

# HKO's expectations of new-generation satellites for hazard monitoring

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Tokyo, Japan, 10 November 2015



香港天文台

HONG KONG OBSERVATORY

# Top hazards of concern that can be monitored by satellite

- Hazard 1: tropical cyclones

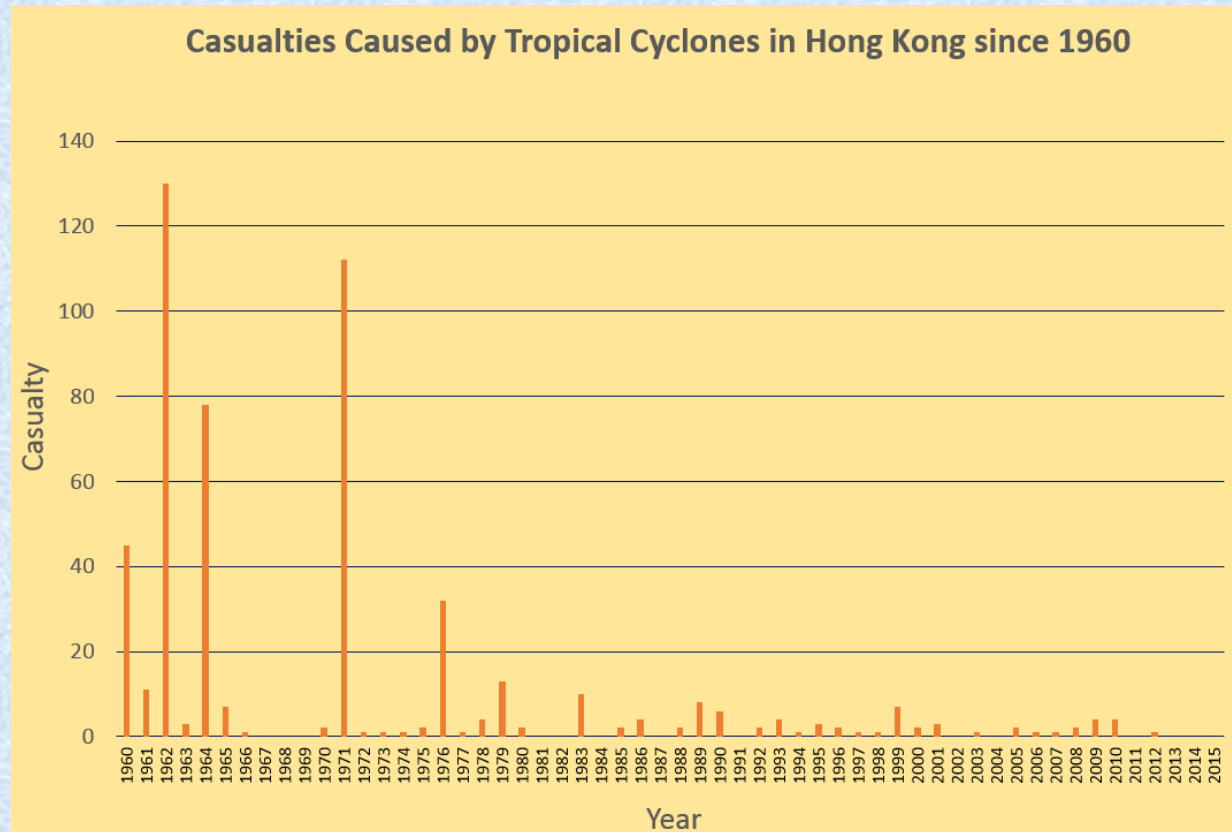


Figure: Casualties caused by tropical cyclones affecting Hong Kong during 1960-2015. A number of historical typhoons brought heavy casualties in thousands in the early years: more than 10,000 deaths in 1906 and in 1937, and more than 2,000 deaths in 1874.

# Hazard 1: tropical cyclones

## Example

- Severe Typhoon Vicente (1208), July 2012
- Hurricane Waning Signal issued on 24 July 2012
- Impacts:
  - 138 people were injured during the passage of Vicente
  - About 8800 trees were down.
  - Two reports of landslides, 7 reports of flooding.
  - Dangerous signboards or fallen scaffoldings in many parts of the territory, resulting in closure of roads and damage to vehicles.
  - Service of Mass Transit Railway was interrupted due to damaged overhead cables.
  - Crops were damaged by flood waters.
  - Seven containers fell overboard from a freighter in nearby waters.
  - 90 flights were cancelled, over 446 flights delayed and 50 flights diverted on 23 to 24 July.



Trees blown down near Olympian City during passage of Vicente (photo courtesy of Ms. Carly Tse)

WEATHER • HONG KONG

## Airlines blamed for chaos in aftermath of typhoon

Ada Lee and Johnny Tam

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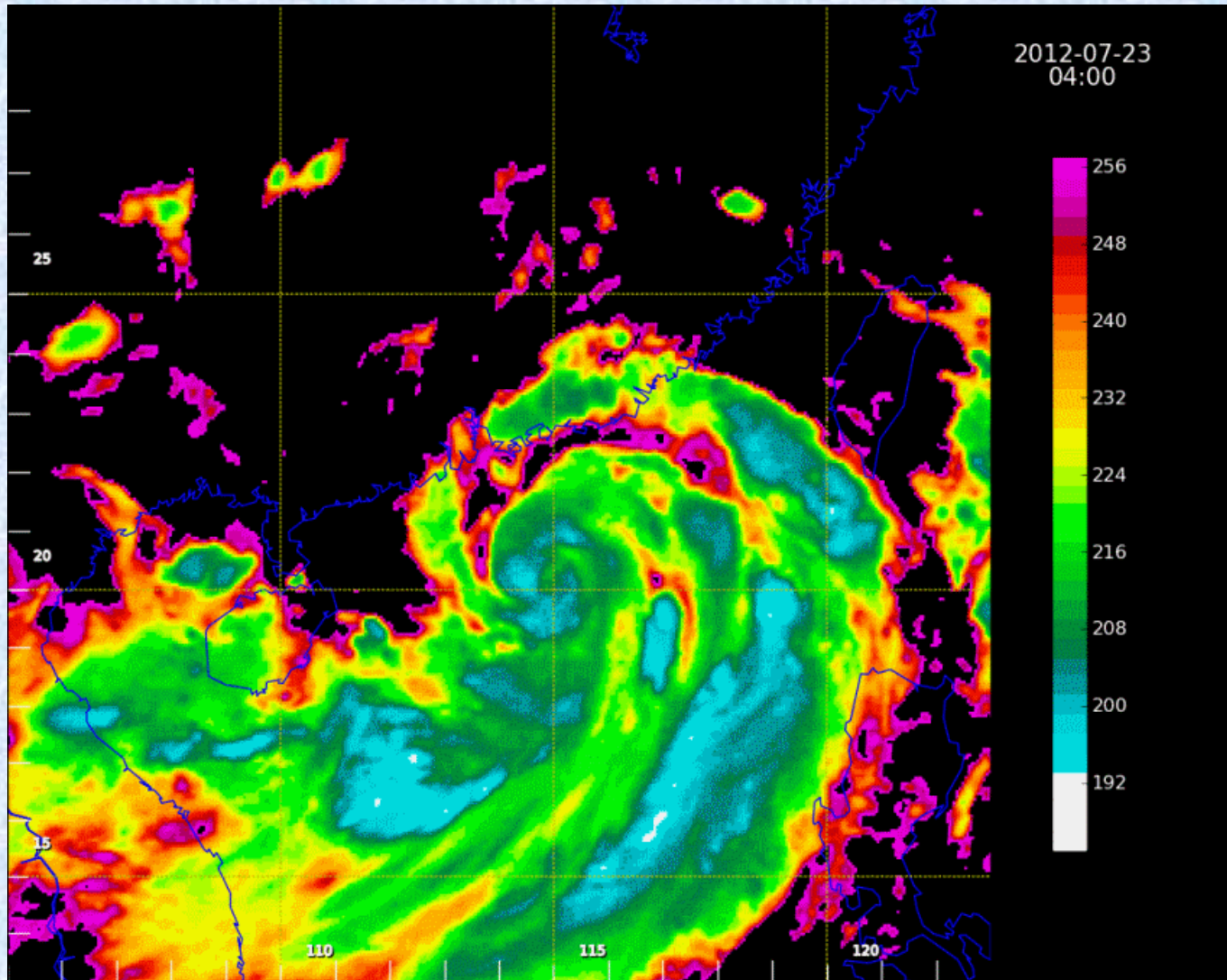
Airport  
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Disaster

A tree collapsed on a park in Tsim Sha Tsui after Typhoon Vicente hit the city. Photo: SCMP

Desperate travellers blamed poor arrangements by airlines for their confusion and delayed trips, as thousands were still stranded at Chek Lap Kok airport yesterday in the aftermath of Severe Typhoon Vicente.

Some arriving passengers were held in their planes for hours, waiting for a parking spot on the tarmac and buses to take them to the terminals. Others said

News report: South China Morning Post



Rapid scan imageries from FY-2F, 23 July 2012

# Top hazards of concern that can be monitored by satellite

- Hazard 2: severe thunderstorms and rainstorms

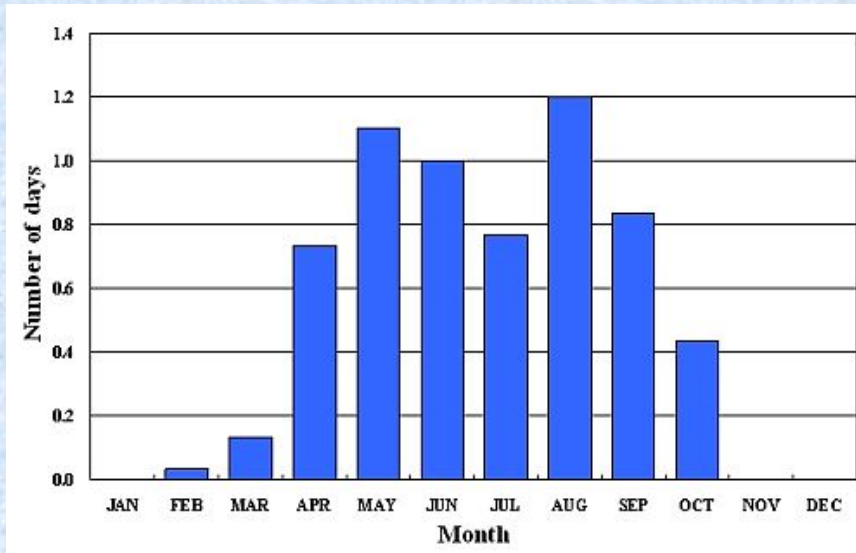
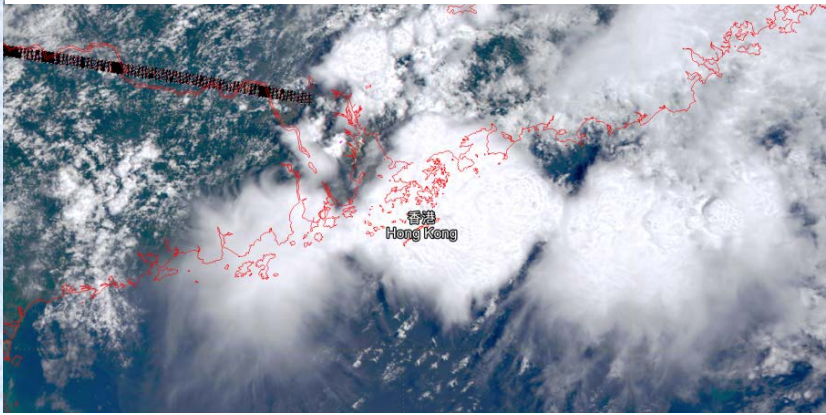


Figure 2 Average number of heavy rain days with hourly rainfall  $\geq 30$  mm in each month (1971-2000).

Showers and thunderstorms are common in Hong Kong during the rainy season. Occasionally, there are heavy downpours which cause flooding and landslides. On average, there are about 6.2 days with hourly rainfall over or equal to 30 mm at the Hong Kong Observatory Headquarters each year. Most of them occur between April and September (see the figure on the left). The highest hourly rainfall at the Observatory Headquarters (up to May 2011) is 145.5 mm on 7 June 2008.

# Hazard 2: Severe thunderstorms and rainstorms

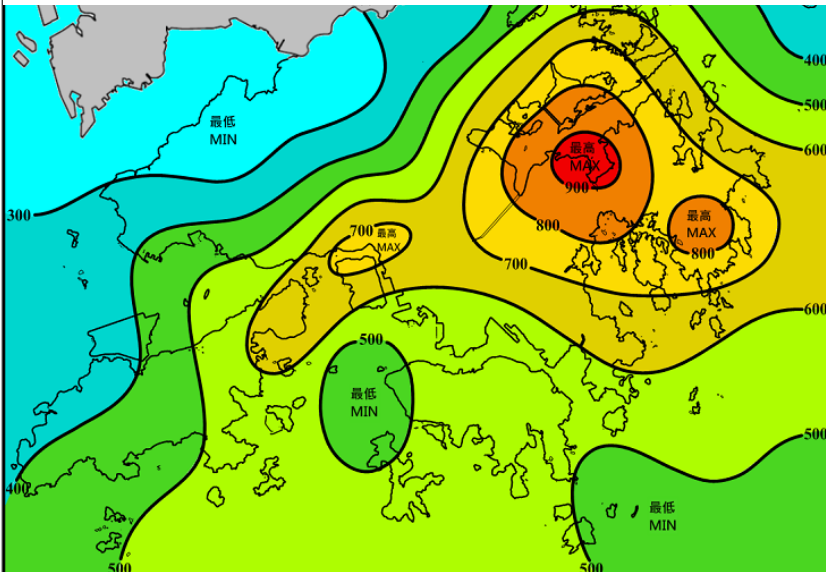
Hourly rainfall exceeding 100 millimetres was recorded on 26 May 2015



Flooding on 26 Sep 2015 (Photo: RTHK)



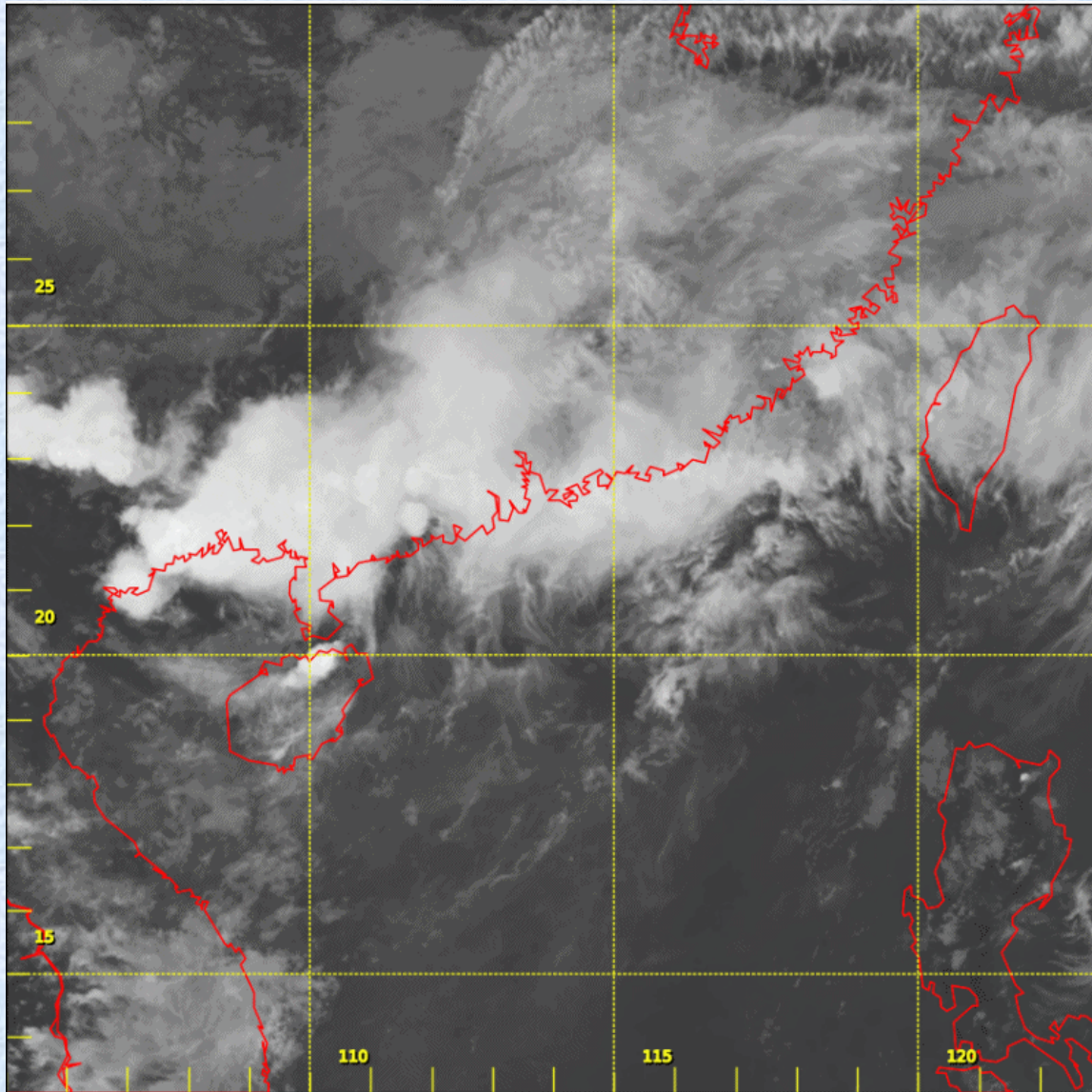
2015年5月雨量圖 (等雨量線單位為毫米)  
Rainfall Map for May 2015 (isohyets are in millimetres)  
Monthly rainfall 513.0 millimetres in May 2015 at HKOHQ



Landslide on 7 Oct 2015 (Photo: RTHK)



大雨令一幅護土牆倒塌，造成山泥傾瀉。(葉耀坤攝)



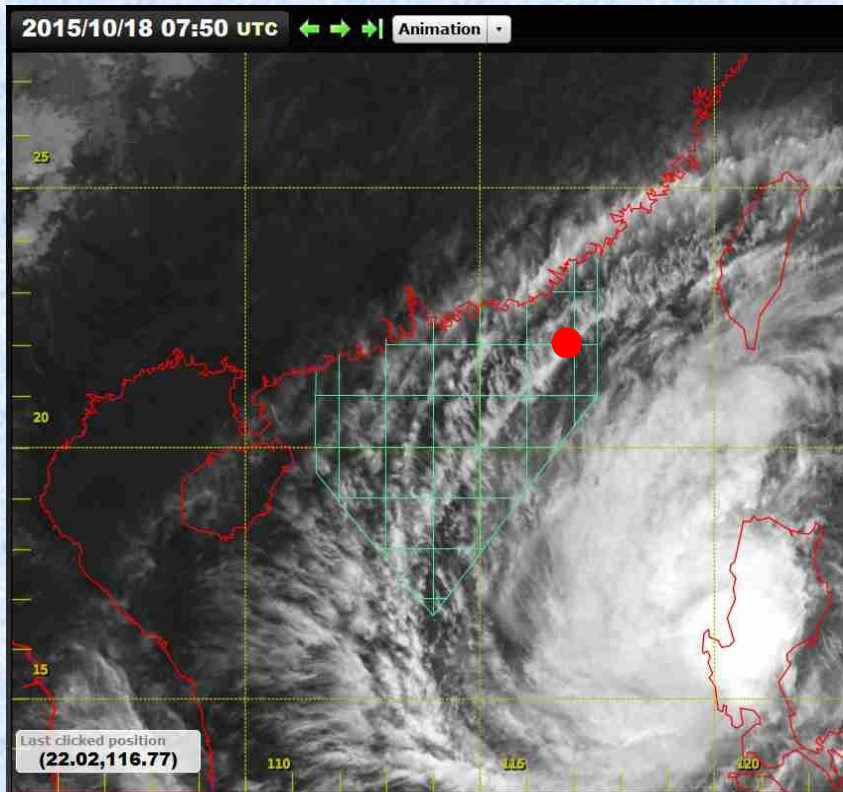
Himawari-8 imageries, 16 to 19 HKT, 20 May 2015





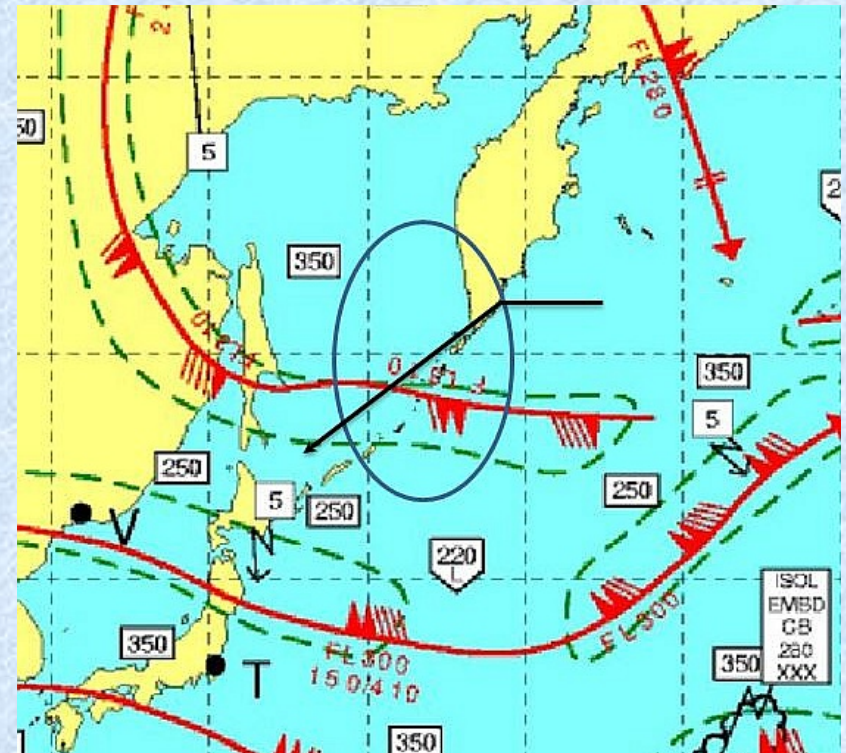
# Hazard 3: Aviation hazards

## Example 1:




Moderate turbulence was reported by an aircraft on 18 Oct 2015 at the location indicated by the red dot, which was under the outer circulation of Severe Typhoon Koppu

## Example 2:



A flight from San Francisco to Hong Kong encountered severe turbulence when flying (black colour straight line) near the jet stream over Russia on 18 February 2014. Some passengers were lifted from the seats and bumped onto the overhead lockers or hit by falling luggage, causing 12 injuries.

## Q.2 Expectations of new series of satellites for hazard monitoring

	Hazard 1: Tropical Cyclones	Hazard 2: Severe Thunderstorms	Hazard 3: Aviation Hazards
a. Multi-spectral bands	Generate RGB products in support of weather forecast operation.		
b. Rapid scanning	<ul style="list-style-type: none"> <li>• Detect explosive development.</li> <li>• Improve continuity and understanding of rapid developing severe weather.</li> <li>• Increase lead time of warnings.</li> </ul>		
c. High spatial resolution	Improve performance on fine-scale numerical weather prediction and data assimilation		
d. New instruments	 <ul style="list-style-type: none"> <li>• Lightning mappers for monitoring severe thunderstorms</li> <li>• Hyperspectral infrared sounders to improve analysis for occurrence of aviation hazards, like icing.</li> </ul>		

## Q.3 Requirements to get benefits from the new generation of geostationary meteorological satellites

	Hazard 1: Tropical Cyclones	Hazard 2: Severe Thunderstorms	Hazard 3: Aviation Hazards
a. Easy-to-understand products	Improve efficiency of weather forecasters and allow appreciation of the weather situation by end-users.		
b. Product algorithms	Develop products to meet requirements of weather forecasters and downstream users.		
c. Training in imagery analysis	<ul style="list-style-type: none"> <li>• For training of weather forecasters and weather services officers.</li> <li>• For training of product development teams.</li> </ul>		
e. Training in product development	<ul style="list-style-type: none"> <li>• To support weather forecasting and provision of weather services.</li> <li>• To support development of new products and tailor-made products to meet user needs.</li> </ul>		
f. Stable provision of imagery without communication errors	Essential requirement for operational use.		

# Future Work

- To implement RGB products for weather forecast operation.
- To develop derived products taking advantage of the new high spatial and temporal resolution data.
- To participate in scientific meetings with focus on utilization of new - generation satellite data.

**Thank You !**