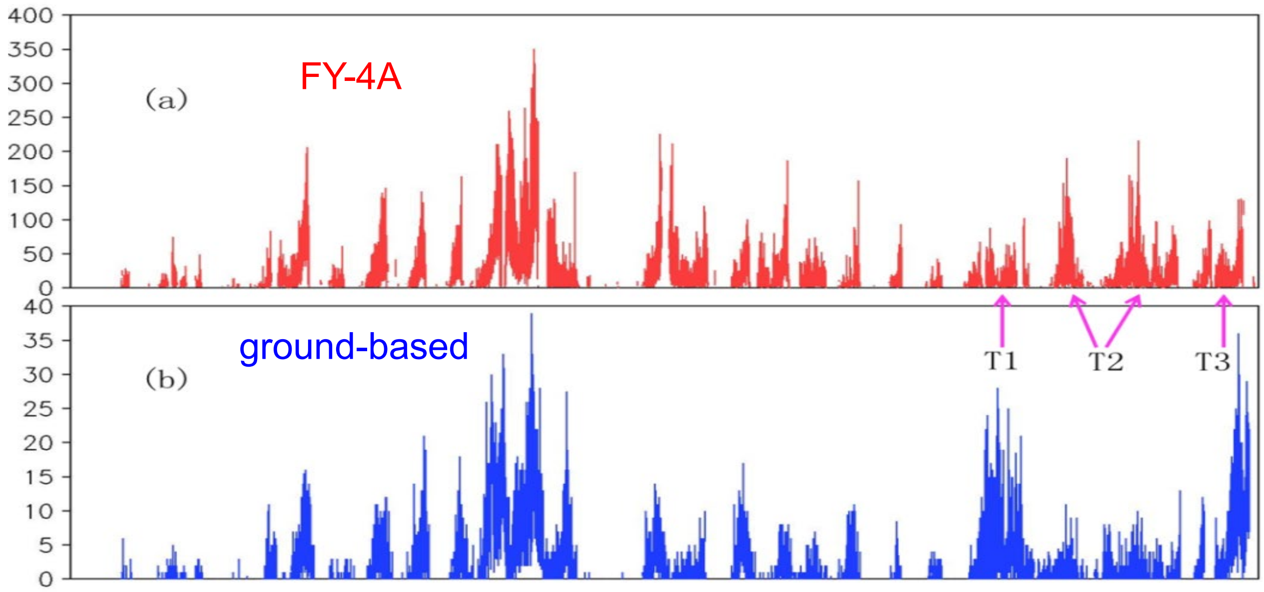


FY-4A lightning imager cover most of China and adjacent areas



LMI
Lightning **M**apping **I**mager
Central Frequency: 777.4nm
7.8Km
S/N >=6
2ms

2 comparative analysis between FY-4A lightning and ground-based observing lightning **in North China** in June, 2018

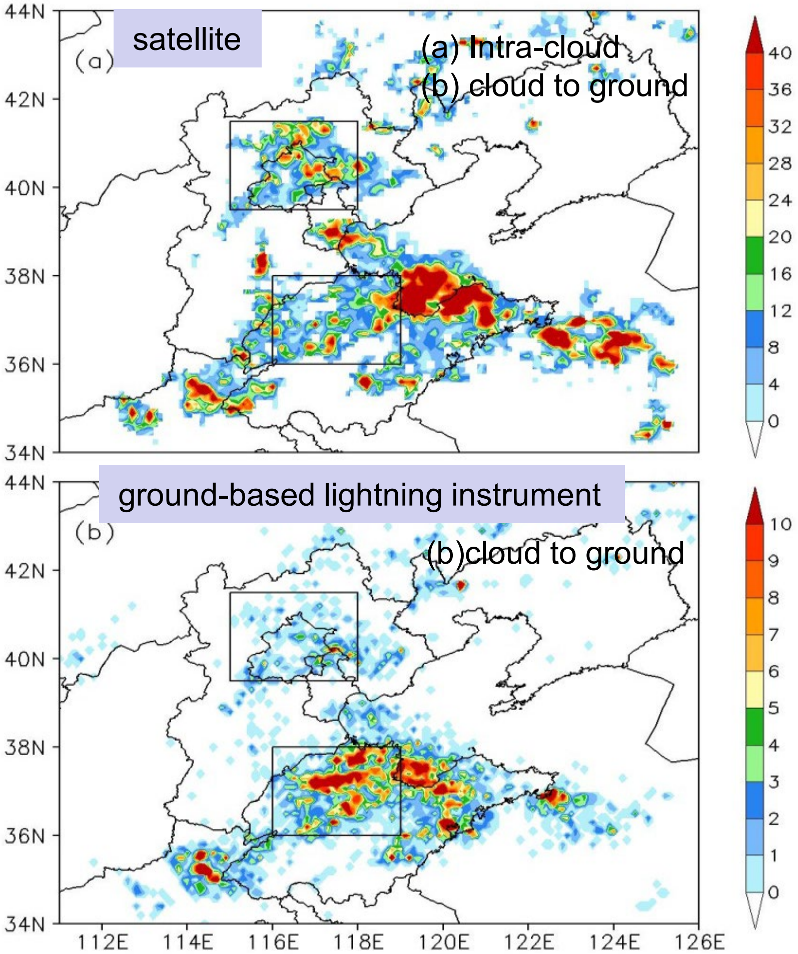


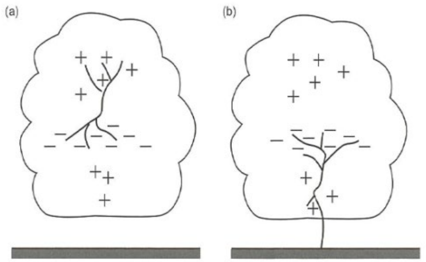
The 1 minute **regional (111º-126ºE；34º-44ºN)** accumulated lightning frequency of FY-4A lightning (a) and ground-based lightning in June, 2018

Due to the different observation methods, the total frequency of FY-4A lighting events is about 10 times that of the ground observation. Most of the times in June, the trend of the total lightning frequency of the two types of data is similar. But in late June, at the time T1 andT3, the ground based observation lighting frequency is relative high. It shows that there are both consistency and difference between the two types of data.

2

The accumulated lightning frequencies of FY-4A lightning (a) and ground lightning (b) from 0000 to 1000 on June 13, 2018





(a) Intra-cloud
(b) cloud to ground

In the development stage of thunderstorm, the intra-cloud lightning appears first

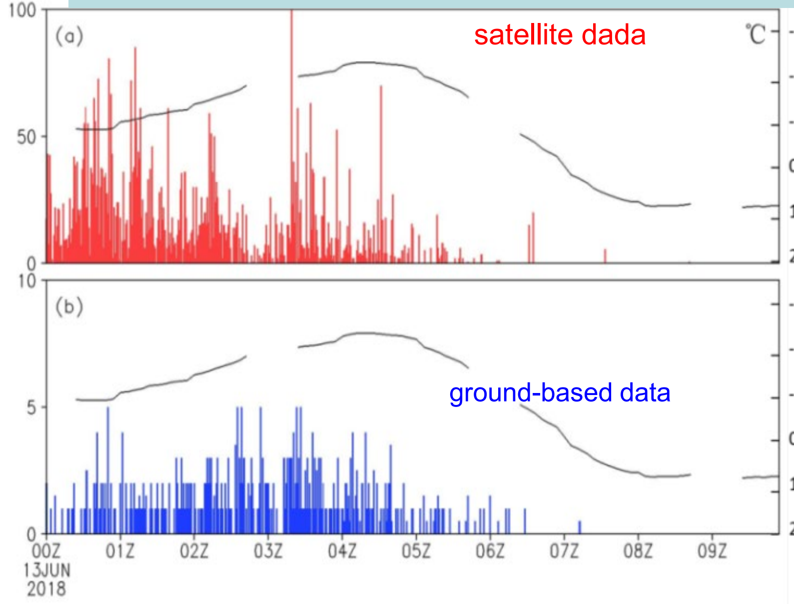
Cloud to ground lightning activity generally lags behind intra-cloud lighting and appears more in the mature stage of the thunderstorms.

The relatively large number of lightning observed by satellite in the northern part of North China is related to the intra-cloud lightning generated by frequent convection in the region.

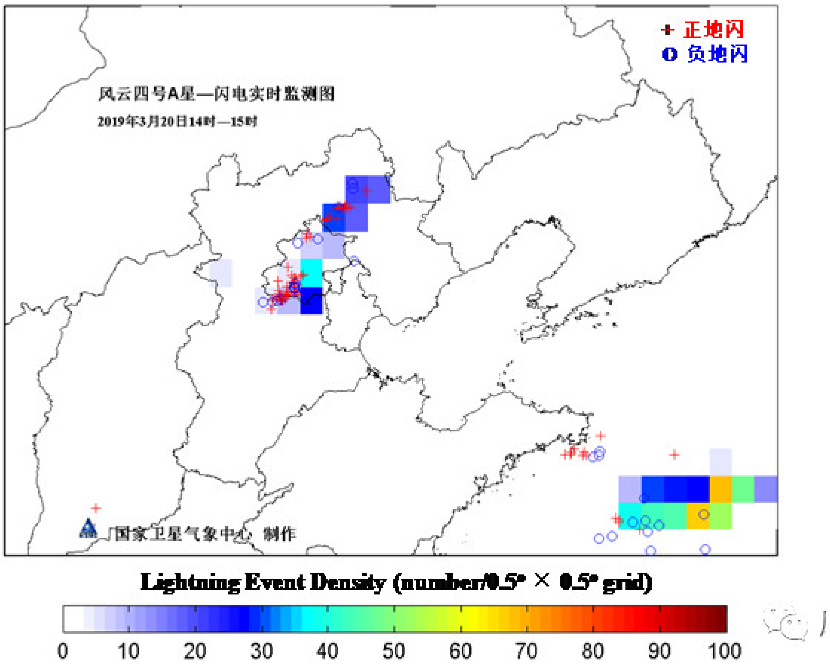
in the northern part of North China, the convection is relatively weak, and there are many small and meso-scale convective clouds. Therefore, in the development stage of each convective cloud, the intra-cloud lightning activity is frequent. Because of the weak convective intensity, the cloud to ground lightning activity observed by the ground-based lightning instrument is not obvious

Convective cloud monitoring using FY-4A lightning products

We can see the satellite lightning is much stronger during the development period



Time series of regional accumulated FY-4A lightning (a), ground lightning (b) frequencies and regional average TBB (black line) from 0000 to 1000 on June 13, 2018 (above: 115-118ºE, 39.5-41.5ºN;



FY-4A lightning monitor the first thunder in Beijing in early spring of 2019.

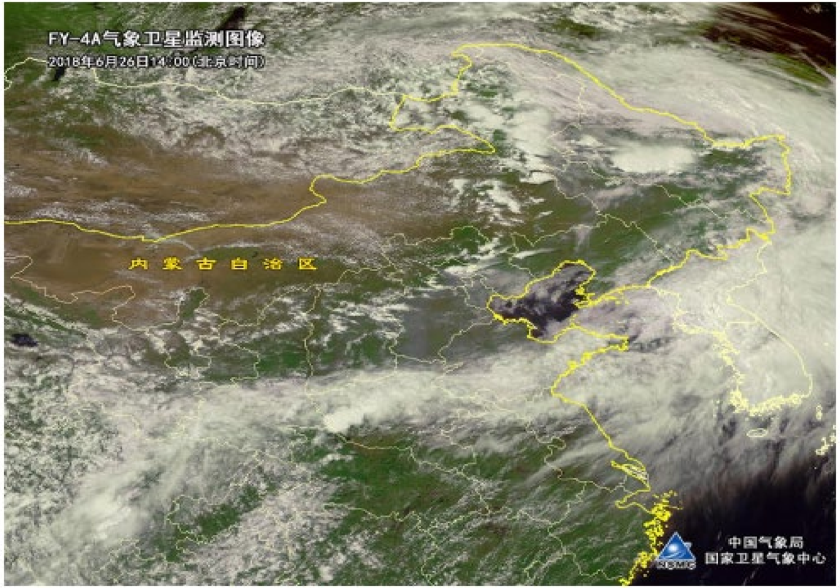


图2. FY-4A静止气象卫星监测图像2018年6月26日14:00时

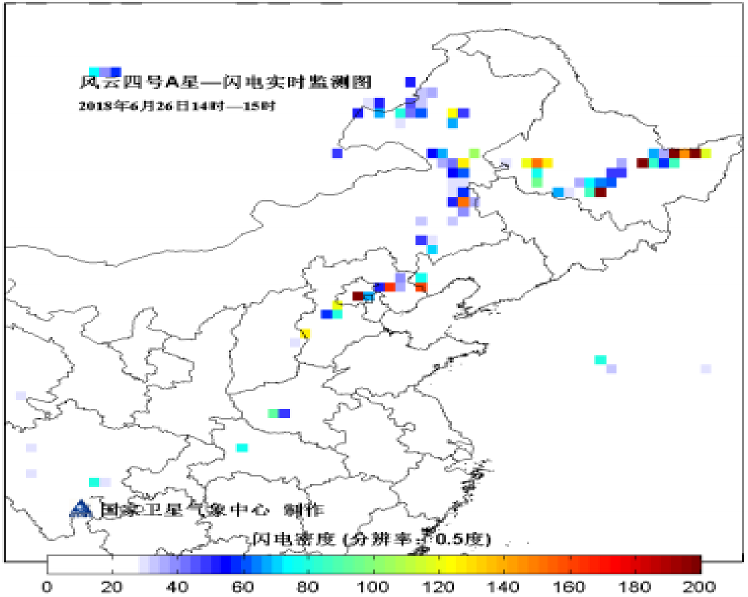


图3. FY-4A闪电成像仪2018年6月26日14时-15时闪电事件频数分布图

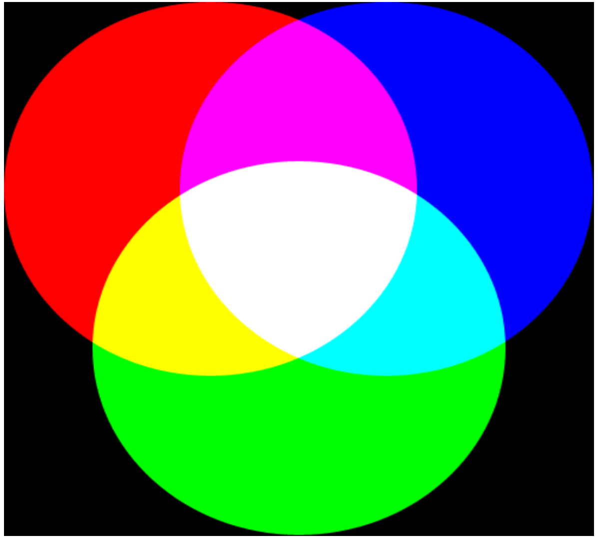
The FY-4A lightning monitor the weak and new born convective cells

3

FY-4A Advanced Geo. Radiation Imager multi-channel RGB composite product

14 channels

What's RGB composite imagery?



Red (R), green (G) and blue (B) which are the three primary colors of light constitute color space expressing additive color composite

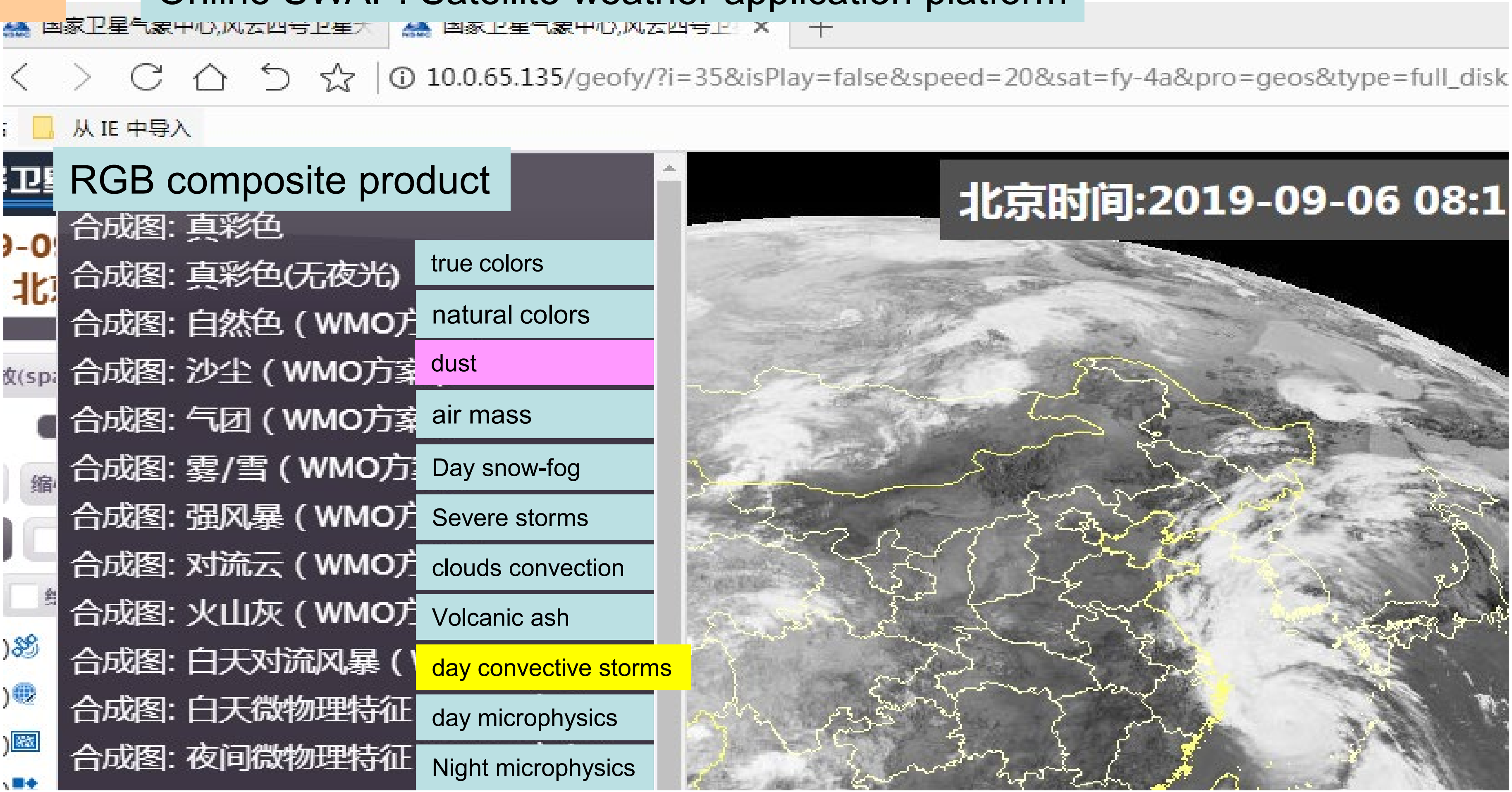
- The RGB composite imagery is a technique to display a color using this property of the three primary colors of light.

FY-4A/AGRI			
Band	Wavelength (μm)	Spatial Resolution (Km)	Physical properties
1	0.46	1	Vegetation, aerosol
2	0.64	0.5～1	Vegetation, aerosol
3	0.86	1	Vegetation, aerosol
4	1.38	2	cirrus
5	1.61	2	Cloud phase
6	2.25	2～4	Particle size
7	3.80 (high)	2	Low cloud,fog,forest fire
8	3.80 (low)	4	Low cloud,fog,forest fire
9	6.5	4	Mid-and upper level moisture
10	7.2	4	Mid and lower level moisture
11	8.5	4	Cloud phase,so2
12	10.8	4	Cloud imagery, imformation of cloud top
13	12.0	4	Cloud imagery, sea surface temperature
14	13.3	4	Cloud top height
OM	1 Full Disk, 15min. Region/5min.		

There are 14 channels on FY-4A/AGRI(**A**dvanced **G**eo. **R**adiation **I**mager)， each channel has different properties. In order to **highlight one kind of information**, we use RGB composite technique.

3

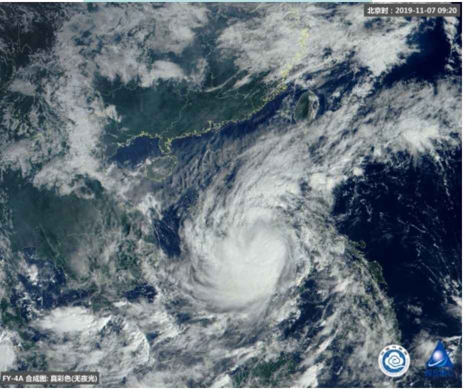
Online SWAP: Satellite weather application platform



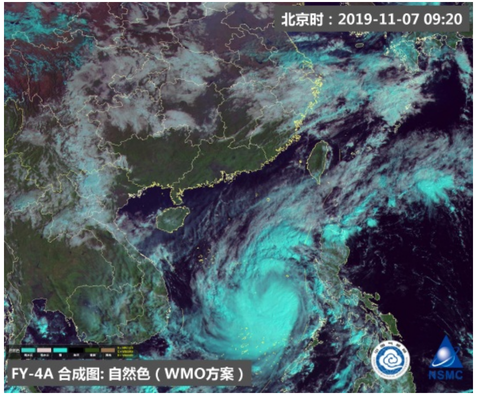
3

Examples of RGB composite products

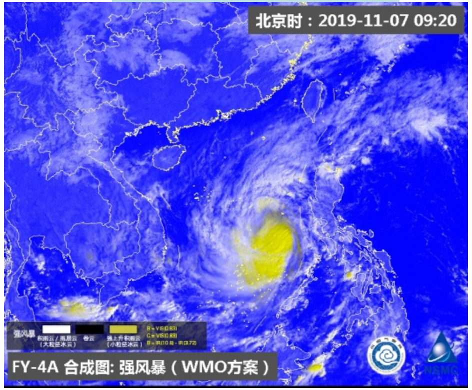
true colors



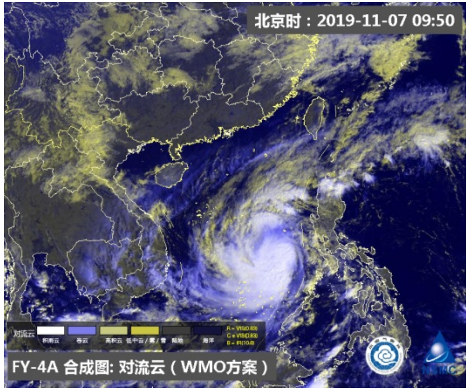
natural colors



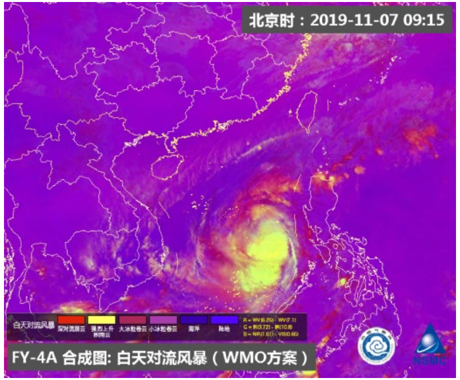
Severe storms



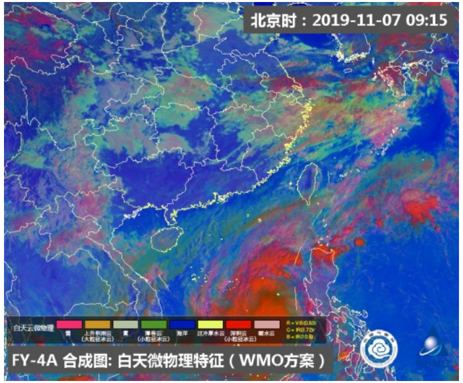
clouds convection



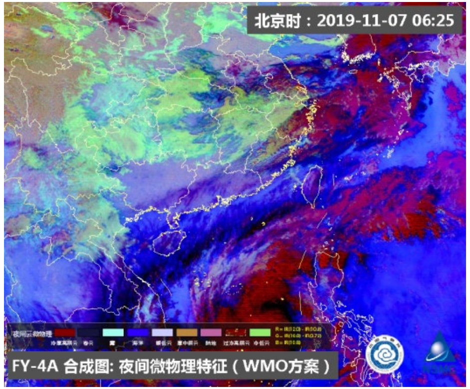
day convective storms



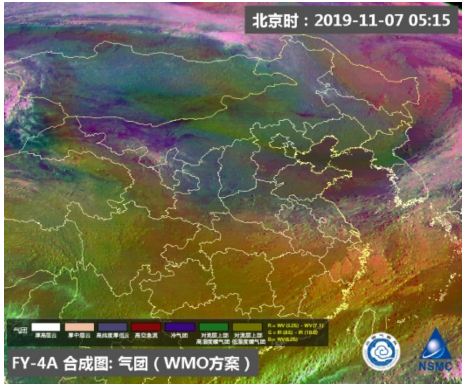
day microphysics



Night microphysics



air mass



3 FY-4A RGB day convective storms

Himawari-8/AHI			FY-4A/AGRI		
band	wave length(μm)	resolution (km)	band	wave length(μm)	resolution (km)
1	0.46	1	1	0.46	1
2	0.51	1	**2**	0.64	0.5~1
3	**0.64**	0.5	3	0.86	1
4	0.86	1	4	1.38	2
5	**1.60**	2	**5**	1.61	2
6	2.30	2	6	2.25	2~4
7	**3.90**	2	**7**	3.80 (high)	2
8	**6.20**	2	8	3.80 (low)	4
9	7.0	2	**9**	6.5	4
10	**7.3**	2	**10**	7.2	4
11	8.6	2	11	8.5	4
12	9.6	2			
13	**10.4**	2			
14	11.2	2	**12**	10.8	4
15	12.3	2	13	12.0	4
16	13.3	2	14	13.3	4

Himawari-8/AHI: composite method

R: WV6.2μm-WV7.3μm, -35~5K , gamma =1.0

G: IR3.9μm-IR10.4μm, -5~60K, gamma =0.5

B: IR1.6μm-VIS0.64μm, -75~25% gamma =1.0

FY-4A: composite method

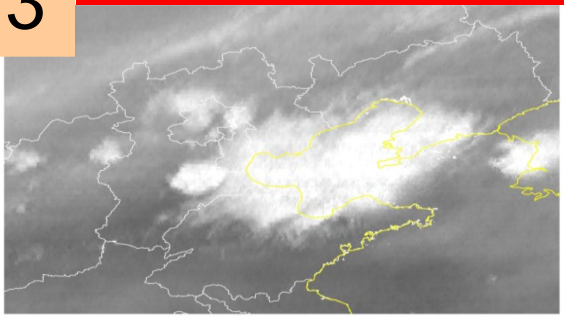
R: WV6.5μm-WV7.2μm, -30~0K , gamma =1.0

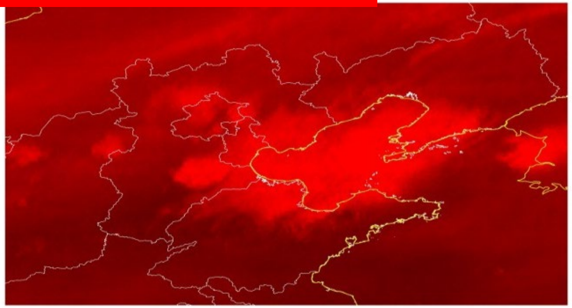
G: IR3.8μm-IR10.8μm, -20~65K, gamma =1.0

B: IR1.61μm-VIS0.64μm, -80~20% gamma =1.0

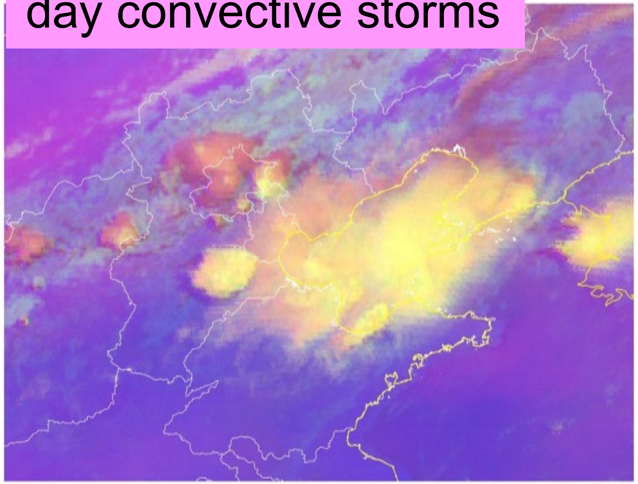
3

R: WV6.5μm-WV7.2μm，-30～0K， gamma =1.0 difference

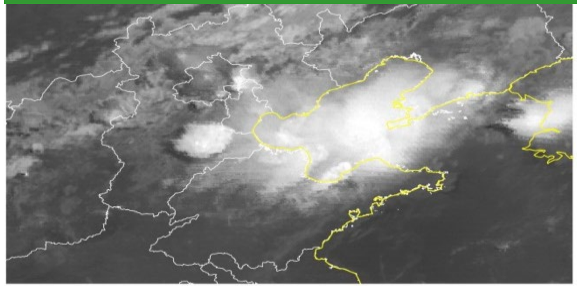


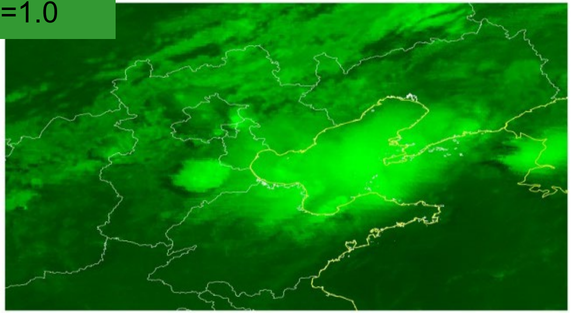


day convective storms



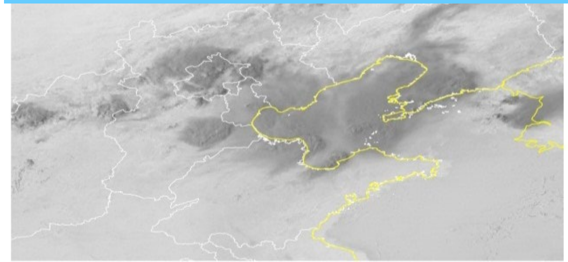
G: IR3.8μm-IR10.8μm，-20～65K，gamma =1.0

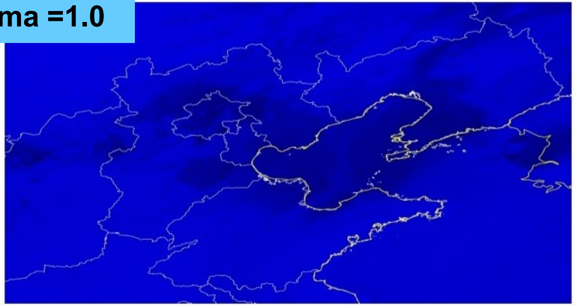


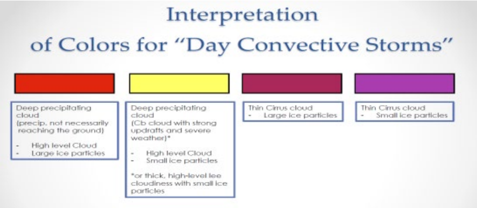


The color of the deep convective cloud of small ice particles with strong ascending is yellow。

B: IR1.61μm-VIS0.64μm，-80～20%， gamma =1.0







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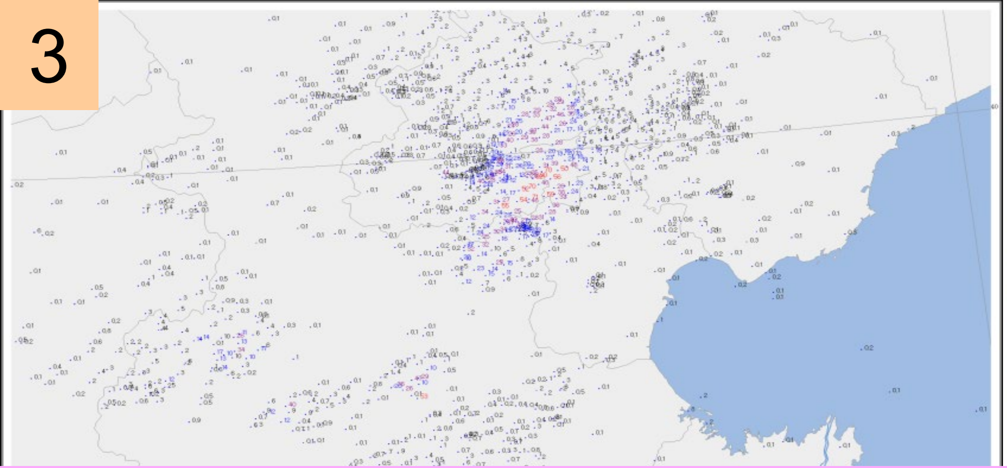
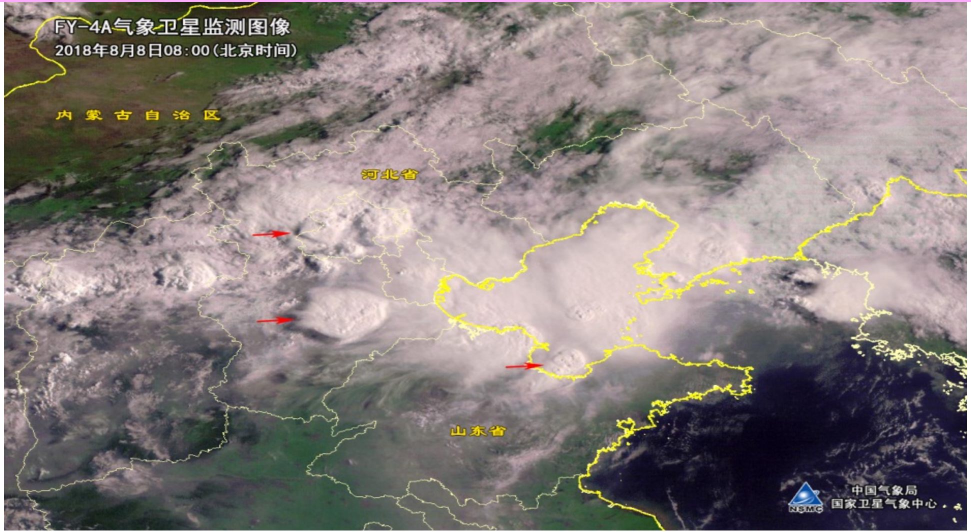
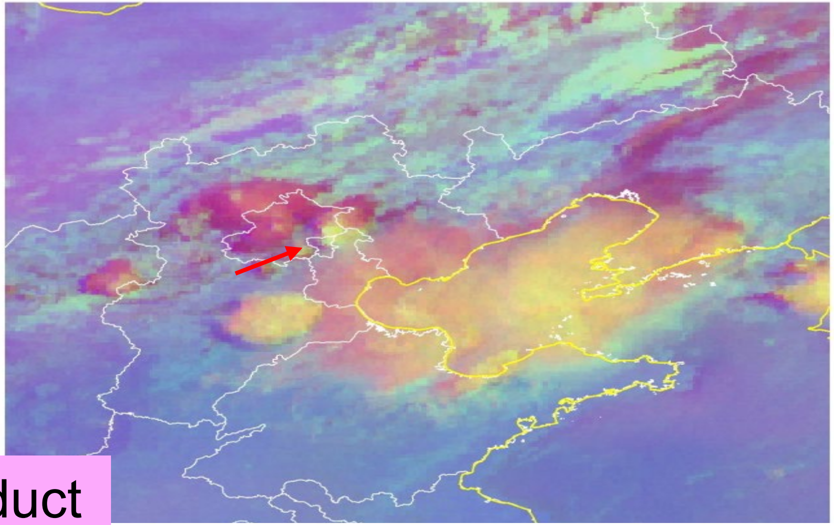
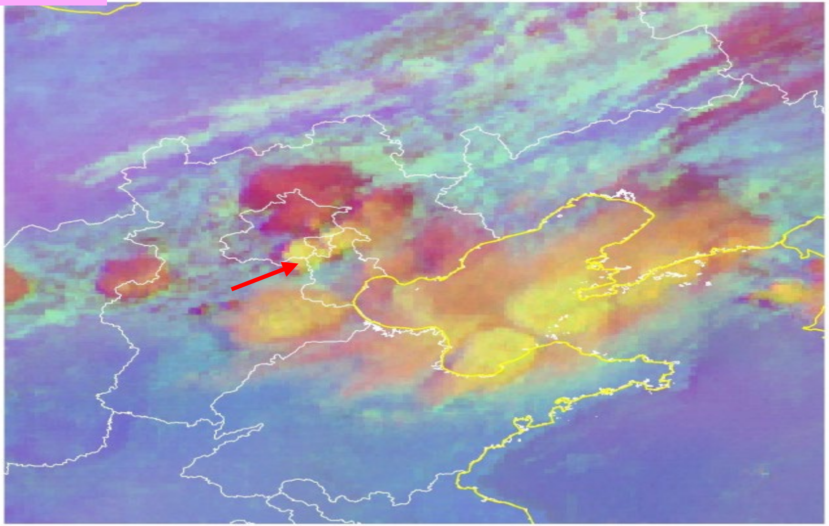


Advantages of day convective storms product







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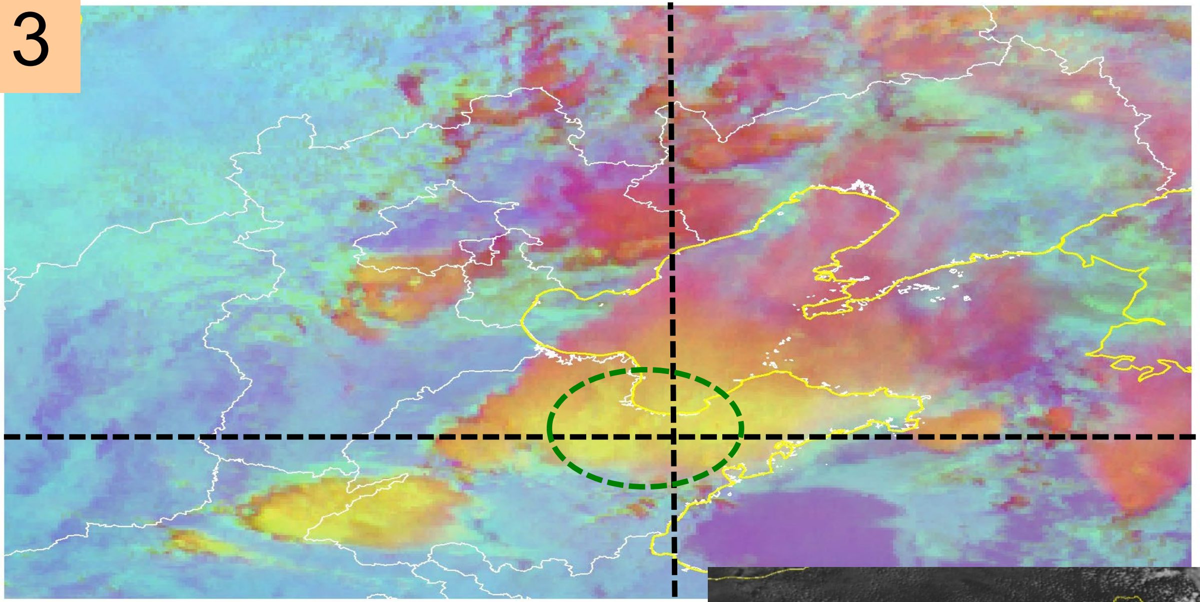
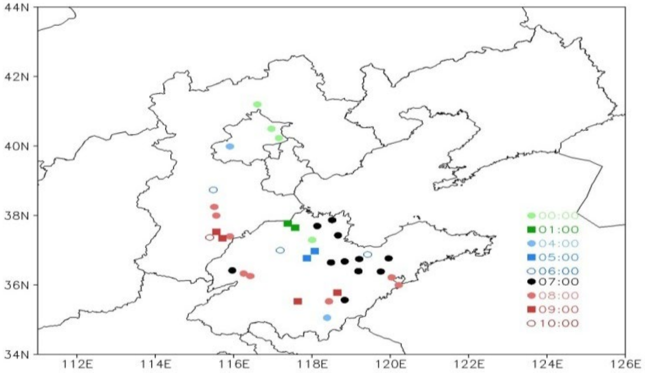


07时


44N
42N
40N
38N
36N
34N
112E
114E
116E
118E
120E
122E
124E
126E
00:00
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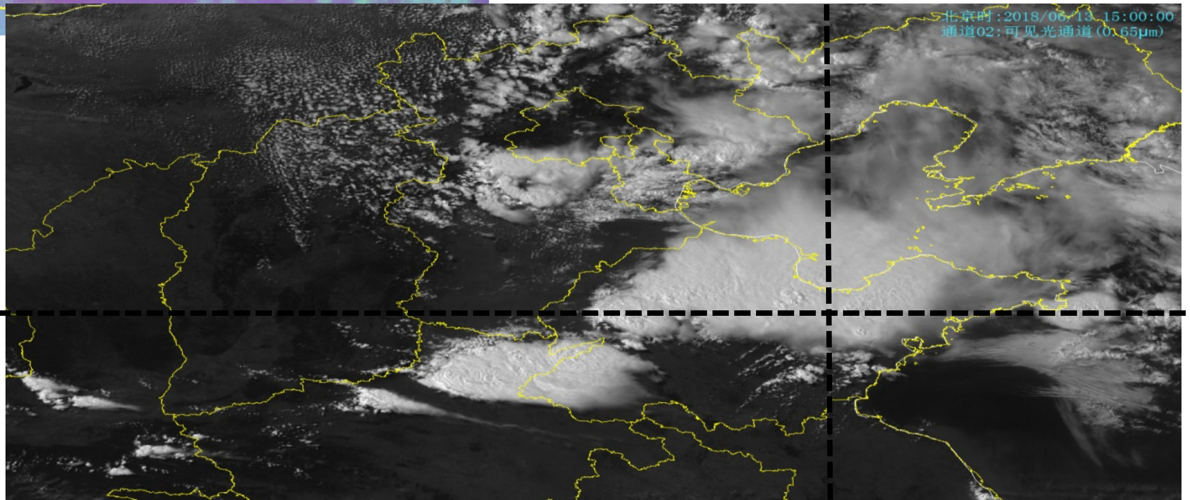
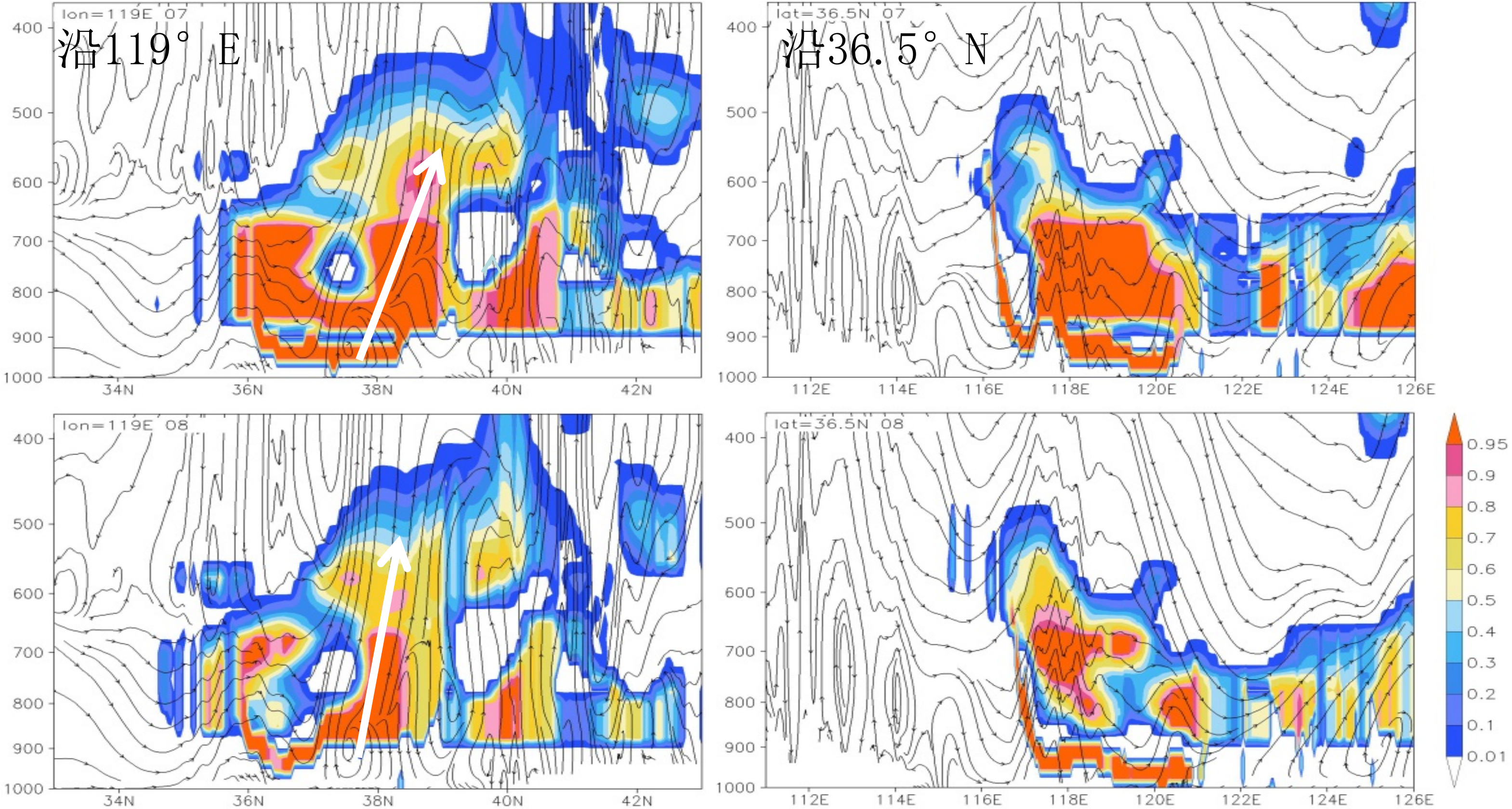
07:00
08:00
09:00
10:00


北京时:2018/06/13 15:00:00
通道02:可见光通道(0.65μm)

3

The vertical profiles of 119.0E and 36.5N hailstones with denser hailstones from 07 to 08 were selected respectively.



Strong updraft

three-dimensional cloud field and wind streamlines

3 DUST

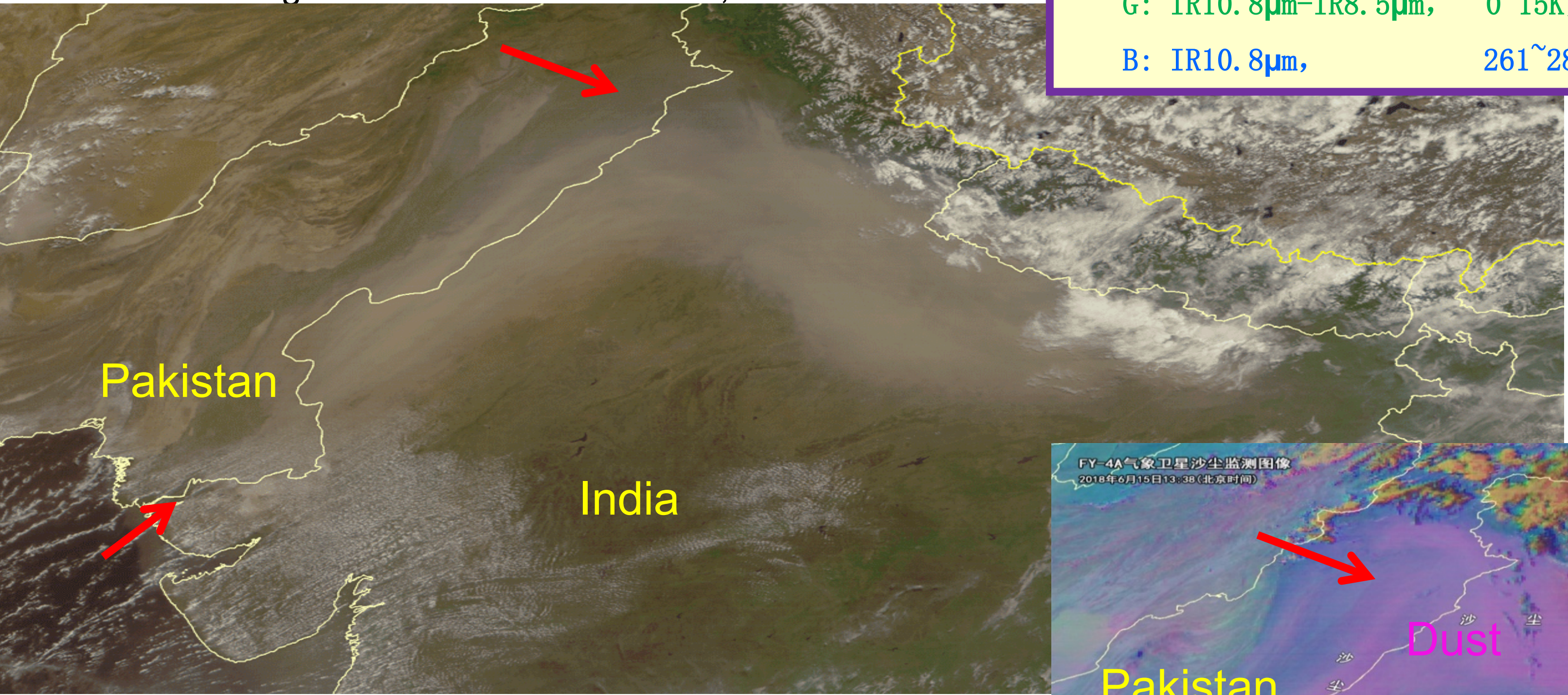
FY-4A monitoring the sand storm June 15th ,2018

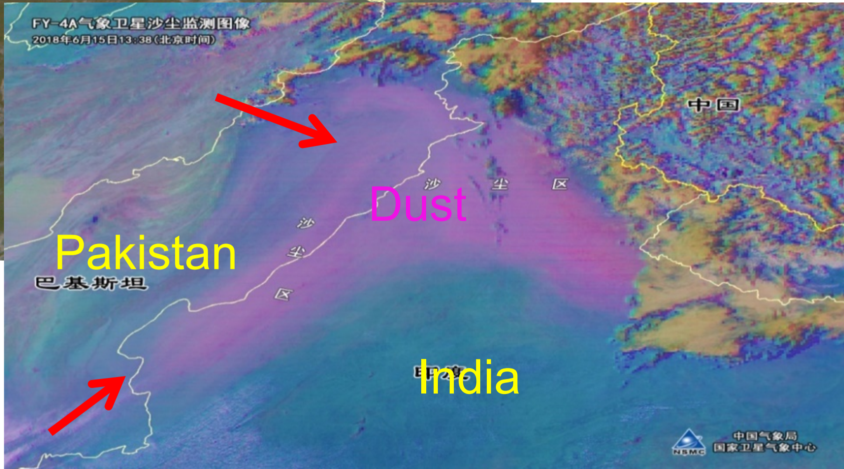
FY-4A：composite method

R: IR12.0μm-IR10.8μm, -4~2K , gamma =1.0

G: IR10.8μm-IR8.5μm, 0~15K, gamma =1.2

B: IR10.8μm, 261~289K, gamma =0.8





Caused by the strong south wind, the sand storm happened in north-western India and eastern Pakistan. The sand storm spread northward then eastward when it reached the Himalayas.

4 Application of meteorological satellite data in global rainstorm disaster monitoring

The regional difference of global rainstorm disaster is obvious. The rainstorm distribution is not only influenced by the location, land and sea distribution, topography, but also by the climate events. Therefore, in research it is necessary to select some important rainstorm disaster areas. and use the global Multi-source Satellite data, ground-based observing meteorological data and reanalysis data to study the monitoring method. **In order to meet the demand of global rainstorm operational services**, the methods of extracting disaster causing factors, disaster indicators and operational rainstorm disaster monitoring are proposed 。

research contents

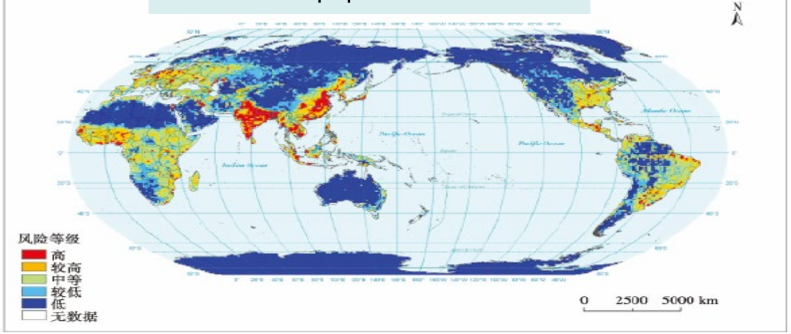
- (1)Analysis on the characteristics of global rainstorm area
- (2)Study on the disaster factors of the rainstorm
- (3)Establishment of rainstorm disaster model
- (4)I Determining the rainstorm disaster index

Establish the operational international rainstorm monitoring in key regions

4 (1)Analysis on the characteristics of global rainstorm area

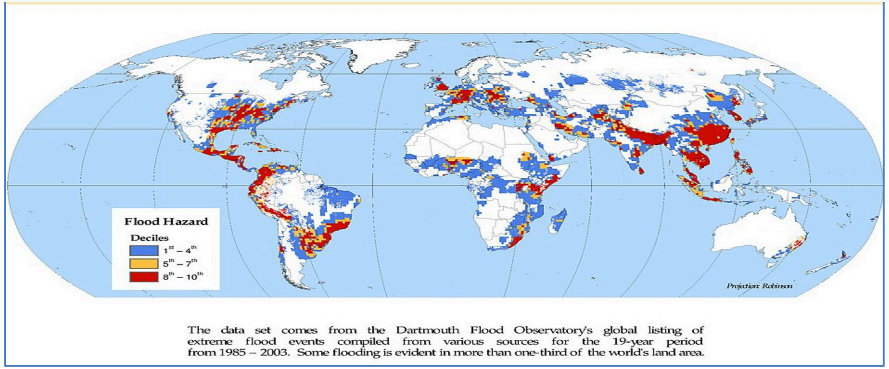
number	Key monitoring areas
1	**Southeast coast of China**
2	**Japan, North Korea and South Korea**
3	**Southeast Asia** (Vietnam, Thailand, Myanmar, Cambodia, etc.)
4	**South Asia** (India, Pakistan, Bangladesh, Sri Lanka, Afghanistan, Nepal, etc.)
5	**East Africa**
6	**Australia**

Global flood population risk level



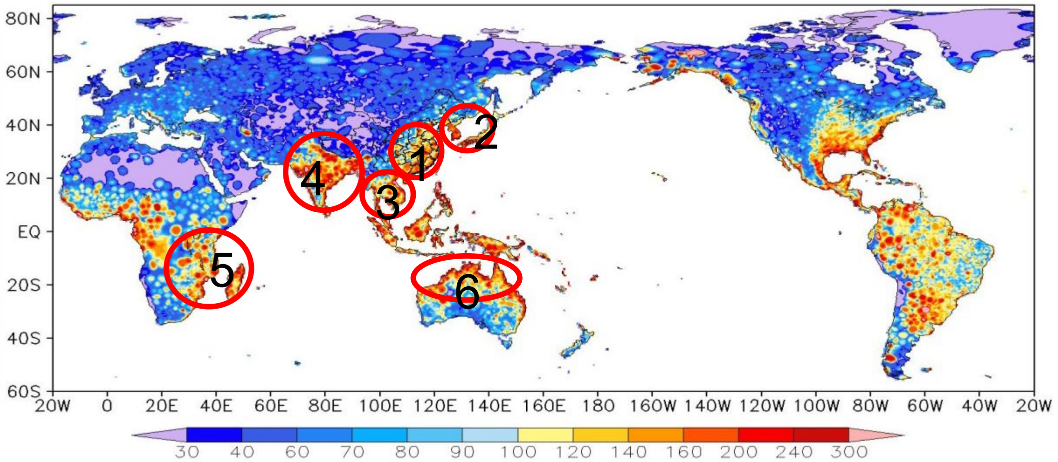
The risk level of flood population in six regions is higher

Global flood disaster distribution （Center for disaster and risk research, Columbia University）



Based on the coverage of FY geostationary meteorological satellites

Global 24-hour maximum precipitation distribution （NCEP precipitation data）



4

(1)Analysis on the characteristics of global rainstorm area

Analysis of precipitation climate characteristics in 6 rainstorm areas

（1）Seasonal distribution characteristics of precipitation in different regions

（2）Seasonal distribution characteristics of rainstorm

（3）Characteristics of rainstorm disaster caused by Brief torrential rain and heavy rainfall

5 years rainstorm data sets

Provide support for the study of disaster causing factors

4

(2)Study on the disaster factors of the rainstorm

Based on the global rainstorm data, FY-3 polar orbiting meteorological satellite, FY-2 and FY-4 geostationary meteorological satellite L1 and L2 data, and according to the global rainstorm area and rainstorm cases, the research include:

（a） Identification method of thunderstorm cloud

（b）Identification of strong precipitation system

（c） The characteristics of cloud parameter

（d）The characteristics of atmospheric and surface temperature

（e）The characteristics of atmospheric humidity

（f）AMV: satellite derived winds

（g）Accumulated precipitation and rainfall intensity

↓

(3)Establishment of rainstorm disaster model

(4)Index of the rainstorm disaster

4 products

	products
Disaster causing factors monitoring products	Rainfall
	Cloud parameter
	Wind parameter
	Temperature parameter
	Humidity parameter
Disaster monitoring products	rainstorm affected area
	Rainstorm intensity
	Rainstorm duration distribution
	Rainstorm disaster level

4 progress

Data sets

Precipitation data sets：

（1）global daily precipitation from 1979 to2019 grid data, resolution: 0.5×0.5° NCEP/NCAR， integration of ground observation and satellite precipitation

（2）TRMM 3 hour precipitation from 2000 to 2019, 3B42。

（3）FY-2 1hour precipitation 。

Satellite data sets：

(1)FY satellite data form 2004 to present

Disaster data sets：

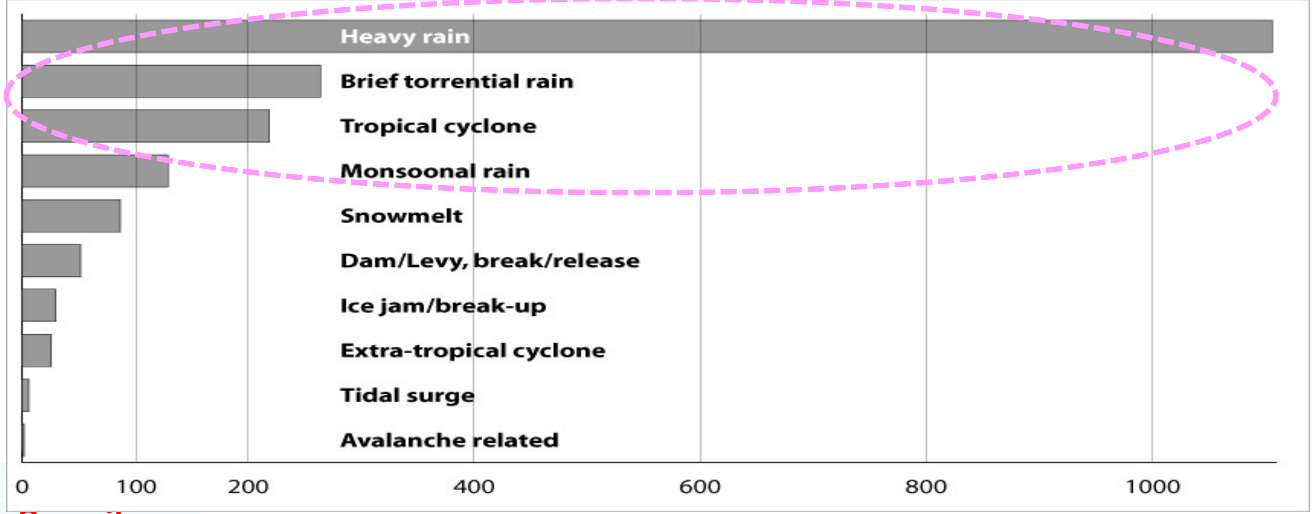
（1）**Dartmouth Flood Observation**（DFO）global active archive of **large flood events** form1985 to 2010， include the location, time, duration, dead, damage, main cause, severity, affected area, magnitude.

（2）**global water monitoring report** caused by rainstorm **in NSMC** from 2010 to present

Dartmouth Flood Observation（DFO）global active archive of **large flood events** form1985 to 2010

Country (click on active links to access current and past inundation extents)	Detailed Locations	Began	Ended	Duration in Days	Dead	Displaced	Damage (USD)	Main cause	Severity *	Affected sq km	Magnitude (M)**
India	Kashmir,	6-Aug-10	08-Aug-10	3	150	180		**Torrential Rain**	11.5	145000	6.7
China	Entire communities in Gansu province's Zhouqu district,Yanji, Yanbian Korean Autonomous Prefecture in Jilin Province	27-Jul-10	11-Aug-10	16	65	180		**Torrential Rain**	1.5	442500	7.0
Pakistan	Pakistan	27-Jul-10	11-Aug-10	16	1600	14,000,000		**Monsoonal Rain**	2.0	129700	6.6

4 Causes of flood



****Flood Magnitude =LOG(Duration x Severity x Affected Area)**

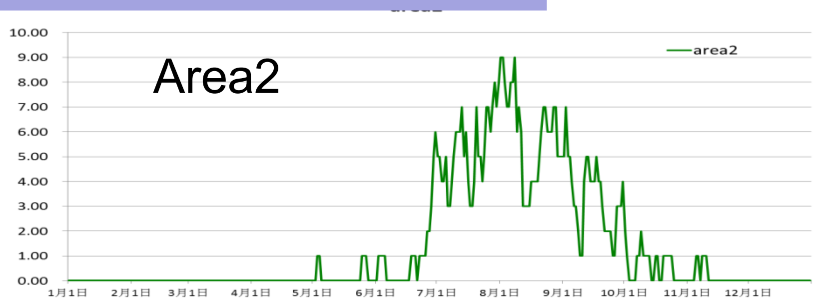
Causes:

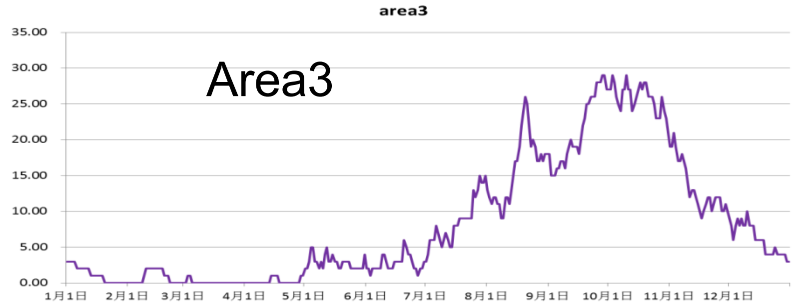
1	Heavy rain
2	Tropical cyclone
3	Extra-tropical cyclone
4	Monsoonal rain
5	Snowmelt
6	Rain and snowmelt
7	Ice jam/break-up
8	Dam/Levy, break or release
9	Brief torrential rain
10	Tidal surge
11	Avalanche related

The main causes of flood disaster are heavy rainfall, brief torrential rain, tropical cyclone and monsoonal rain.

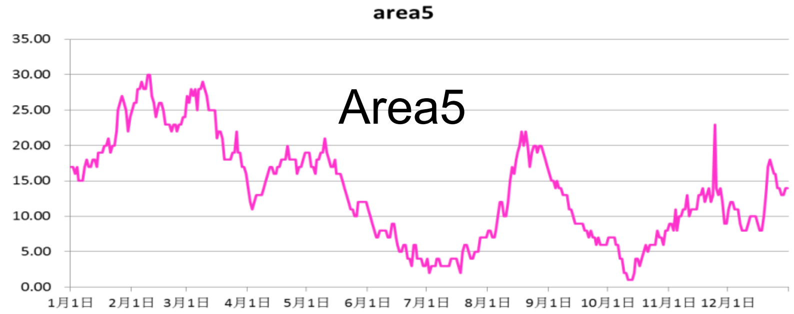
4

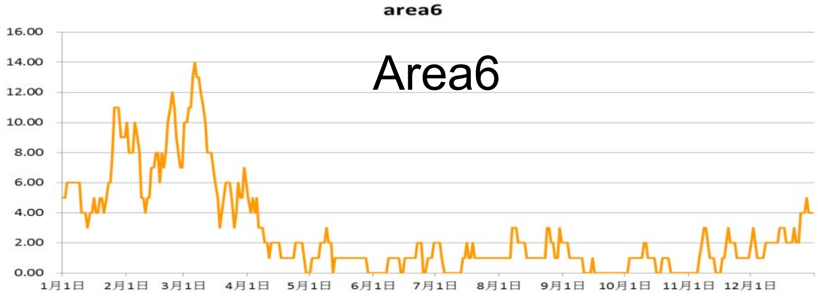
The time series of the total flood number during 1985 to 2010





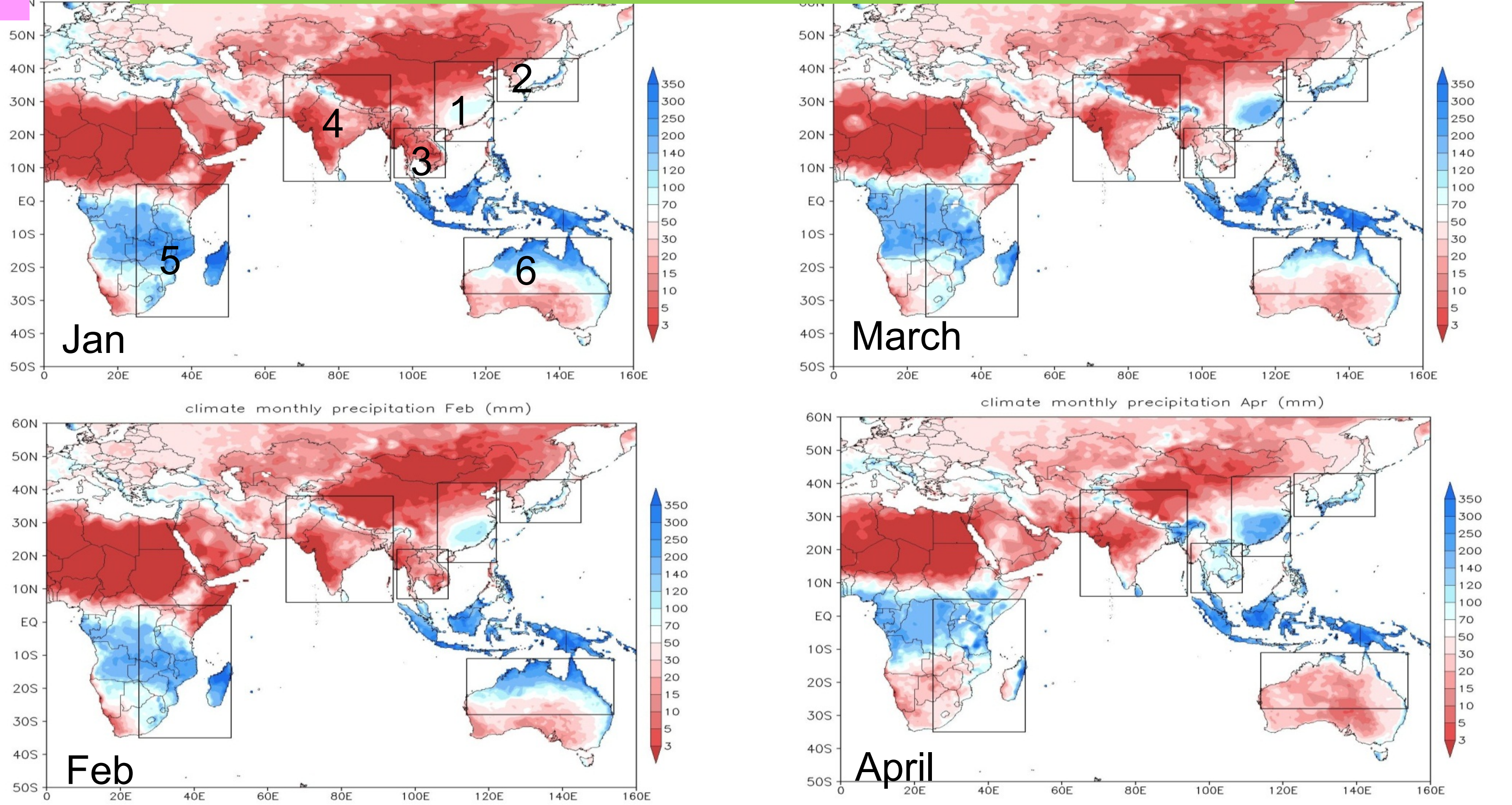
South Asia (India, Pakistan, Bangladesh, Sri Lanka, Afghanistan, Nepal, etc.)



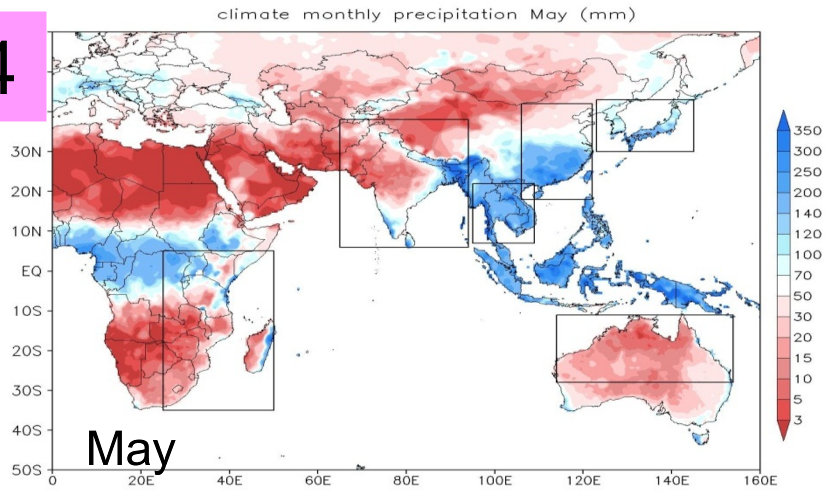


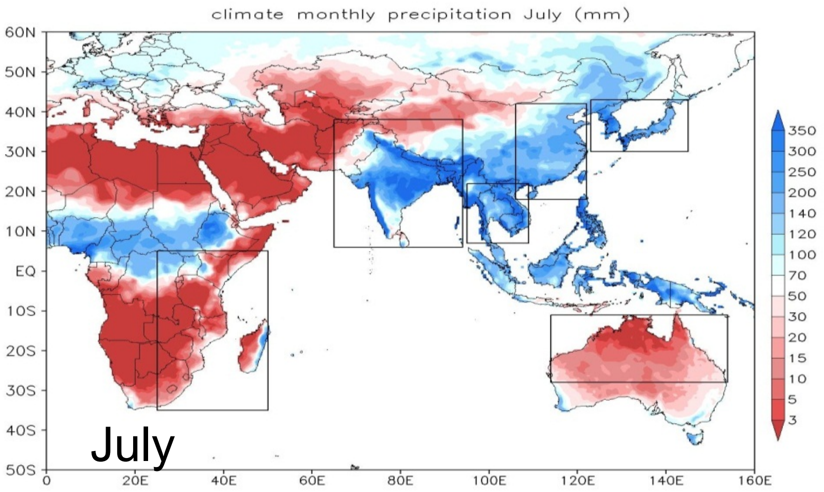
4

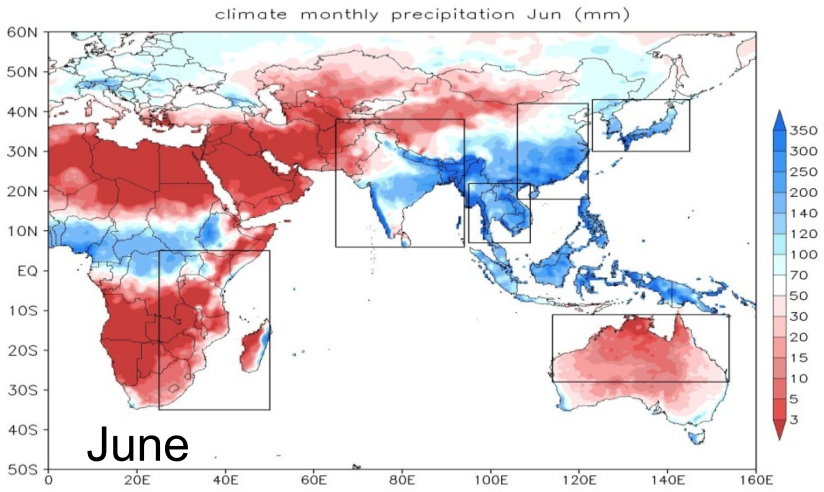
monthly average precipitation distribution of six major rainstorm areas in the world

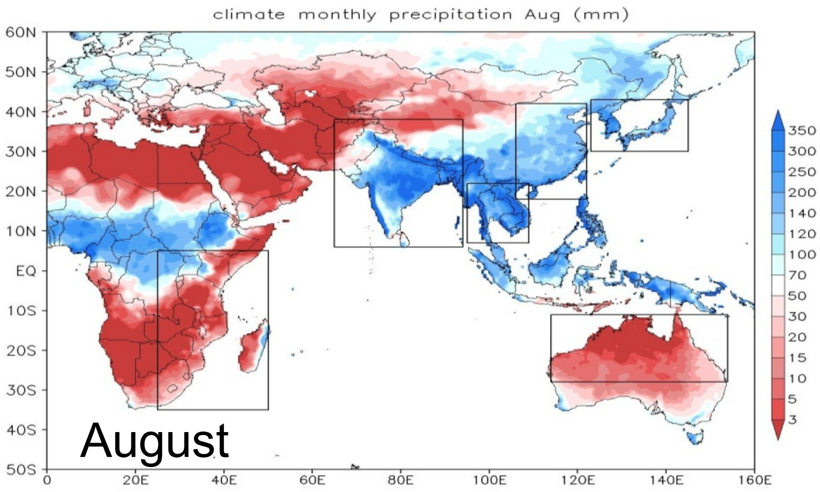


4

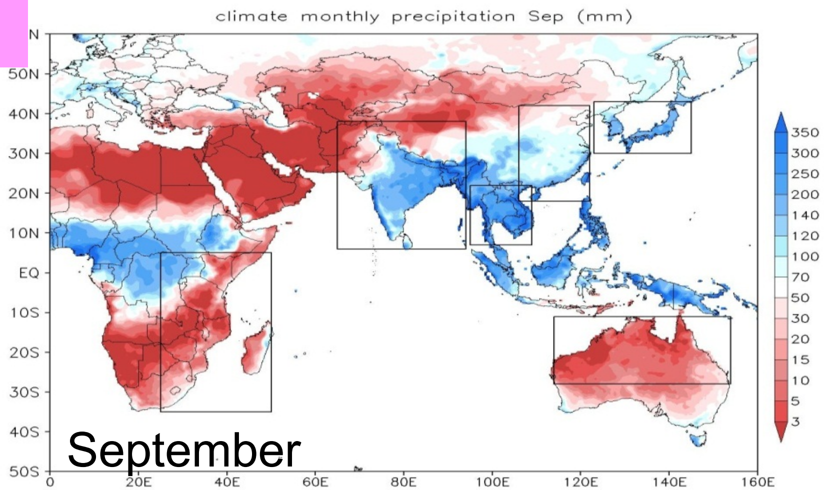

climate monthly precipitation May (mm)
60N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
May

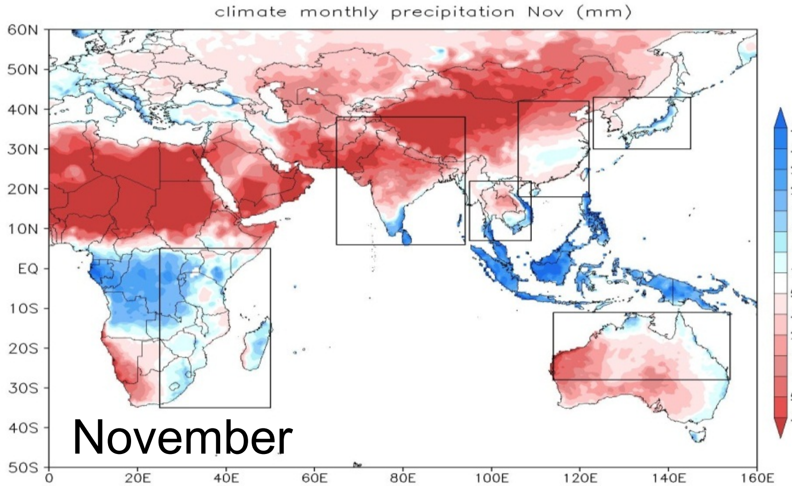

climate monthly precipitation July (mm)
60N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
July

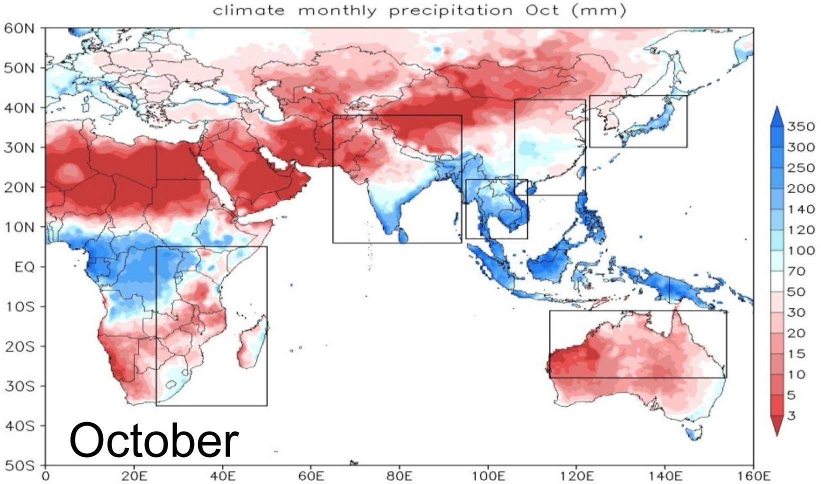

climate monthly precipitation Jun (mm)
60N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
June

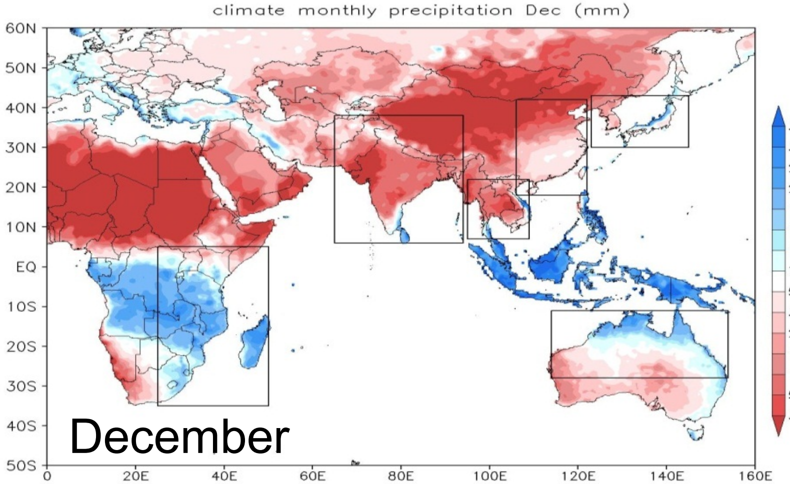

climate monthly precipitation Aug (mm)
60N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
August

4


climate monthly precipitation Sep (mm)
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
September


climate monthly precipitation Nov (mm)
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
60N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
November

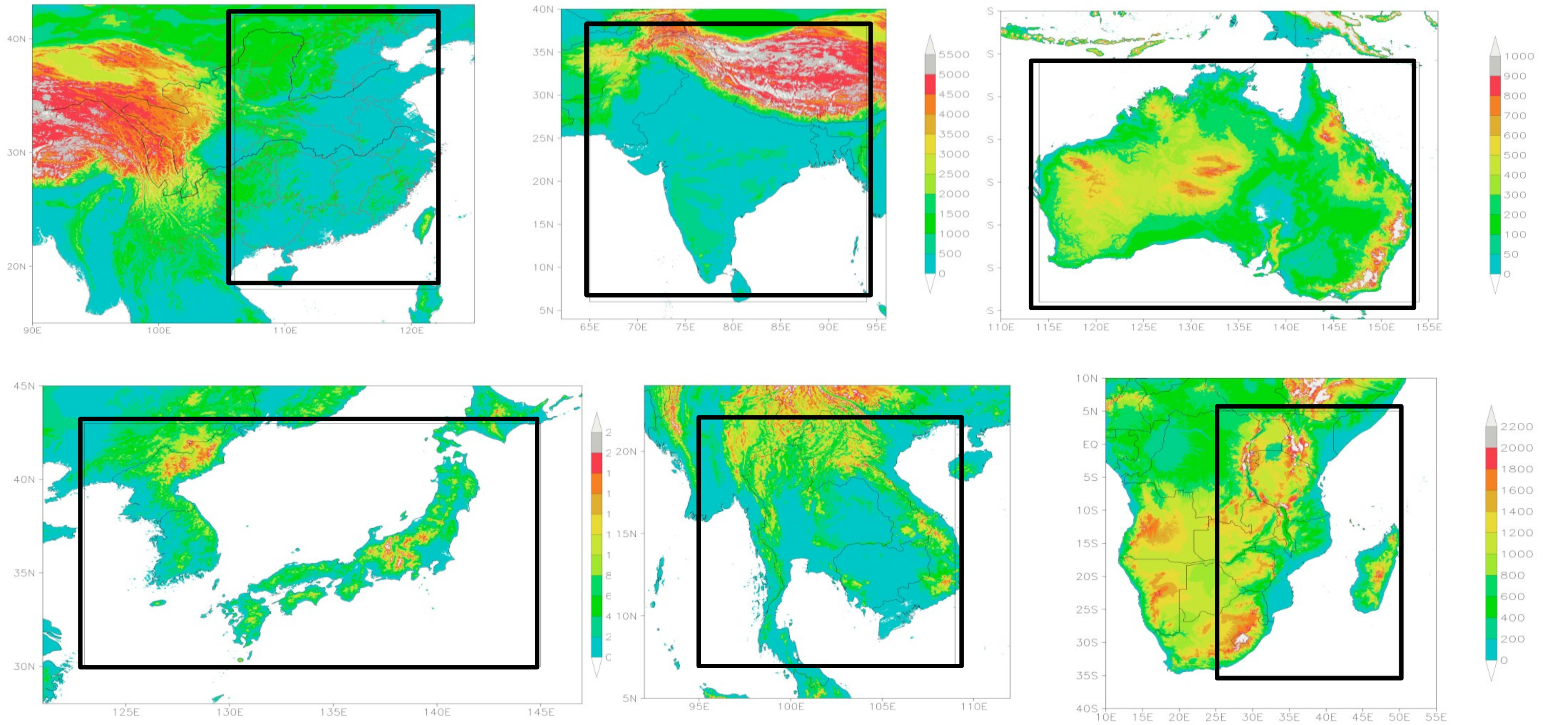

climate monthly precipitation Oct (mm)
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
60N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
October


climate monthly precipitation Dec (mm)
350 300 250 200 140 120 100 70 50 30 20 15 10 5 3
60N 50N 40N 30N 20N 10N EQ 10S 20S 30S 40S 50S
0 20E 40E 60E 80E 100E 120E 140E 160E
December

4

number	Key monitoring areas	region	Rainstorm active period
1	**Southeast coast of China**	(1): 18ºN-43ºN;106º-122ºE	Mar-Sep
2	**Japan, North Korea and South Korea**	(2) 30ºN-43ºN;123º-145ºE	Mar-Oct
3	**Southeast Asia** (Vietnam, Thailand, Myanmar, Cambodia, etc.)	(3) 7ºN-22ºN;95º-109ºE	May-Oct
4	**South Asia** (India, Pakistan, Bangladesh, Sri Lanka, Afghanistan, Nepal, etc.)	(4) 6ºN-38ºN;65º-94ºE	June-Sep
5	**East Africa**	(5) 35ºS-5ºN;25º-50ºE	Dec，Jan-Mar
6	**Australia**	(6) 28ºS-11ºS;114º-154ºE	Dec，Jan-Mar

4 topography



4

Example: rainstorm disaster monitoring from July 27th to August 10th in 2010, Pakistan

According to media reports, affected by tropical monsoon, heavy rainfall in Pakistan had caused flooding in many parts of the country, the flood moved from north to south along the Indus River. it was the biggest flood disaster since 1929.

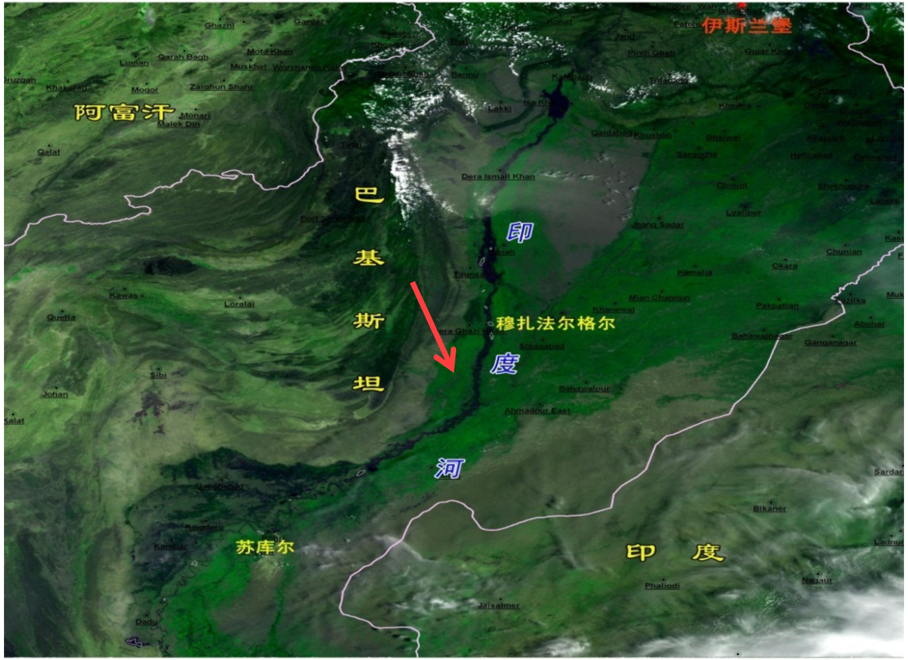
Country (click on active links to access current and past inundation extents)	Detailed Locations	Began	Ended	Duration in Days	Dead	Displaced	Damage (USD)	Main cause	Severity *	Affected sq km	Magnitude (M)**
Pakistan	Pakistan	27-Jul-10	11-Aug-10	16	1600	14,000,000		**Monsoonal Rain**	2.0	129700	6.6

Water monitoring

Before the flood

FY-3A/MERSI 巴基斯坦地表监测图

2010年7月19日 06:00（世界时）

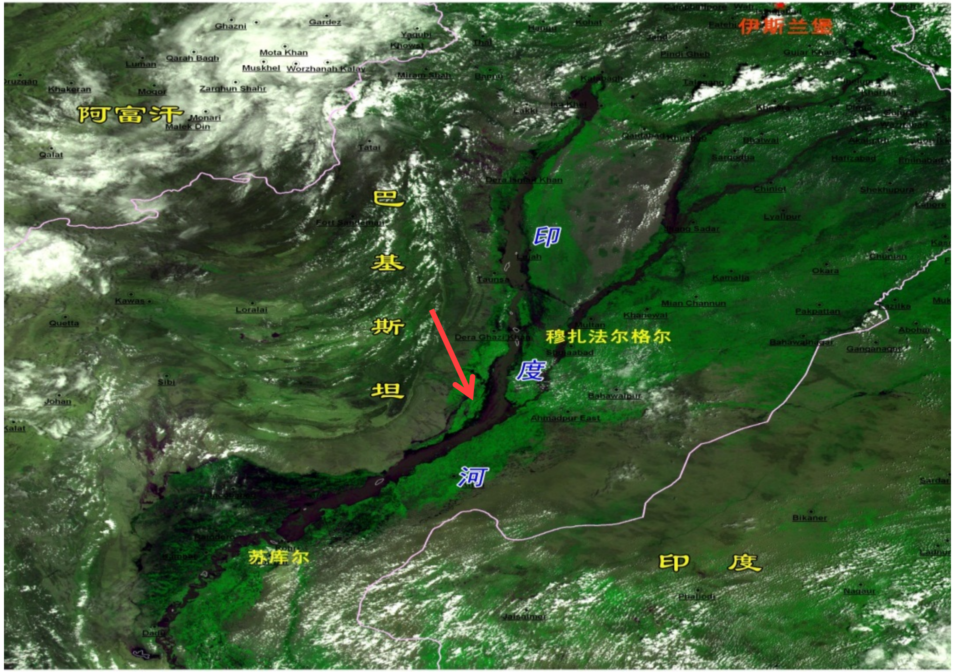


中国气象局国家卫星气象中心

During the flood

FY-3A/MERSI 巴基斯坦洪涝监测图

2010年8月10日 05:45（世界时）



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The lower-Indus river widens considerably

4 Overview of Indus River Basin

Region：24º-37º N ;66º-82ºE
Total area： 1.1×10^6km^2
（Afghanistan 6.7%，China 10.7%，India 26.6%，<u>**Pakistan 56%）**</u>

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THE SOUTH ASIATIC MONSOON AND FLOOD HAZARDS IN THE INDUS RIVER BASIN, PAKISTAN

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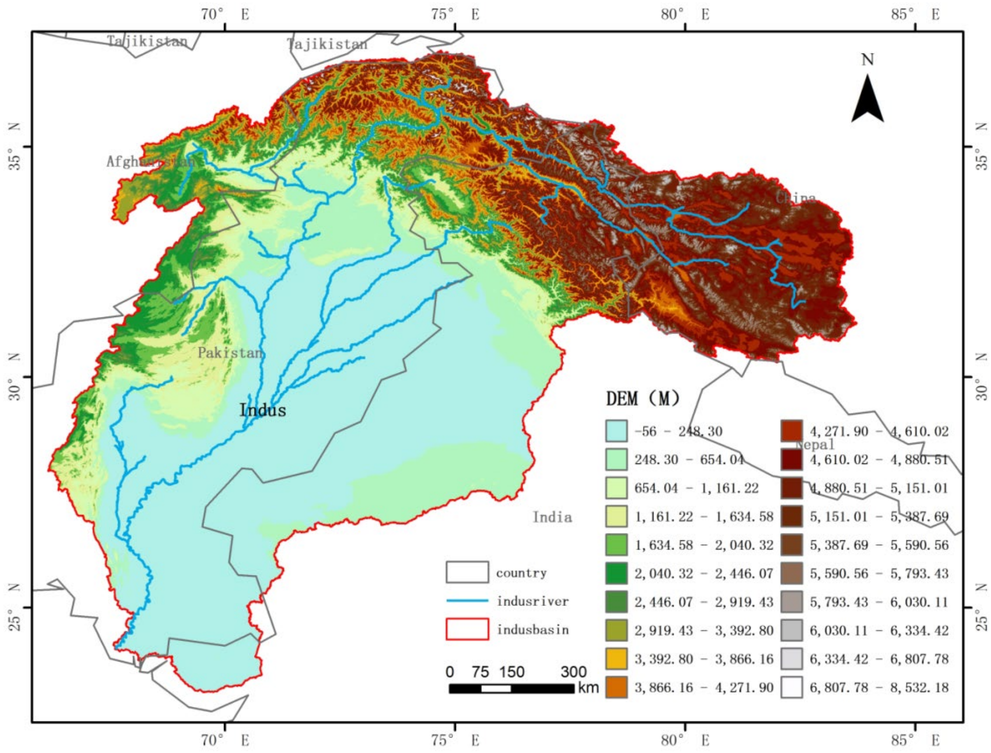
Abstract

Flood is the most common of all environmental hazards. Each year floods claim over 20,000 lives adversely affect around 75 million people . The reason lies because of the widespread geographical distribution of rivers basins from mountainous terrain to flood plains, the low lying coasts and deltas. Pakistan is also a country which faces flood hazard periodically. The Indus river basin is the main flood prone area which occupies two-third area of Pakistan. The recent flood which occurred between 29th July and 26th August 2010 was the worst flood in the history of Pakistan. It affected



Indus River Basin is the main flood area in Pakistan, about 95% of the population live in this area. The main cause of the flood are and summer monsoon rainfall and snow melting in northern mountainous area

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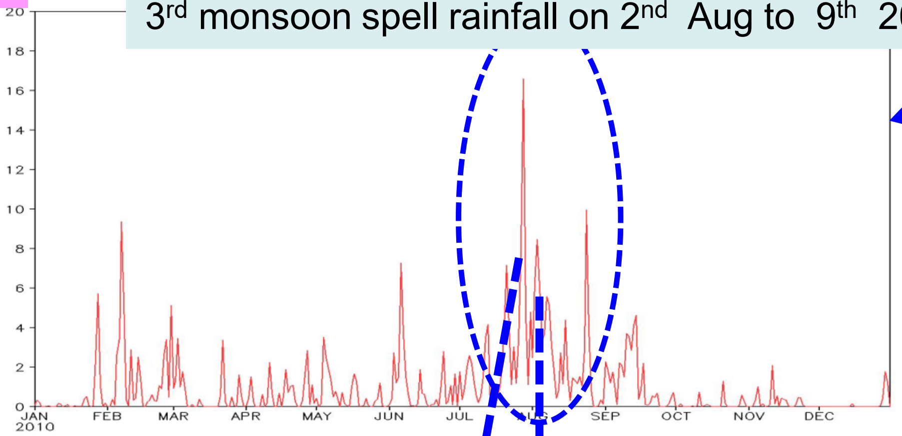
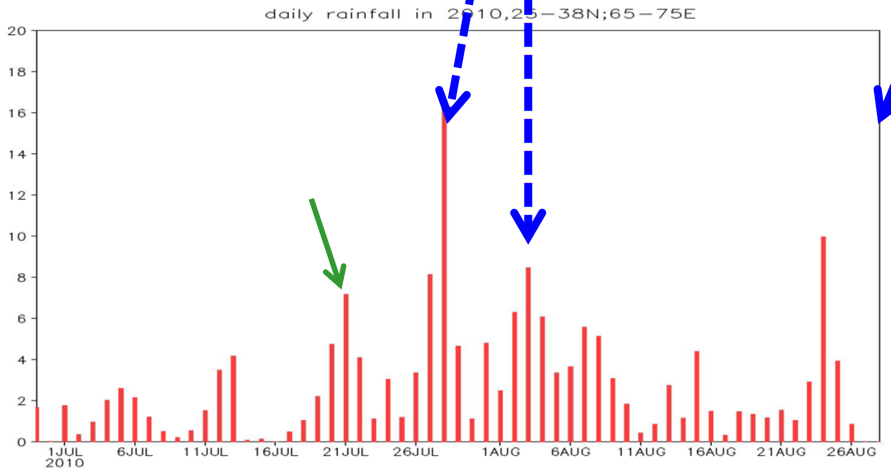
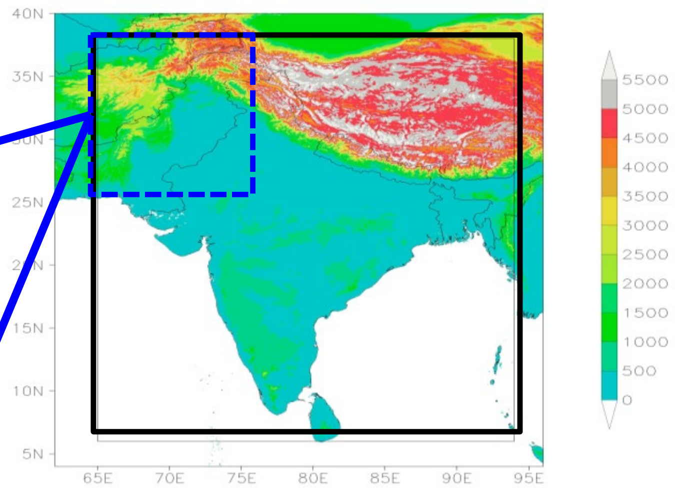
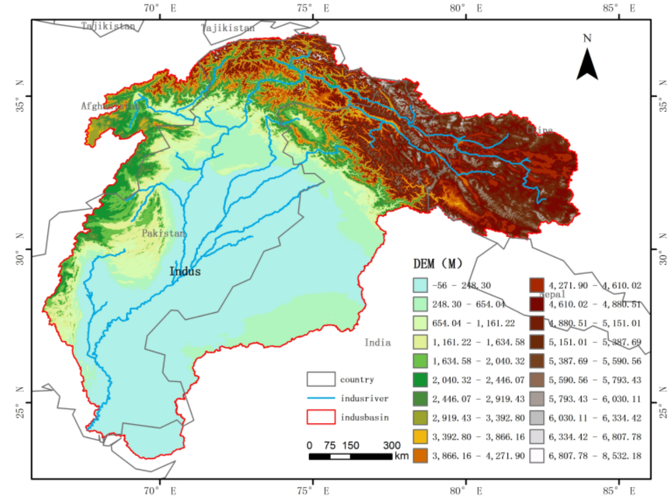
1st monsoon spell rainfall on 20th July to 20th 2018
2nd monsoon spell rainfall on 26th July to 28th 2018
3rd monsoon spell rainfall on 2nd Aug to 9th 2010









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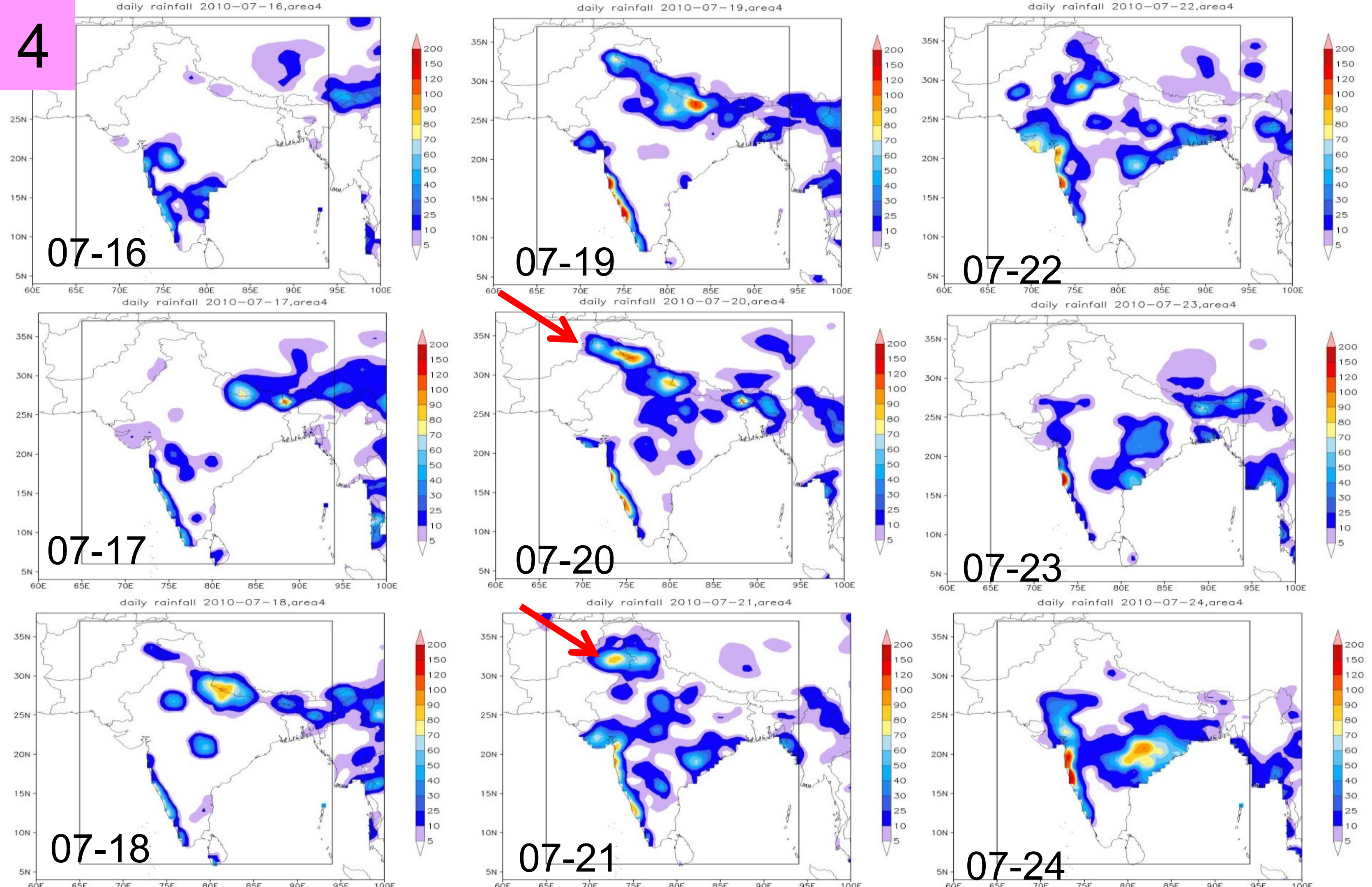
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07-16
daily rainfall 2010-07-19,area4
07-19
daily rainfall 2010-07-22,area4
07-22
daily rainfall 2010-07-17,area4
07-17
daily rainfall 2010-07-20,area4
07-20
daily rainfall 2010-07-23,area4
07-23
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07-18
daily rainfall 2010-07-21,area4
07-21
daily rainfall 2010-07-24,area4
07-24

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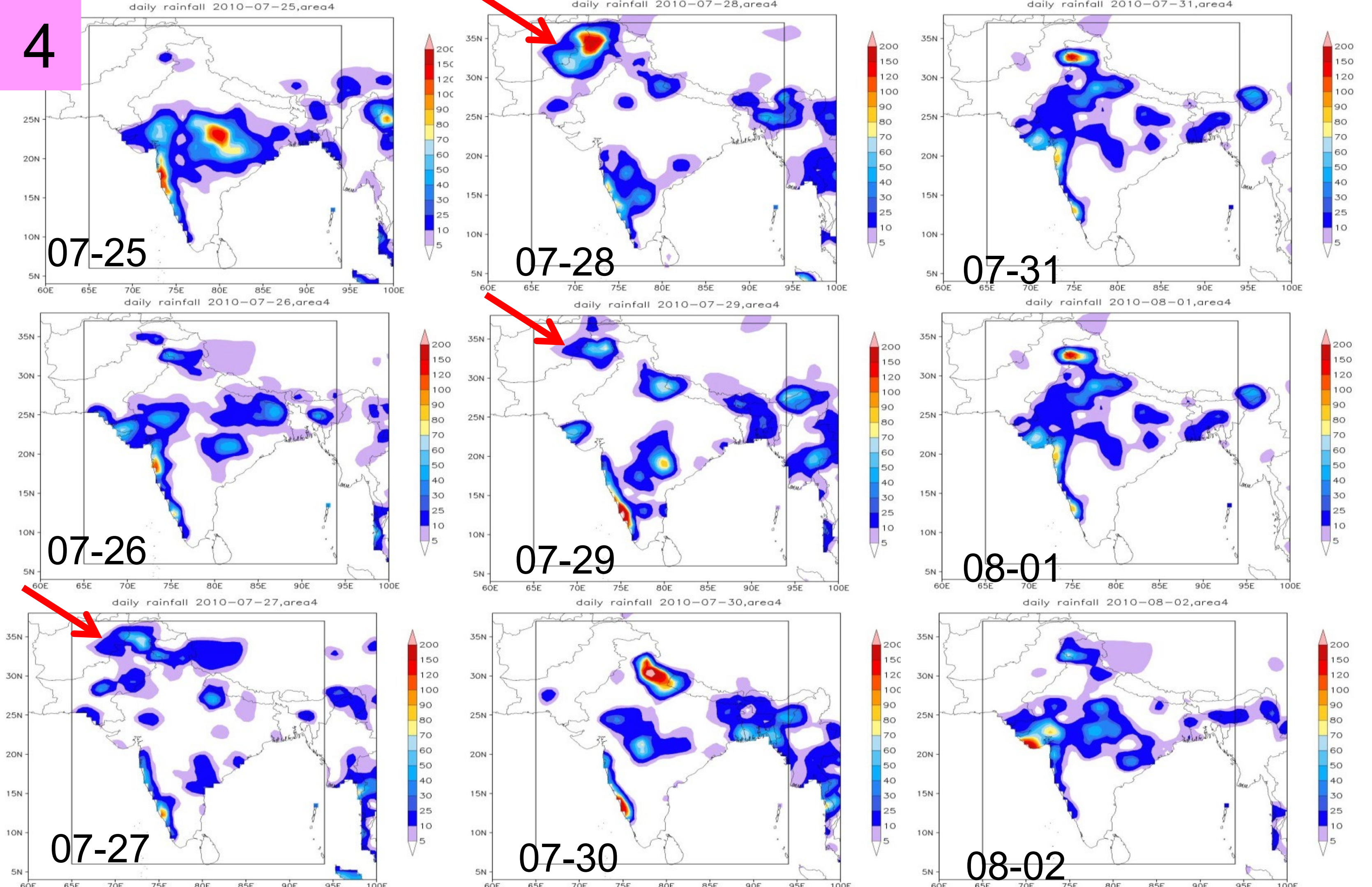

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07-25
daily rainfall 2010-07-28,area4
07-28
daily rainfall 2010-07-31,area4
07-31
daily rainfall 2010-07-26,area4
07-26
daily rainfall 2010-07-29,area4
07-29
daily rainfall 2010-08-01,area4
08-01
daily rainfall 2010-07-27,area4
07-27
daily rainfall 2010-07-30,area4
07-30
daily rainfall 2010-08-02,area4
08-02
200
150
120
100
90
80
70
60
50
40
30
25
10
5
35N
30N
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20N
15N
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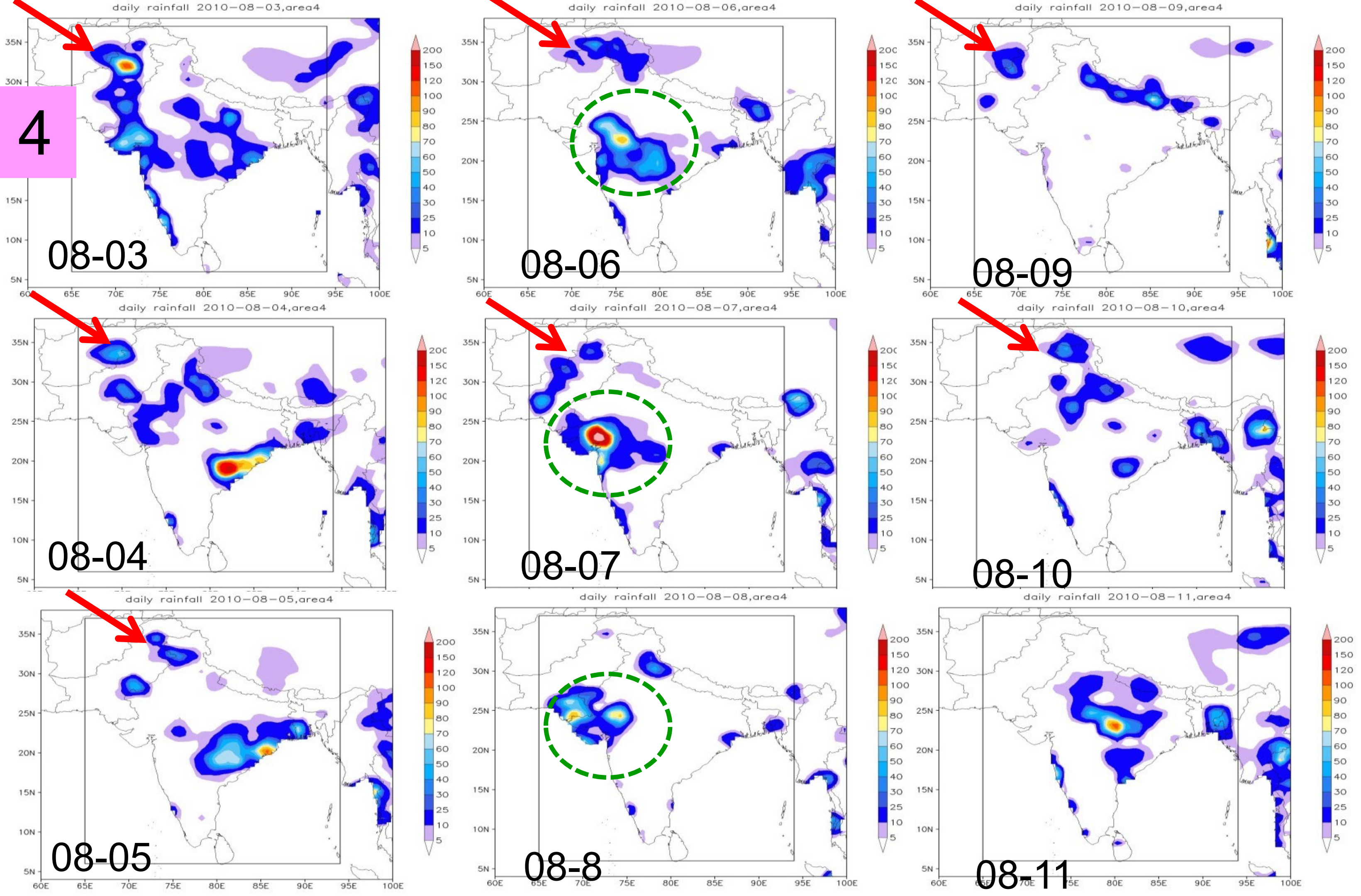
5N
60E
65E
70E
75E
80E
85E
90E
95E
100E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08-03
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daily rainfall 2010−08−07,area4
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daily rainfall 2010−08−08,area4
08-8
daily rainfall 2010−08−09,area4
08-09
daily rainfall 2010−08−10,area4
08-10
daily rainfall 2010−08−11,area4
08-11
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35N 30N 25N 20N 15N 10N 5N
60E 65E 70E 75E 80E 85E 90E 95E 100E

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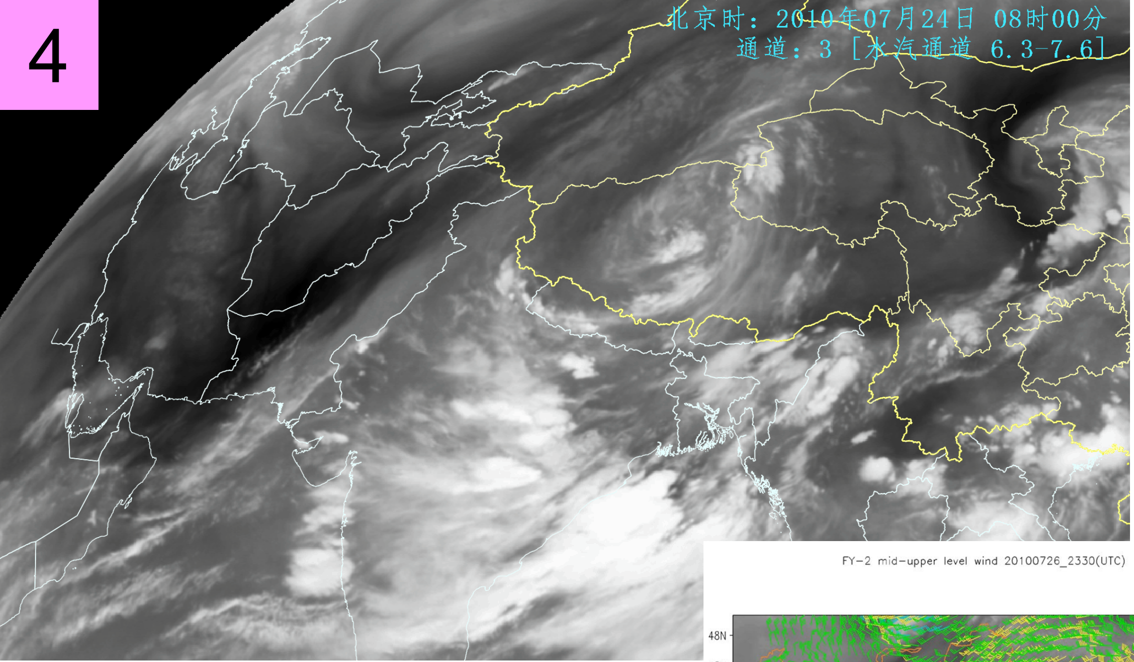

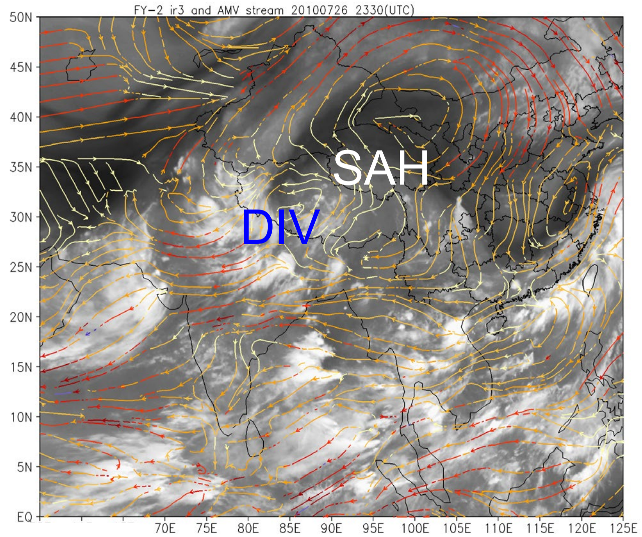

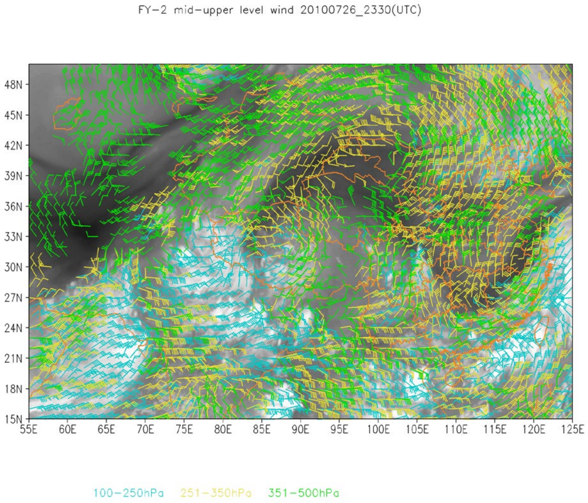

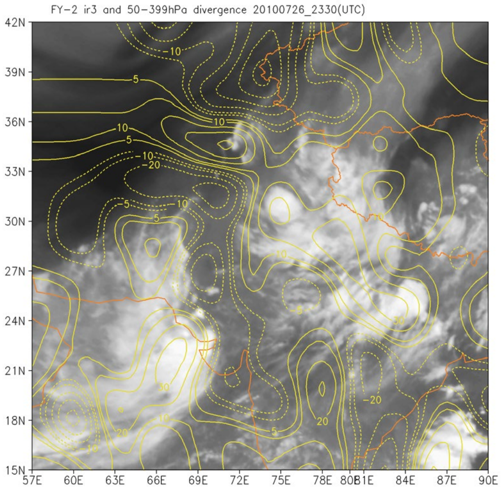

2nd monsoon spell rainfall on 26th July to 28th 2018

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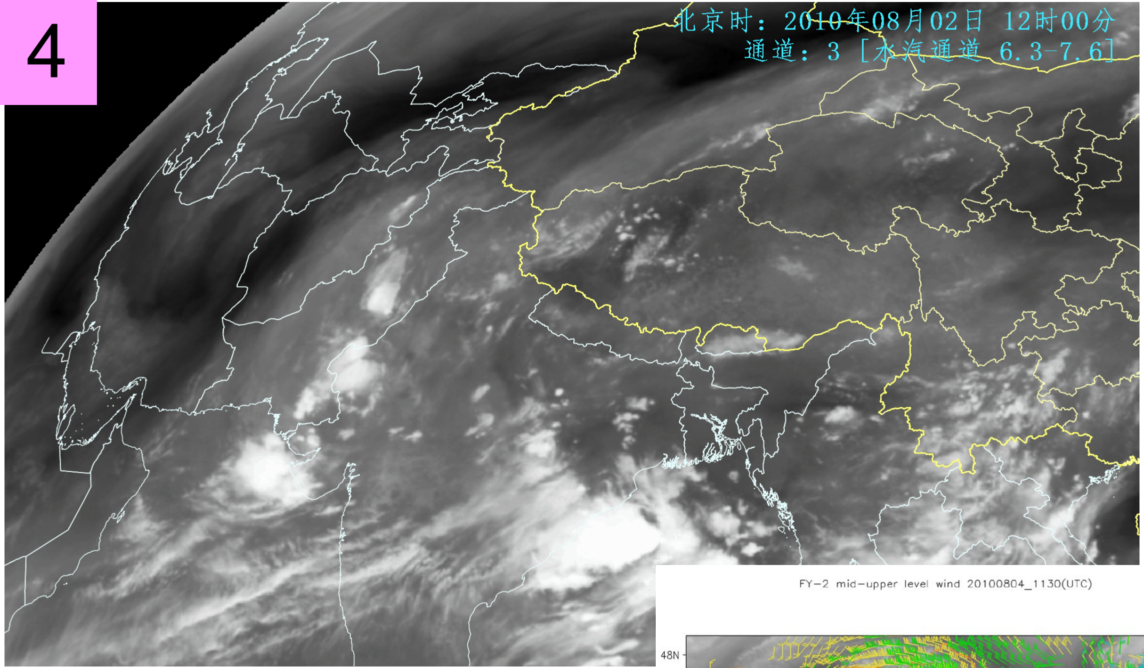
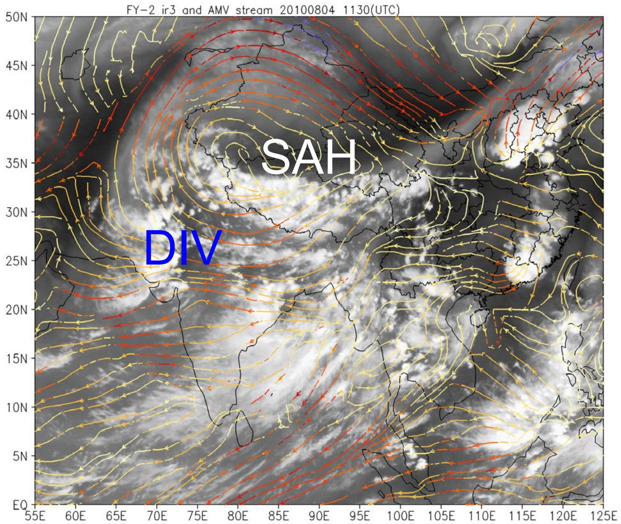
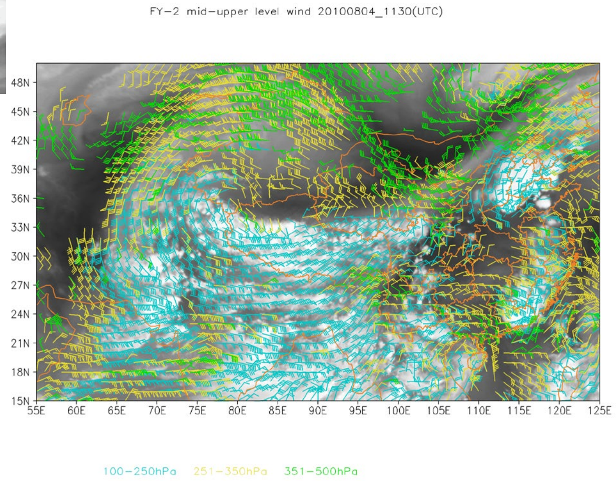
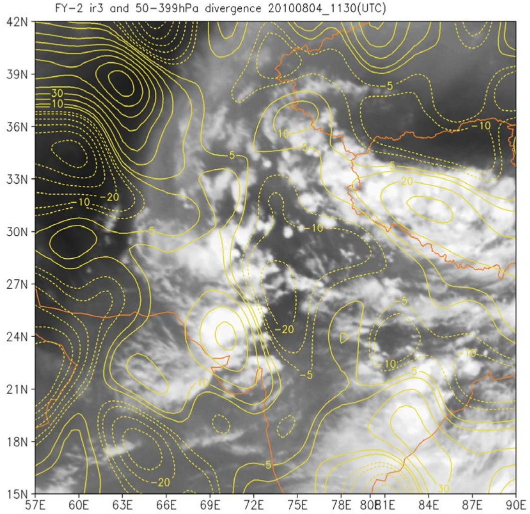




3rd monsoon spell rainfall on 2nd Aug to 9th 2010





summary

- （1）Satellite imagery application and important weather system concept models using satellite data
- （2）Satellite derived L2 products: the AMVS and WV imagery to show the atmosphere dynamic process， FY-4A LMI product application
- （3）FY-4A multi-channel RGB composite products
- （4）We are trying to improve the real-time monitoring ability of global rainstorm disasters using FY satellites

Thanks for your attention!