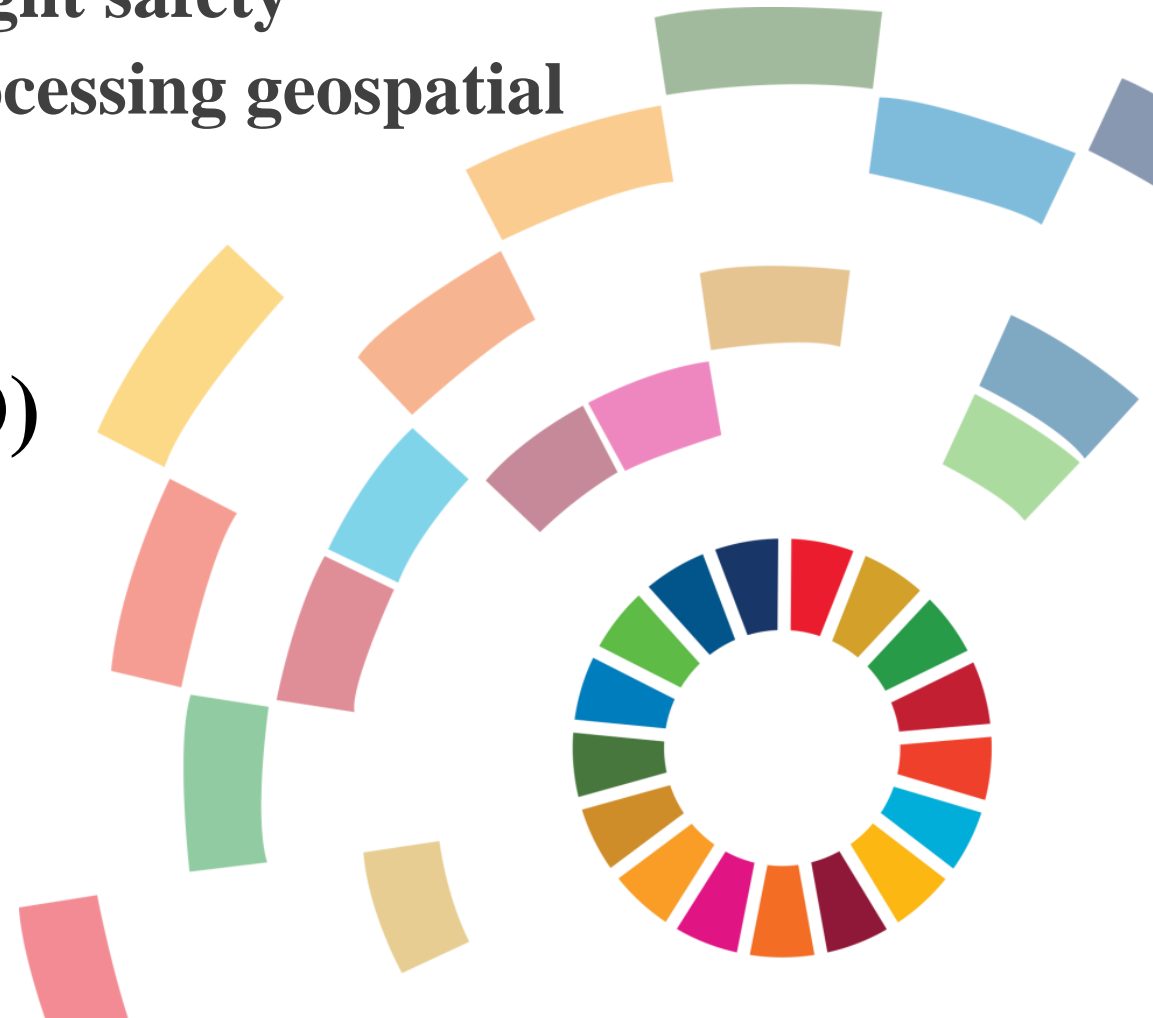


Sharing of HKO's experience in:

- **Disaster risk reduction and resilience**
- **Web-based GIS platform to enhance flight safety**
- **Application of machine learning for processing geospatial information**

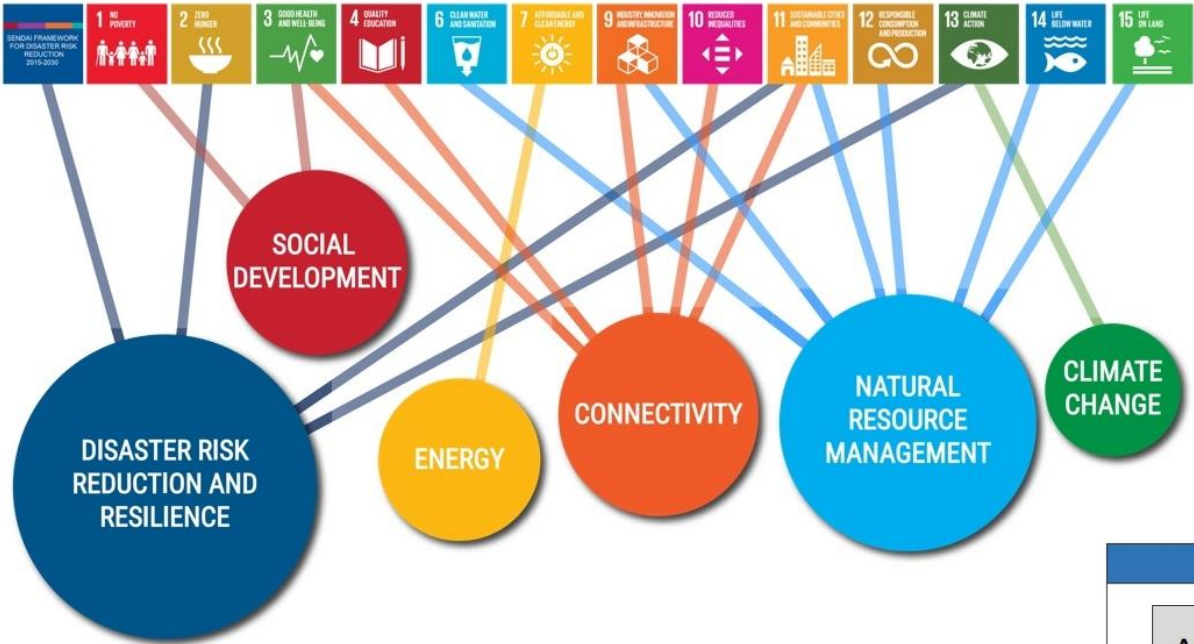
Hong Kong Observatory (HKO)
Hong Kong, China



The Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018-2030)

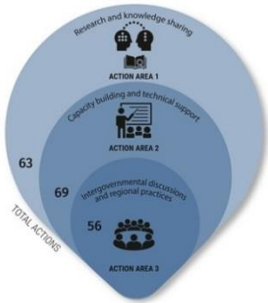
Space for the Sustainable Development Goals

Space Applications can contribute to multiple Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction.



Modalities (Action Areas)

Action Area	Description	Total Actions Identified
Action Area 1	Research and knowledge sharing	63
Action Area 2	Capacity building and technical support	69
Action Area 3	Intergovernmental discussions and regional practices	56



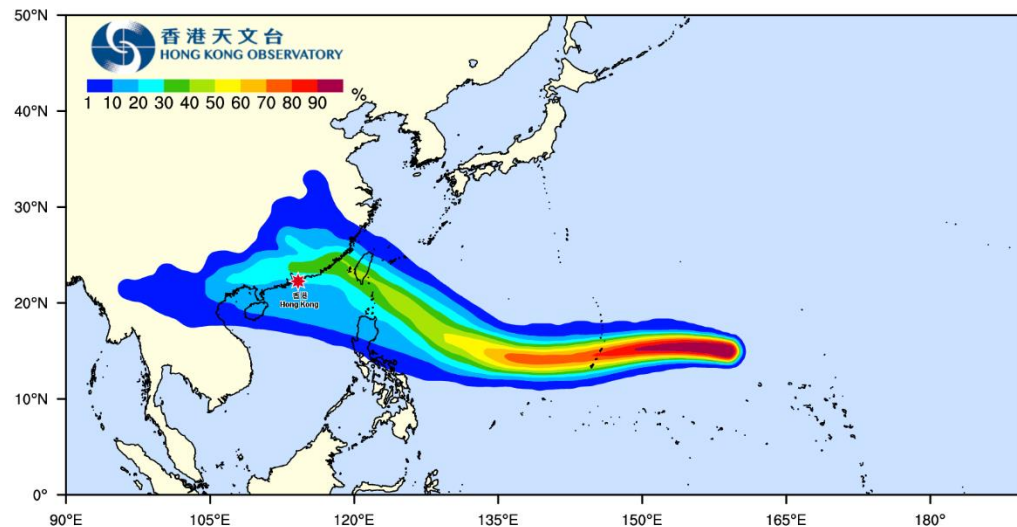
Thematic Area: Disaster Risk Reduction; Action Area: Research and Knowledge Sharing

Handling the multi-hazards brought by Super Typhoon Mangkhut in 2018

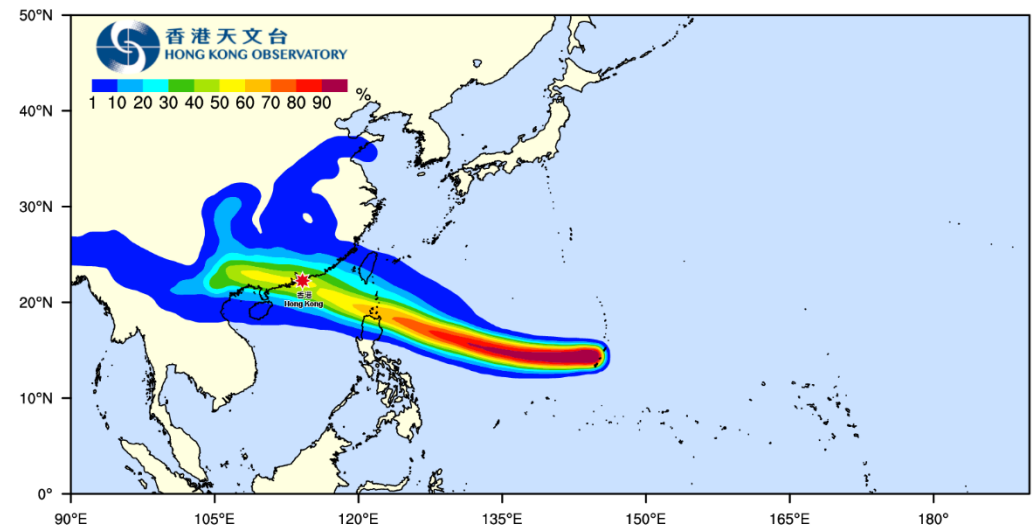
Disaster Risk Reduction, Emergency Response and Disaster Assessment

Early alert via:

HKO website, “MyObservatory” mobile app., social media platforms (Facebook, YouTube etc.)



Strike Probability Map of Mangkhut
(12UTC on 8 Sep. 2018)



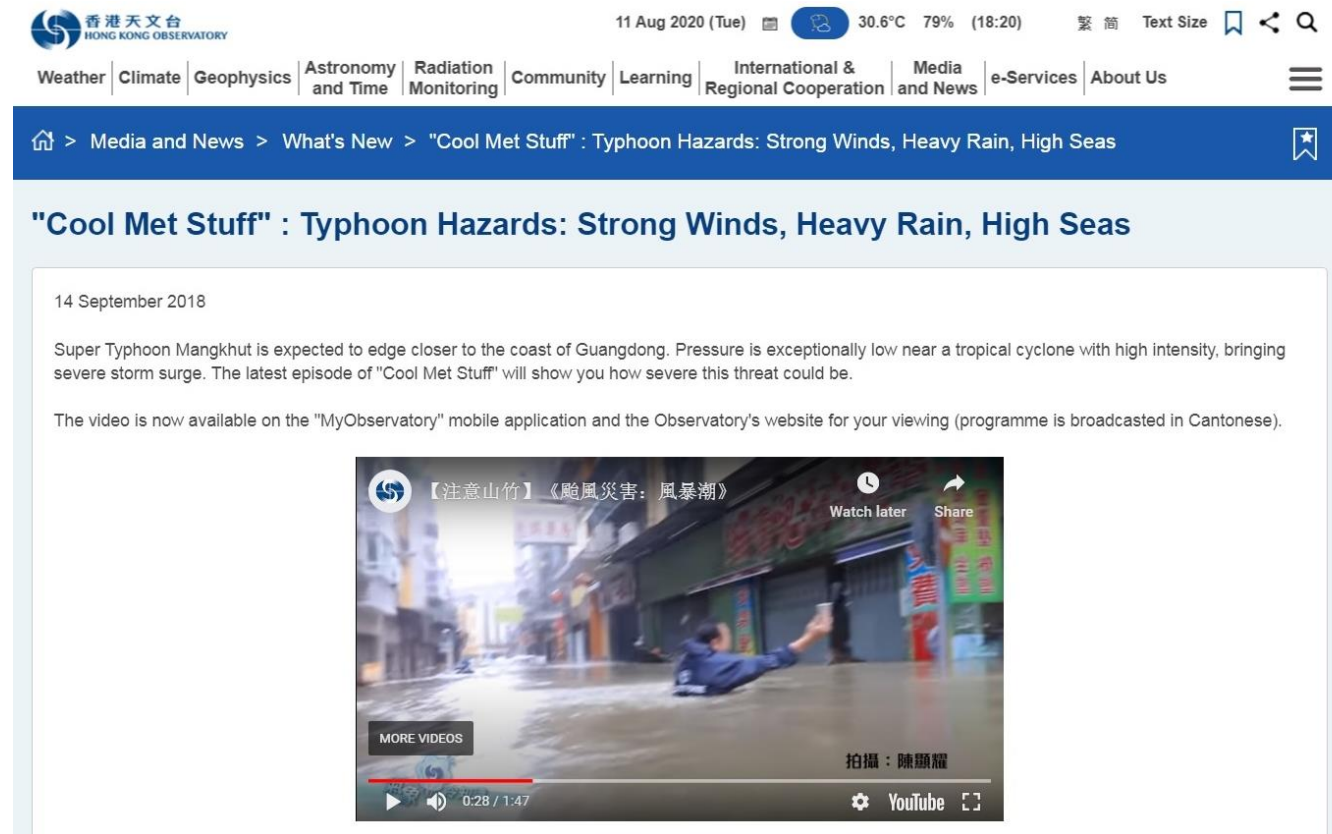
Strike Probability Map of Mangkhut
(12UTC on 10 Sep. 2018)

Handling the multi-hazards brought by Super Typhoon Mangkhut in 2018

Risk Reduction, Emergency Response and Disaster Assessment

Coordinated Response and Engage the Public

- Video conference with neighbouring Meteorological Services
- Joint press conference with other Government departments
- Publicity videos on the hazards on storm surges, high winds and heavy rain



Handling the multi-hazards brought by Super Typhoon Mangkhut in 2018

Risk Reduction, Emergency Response and Disaster Assessment

Crowdsourcing for damage photos



紅磡 Hung Hom

(鳴謝吳耀華提供相片 Courtesy of Y W Ng)



旺角 Mong Kok

(鳴謝鄧先生提供相片 Courtesy of 鄧先生)



(鳴謝 Angie Lee 提供相片 Courtesy of Angie Lee)



(鳴謝 S S Wong 提供相片 Courtesy of S S Wong)



(鳴謝 Brain Tse 提供相片 Courtesy of Brain Tse)



(鳴謝 Mr Tsui 提供相片 Courtesy of Mr Tsui)

西貢 Sai Kung

Handling the multi-hazards brought by Super Typhoon Mangkhut in 2018

Risk Reduction, Emergency Response and Disaster Assessment



九龍灣 Kowloon Bay
(鳴謝 Andy Ho 提供相片 Courtesy of Andy Ho)



長洲 Cheung Chau
(鳴謝龔穎恒提供相片 Courtesy of T Kung)



中環 Central
(鳴謝龔穎恒提供相片 Courtesy of T Kung)



愉景灣 Discovery Bay
(鳴謝龔穎恒提供相片 Courtesy of T Kung)

Crowdsourcing for
damage photos



鴨脷洲海怡半島 South Horizons, Ap Lei Chau
(鳴謝 H C Chan 提供相片 Courtesy of H C Chan)



杏花邨 Heng Fa Chuen
(鳴謝 Fong Wai 提供相片 Courtesy of Fong Wai)

Handling the multi-hazards brought by Super Typhoon Mangkhut in 2018

Risk Reduction, Emergency Response and Disaster Assessment



Thematic Area: Disaster Risk Reduction; Action Area: Capacity and Technical Support

Web-based GIS Platform to Enhance Flight Safety in the APAC Region

Objective:

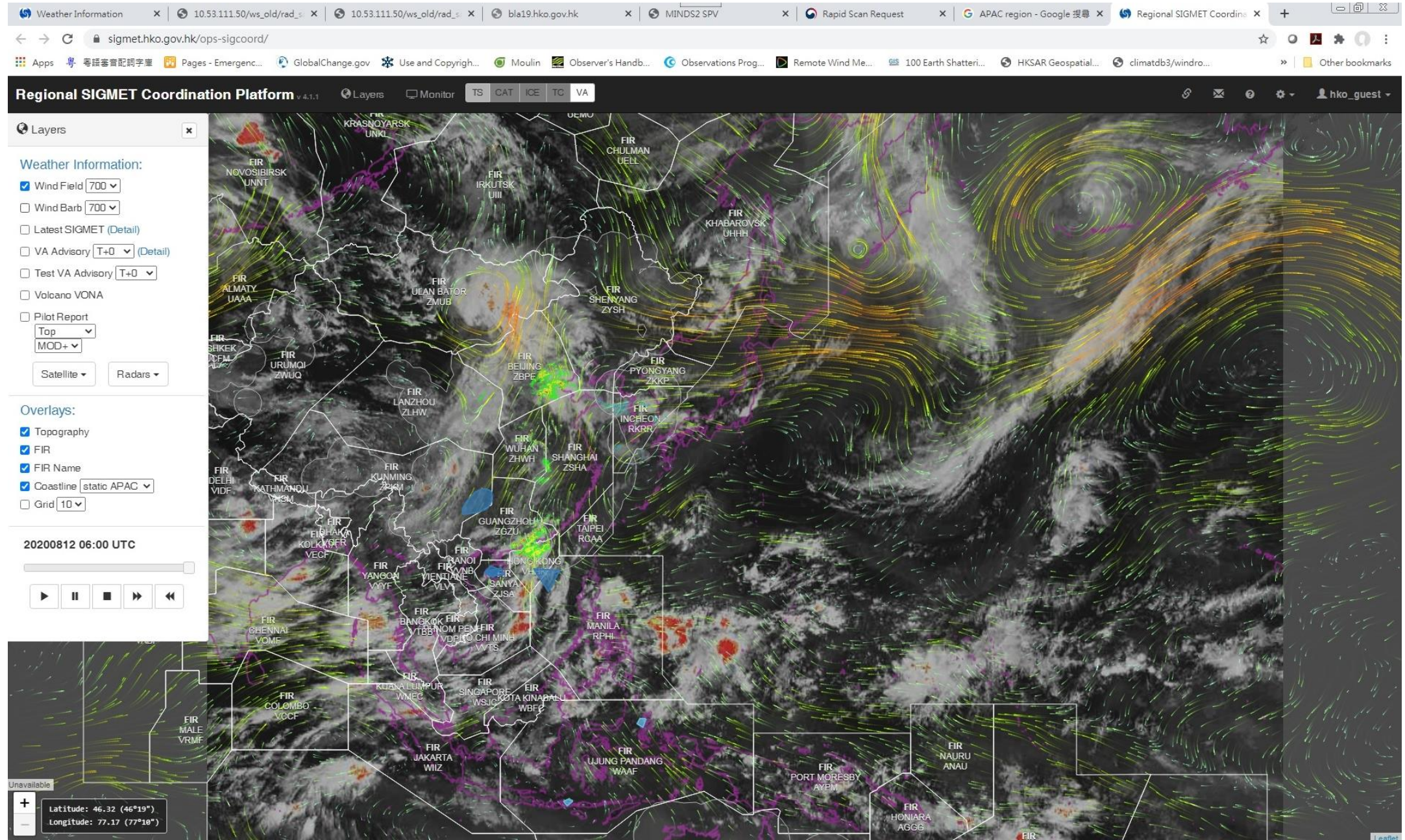
Setting up a mechanism for harmonizing the SIGMET (Significant Meteorological Information) service provision across the borders of the flight information regions (FIRs) for improving aviation safety in the Southeast Asia.

Tool:

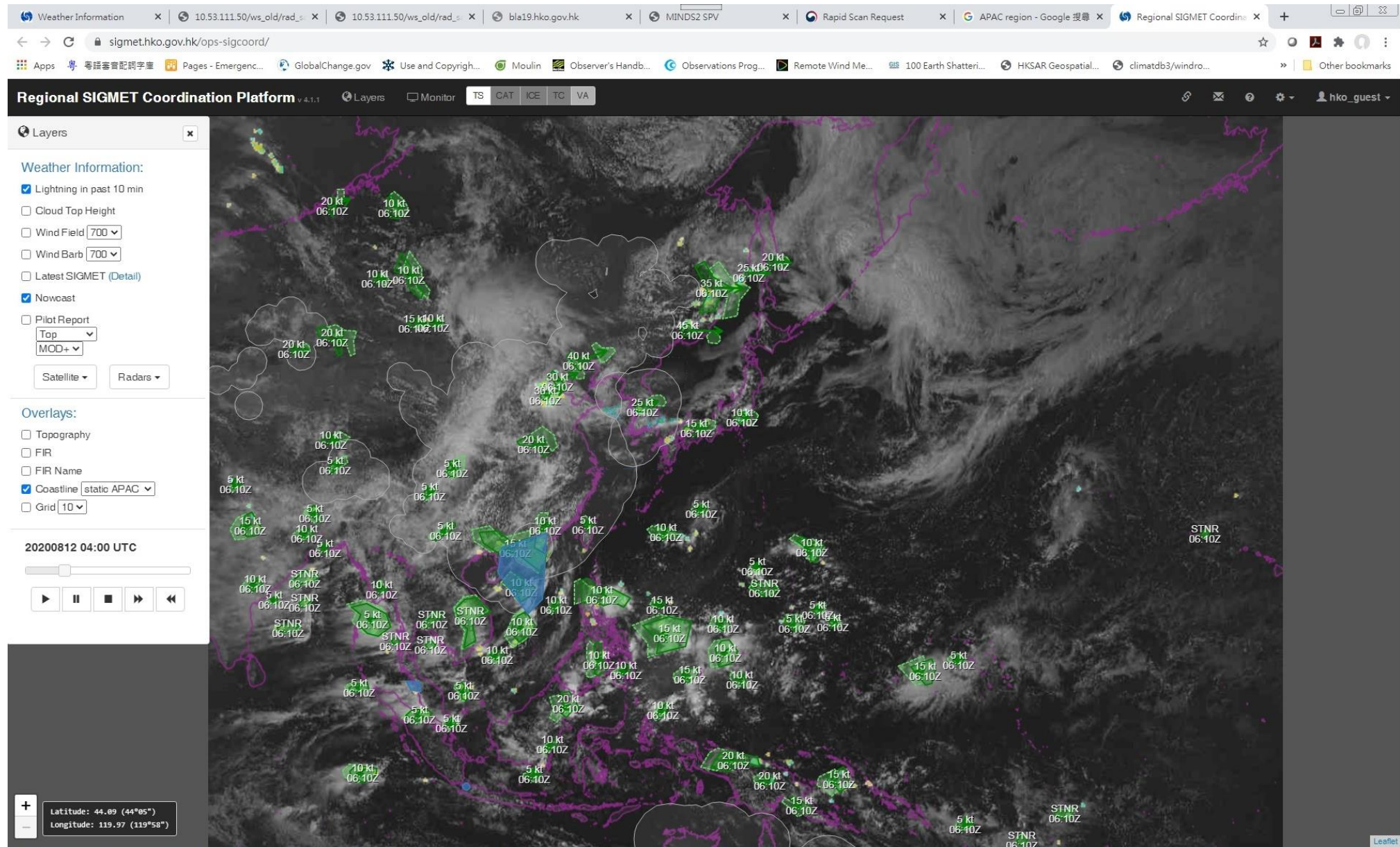
A web-based GIS platform is developed to support the SIGMET coordination in the Asia Pacific (APAC) region.

The web platform includes software to automatically analyze en-route hazardous weather based on geostationary meteorological satellites, global lightning, NWP data plus pilot and aircraft reports, to provide a common situational awareness environment for preparation of SIGMET. Aviation forecasters can communicate via the platform for harmonizing SIGMET messages.

Web-based GIS Platform to Enhance Flight Safety in the APAC Region



Web-based GIS Platform to Enhance Flight Safety in the APAC Region



Web-based GIS Platform to Enhance Flight Safety in the APAC Region

Some main features of the platform:

- Nowcast (4 hours ahead) of significant convection areas (polygons);
- Interactive tools for online participants to draw weather polygons, input the weather type, movement and the respective forecast positions;
- Generates the individual SIGMET message for the respective FIR concerned;
- Produces both textual, graphical and XML codes SIGMET message in compliance with the latest ICAO Annex 3 coding standard for international exchange;
- Chat room for discussion such as the size, intensity, height, movement and trend of any cross-boundary weather phenomena;
- Volcanic ash SIGMET coordination;
- Tropical cyclone and turbulence SIGMET coordination (Future)

Web-based GIS Platform to Enhance Flight Safety in the APAC Region

Results:

- For coordination over the western and northwestern part of the south China sea, about 87% cases of SIGMET coordination in 2018 were performed with consensus reached;
- Online survey reviewed that over 80% of the respondents were satisfied or very satisfied with the platform.

Emerging Technologies: Machine Learning for processing geospatial information

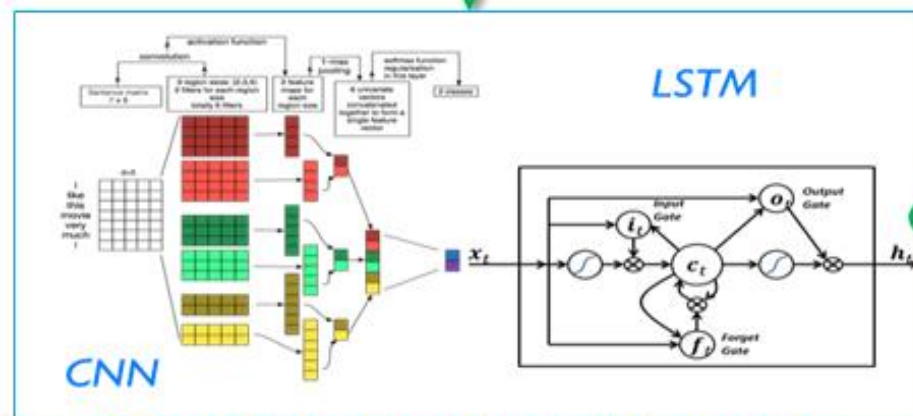
Example 1: Use of deep learning model to ingest traffic news to generate graphical output product showing traffic route congestion conditions.

- **Input: online traffic news in text**

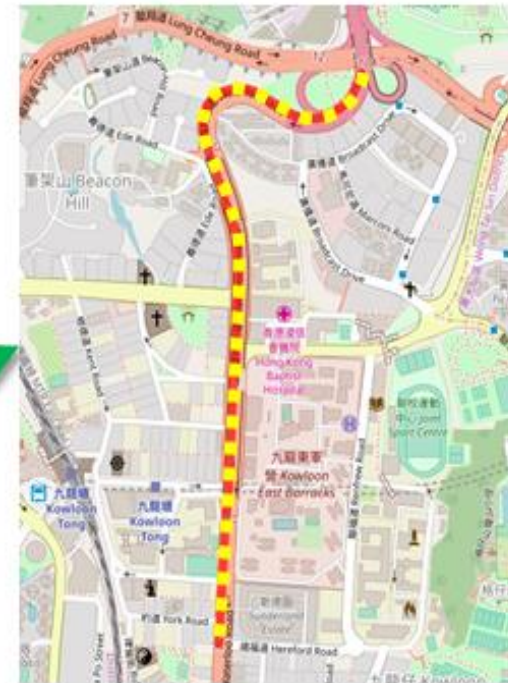
“窩打老道往沙田方向，車多，龍尾：映月台。”

(e.g. “Heavy traffic on Waterloo Road heading to Sha Tin near Moonbeam Terrace.”)

- **Output: affected traffic route on GIS**

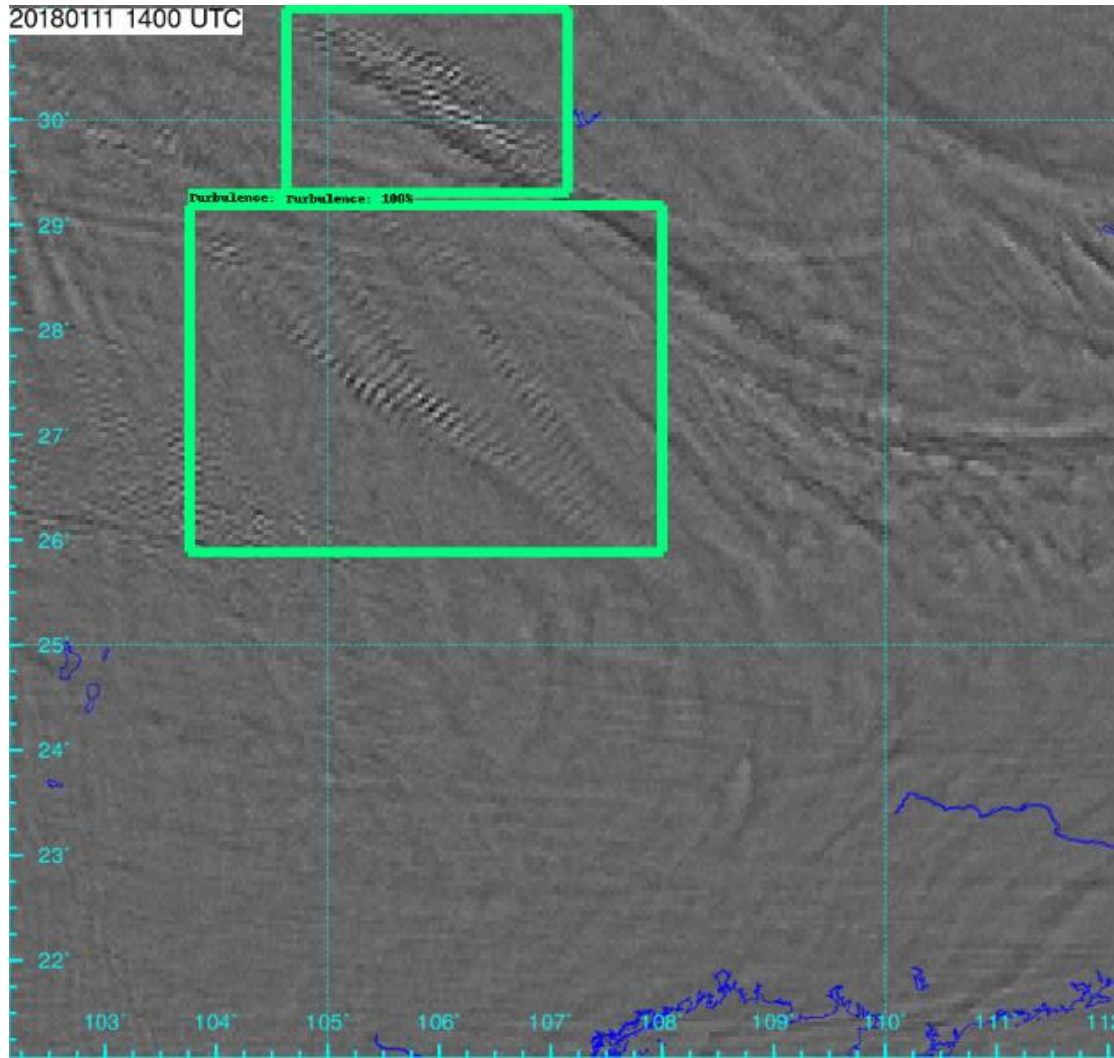


**Deep-learning Neural Networks
(Natural Language Processing)**



Emerging Technologies: Machine Learning for processing geospatial information

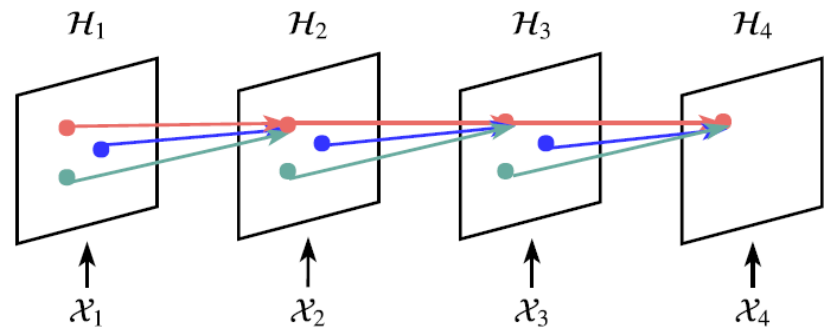
Example 2: Use of Deep learning model in turbulence detection.



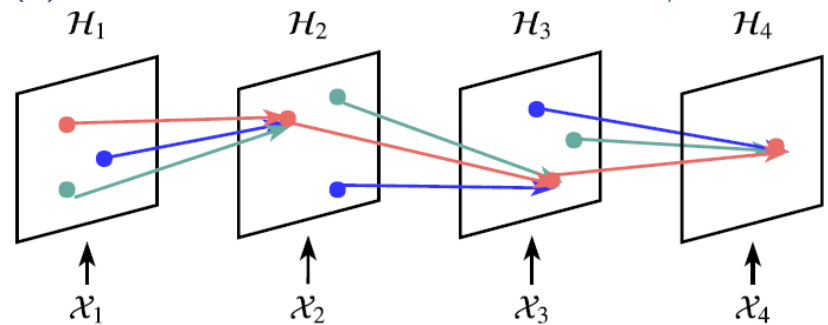
Development of a deep learning model with object detection technique using the Faster Region-based Convolutional Neural Network (RCNN) for auto-detection of Atmospheric Gravity Waves (AGW)

Emerging Technologies: Machine Learning for processing geospatial information

Example 3: Use of deep learning model in nowcasting of severe weather.

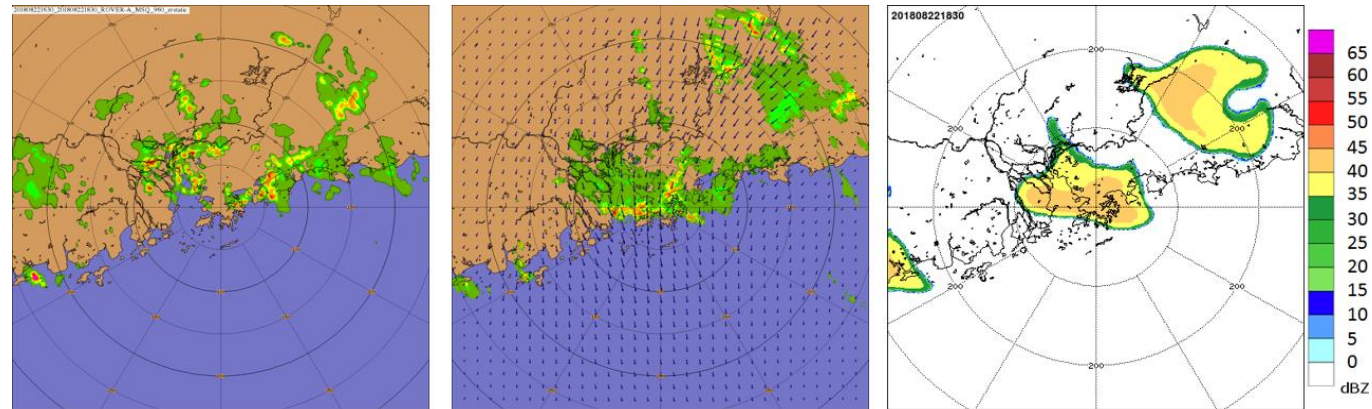


(a) ConvRNN: Links are fixed over time/location.



(b) TrajRNN: Links are dynamically determined.

Schematic of neural network links in space and time in (a) convolutional recurrence neural network (ConvRNN) and (b) trajectory based RNN.



2-hr nowcast from extrapolation using optical flow (left panel) and TrajGRU (right). Actual radar reflectivity is shown in the middle panel.

THANK YOU

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Hong Kong Observatory

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Senior Scientific Officer
Hong Kong Observatory