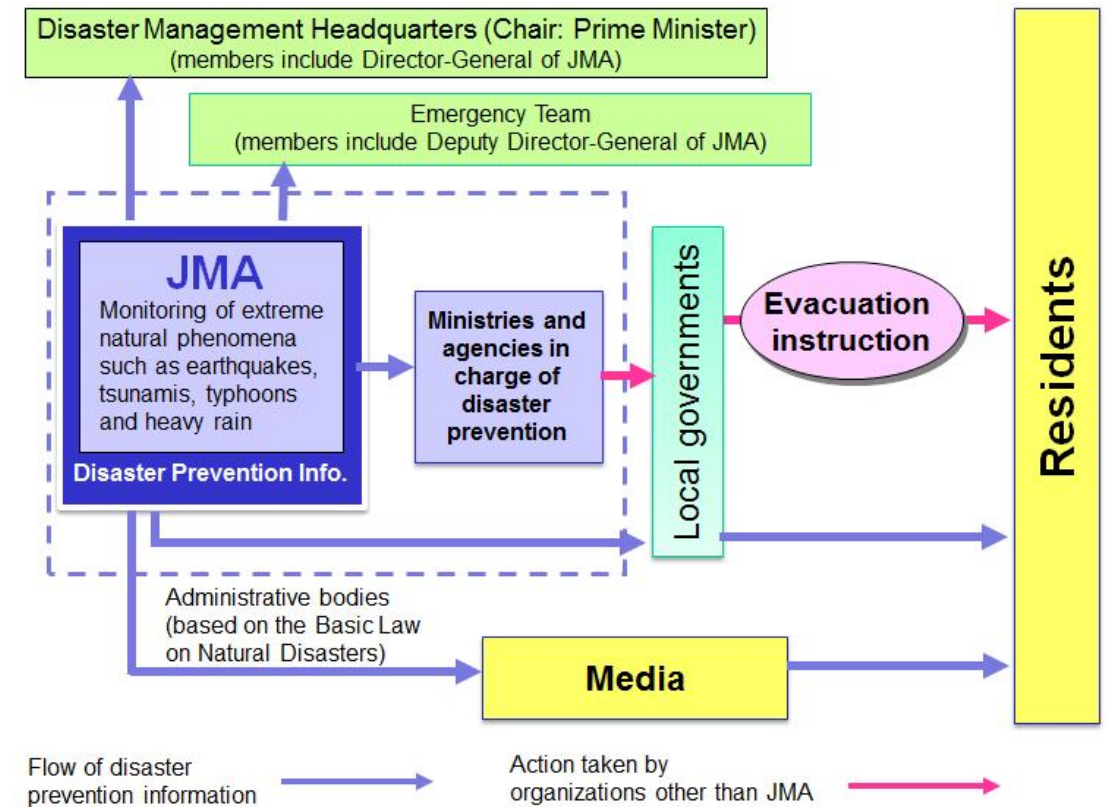


Current status and future expectation of AI implementation in JMA operations

SATO Yoshiaki (JMA)
July 2025

- As part of Japan's government, JMA implements its services with the following ultimate goals in compliance with the Act for Establishment of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Meteorological Service Act:
 - Prevention and mitigation of natural disasters
 - Safety of transportation
 - Development and prosperity of industry
 - Improvement of public welfare
- To meet these goals, JMA focuses its efforts on monitoring the earth's environment and forecasting natural phenomena related to the atmosphere, the oceans and the earth, as well as on conducting research and technical development in related fields.
- Particular emphasis is placed on the prevention and mitigation of natural disasters, as Japan is prone to a variety of natural hazards such as typhoons, heavy rains and earthquakes. JMA, as the sole national authority responsible for issuing weather/tsunami warnings and advisories, is required to provide reliable and timely information to governmental agencies and residents for the purposes of natural disaster prevention and mitigation.



Disaster prevention operation schemes and role of JMA

Emergency Warnings

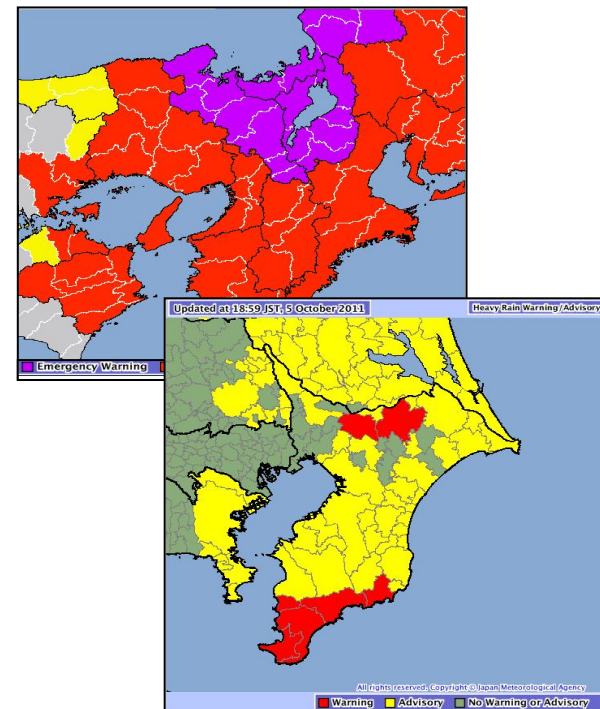
Heavy rain (landslide/inundation)
Storm Snow-storm Heavy snow
Storm surge High waves

Warnings

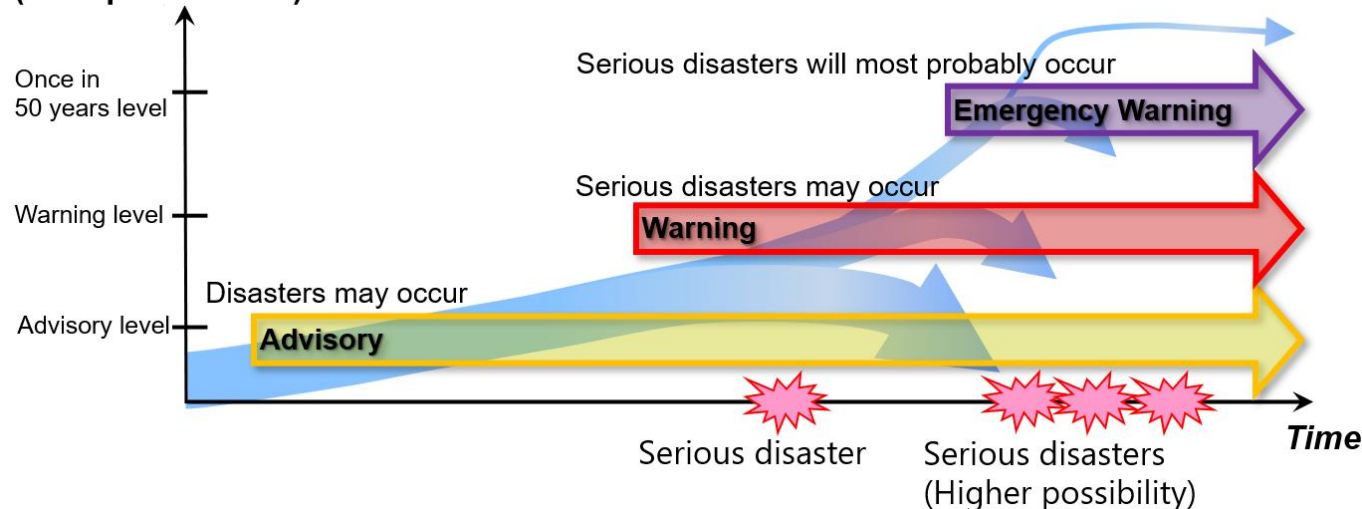
Heavy rain (landslide/inundation) Flood
Storm Snow-storm Heavy snow
Storm surge High waves

Advisories

Heavy rain (landslide/inundation) Flood
Gale Gale and snow Heavy snow
Storm surge High waves etc.



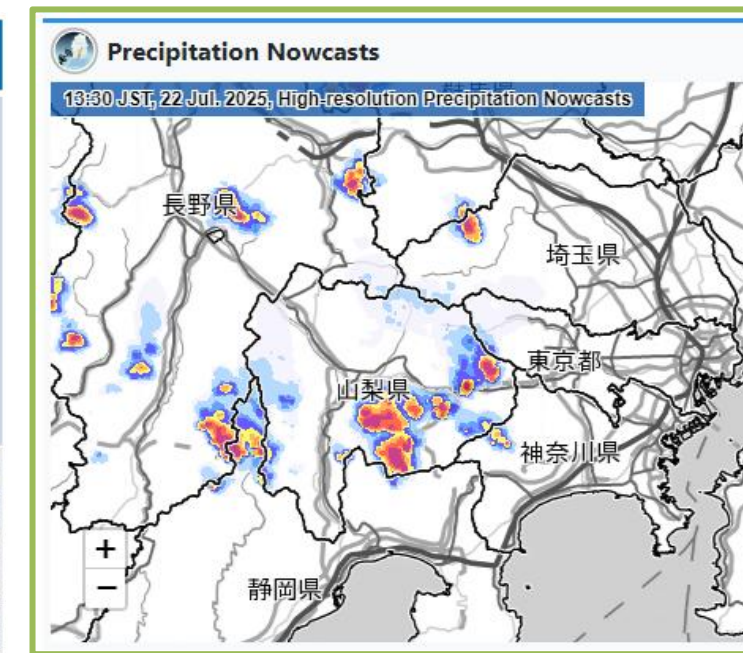
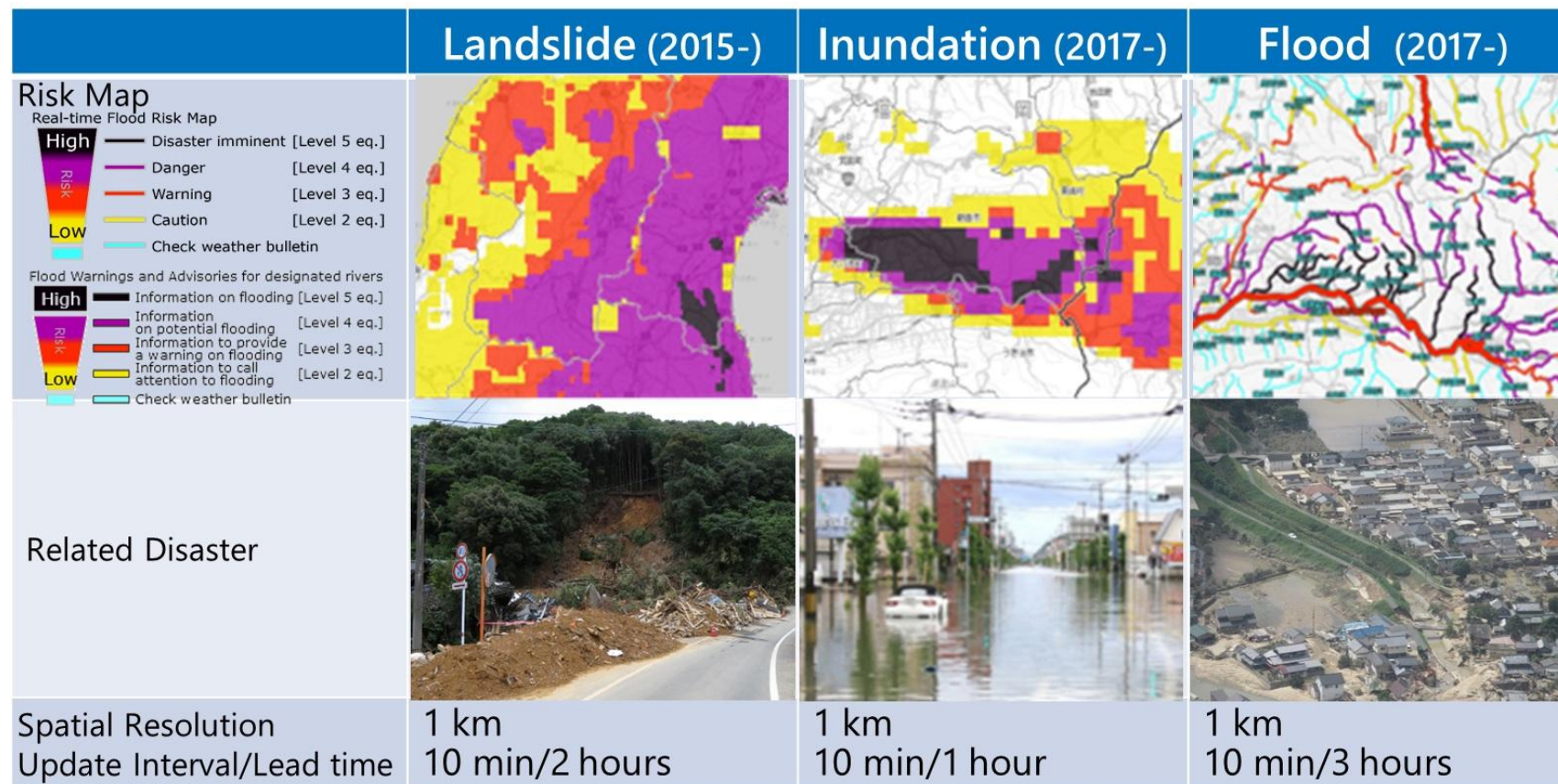
Intensity level
(Precipitation etc.)



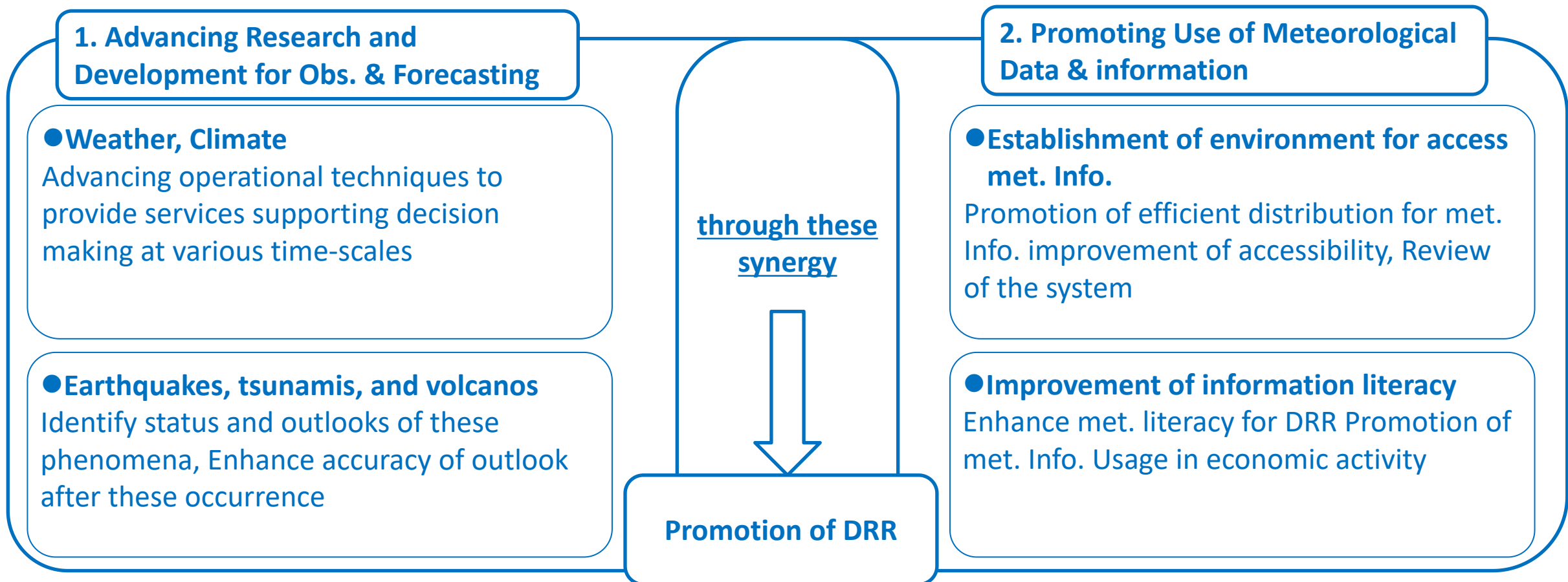
Local Meteorological
Offices issue warnings
for each municipality.

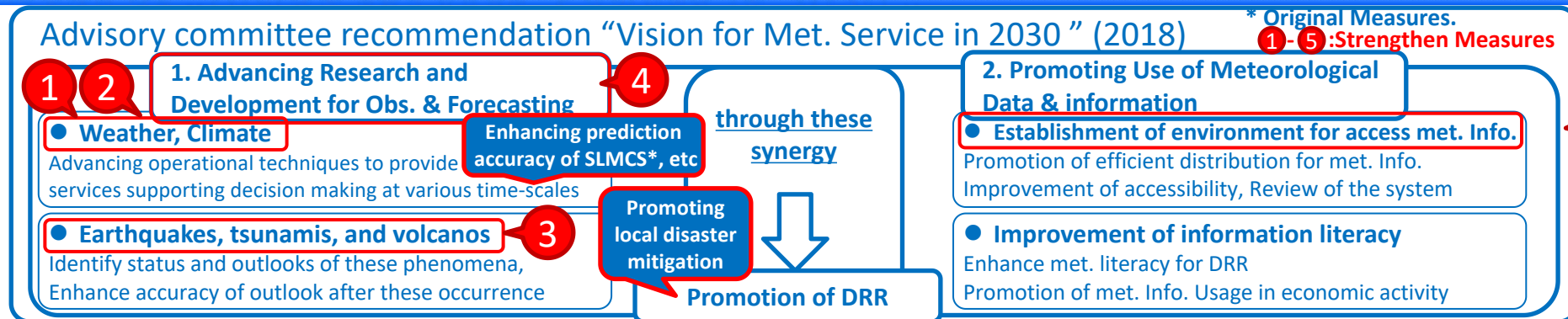
JMA is producing real-time risk map, which provides spatially specific information on risk-level of landslide, inundation and flood in colors using a standardized color code to understand risks of hazardous phenomena and the urgency.

The map is shown in JMA's web page with precipitation nowcast. Not only news media but general public can watch the risk level information with their interest.

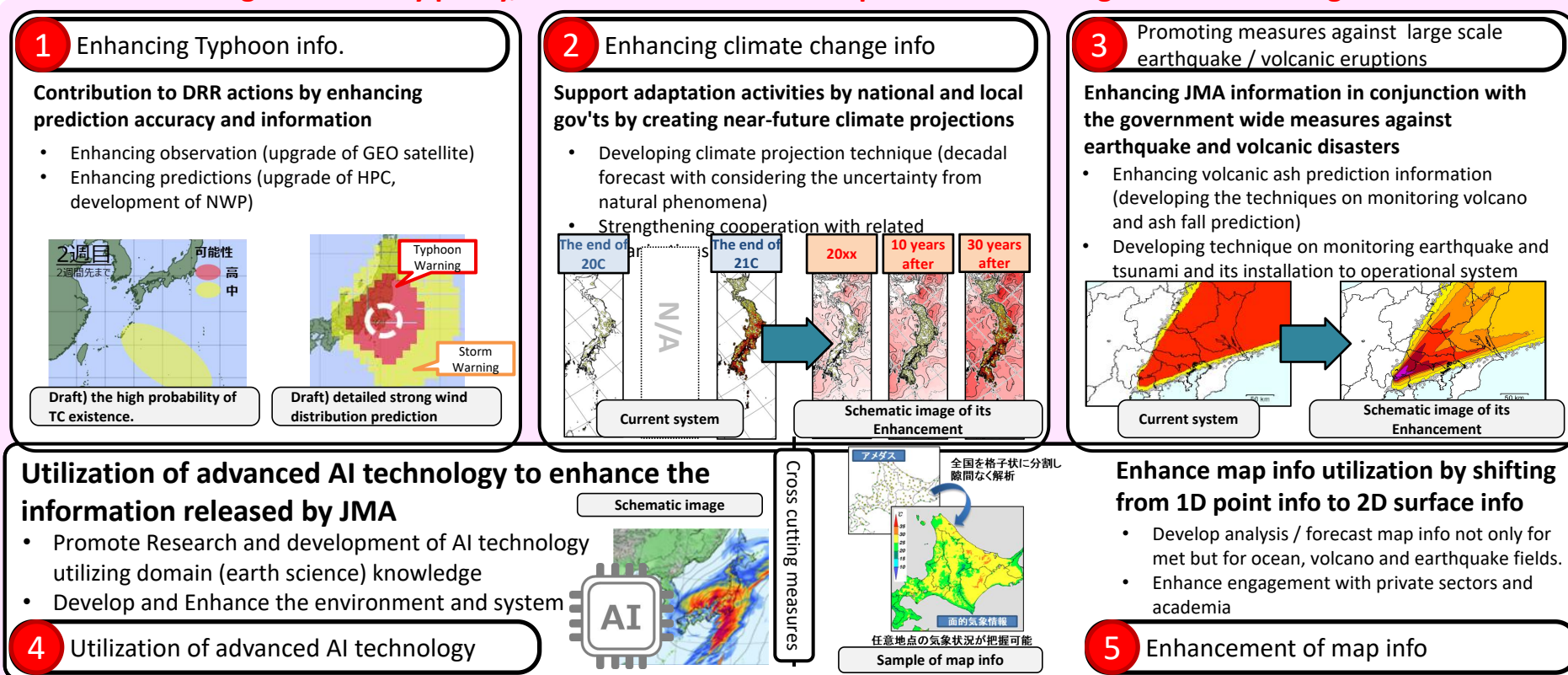


- Advisory Committee (Meteorological subcommittee, Council of Transport policy) makes recommendations on high-level JMA policies.
- In the “Vision for Meteorological Service in 2030” recommended by the advisory committee in 2018, priority areas are defined as follows:

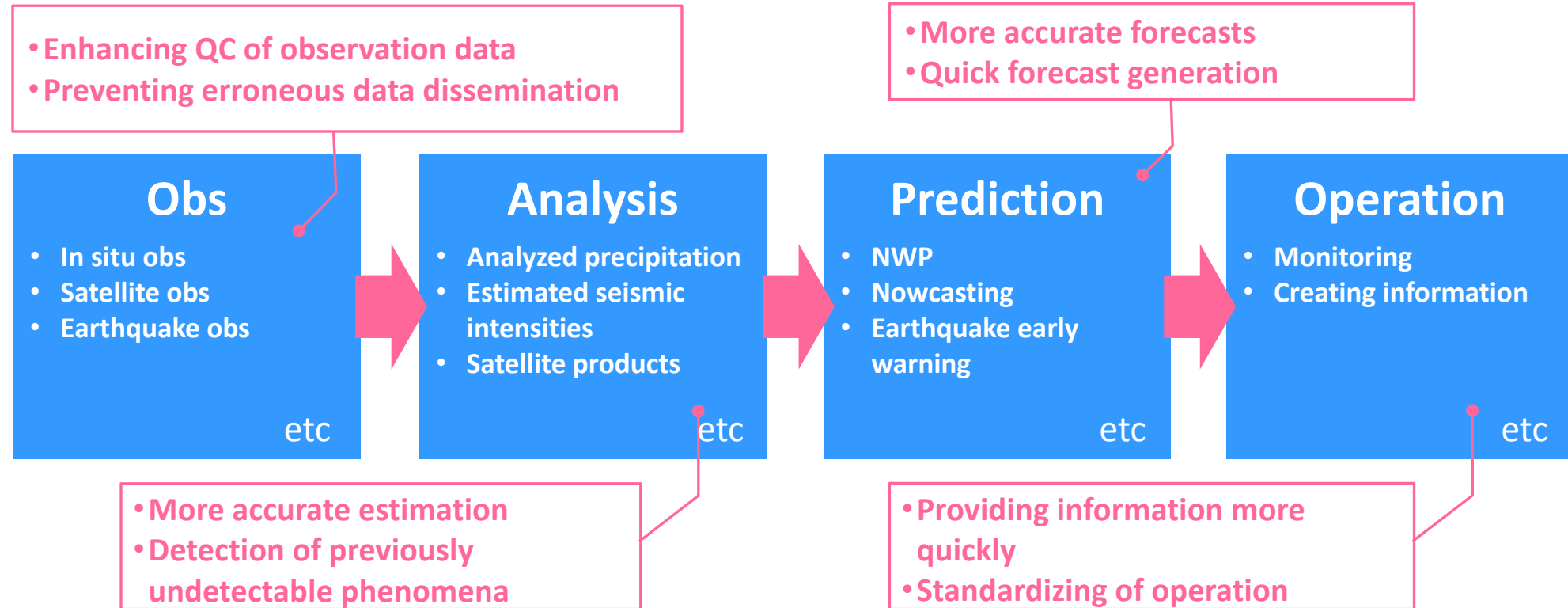




Based on the original recommendation and the Strengthen Measures of ① - ⑤ considering the recent social situations, JMA will contribute to realize the safe, resilient and vibrant society. To promote the information advancement and utilization considering user friendly policy, JMA will enhance the cooperation and dialog with relevant organizations.



- JMA provides the information, which are prepared with the following steps:
 - 1. Observation, 2. Analysis, 3. Prediction, 4. Operation
- JMA considers there are possibilities to apply AI techniques to each steps.



Utilizing advanced AI technology to all the JMA tasks
Enhancing information to support DRR action

Past efforts based on the previous Vision 2030

■ Utilizing AI technology to the weather forecast

- Early AI techniques have already been applied to the post-processing of NWP.
- Conducting joint research with RIKEN AICS.

Considering new social trends,

To enhance DRR information, it is necessary to utilize rapidly developing advanced AI technology. But it is noted that the use of AI technology comes with undesirable risks and challenges, such as hallucinations and black box problems.

Strengthening efforts towards 2030 and beyond

■ Utilizing advanced AI technology for enhancing DRR information

- To strengthen JMA operations overall and provide strong support for DRR.
- Leveraging human and natural science knowledge to address AI risks and challenges.

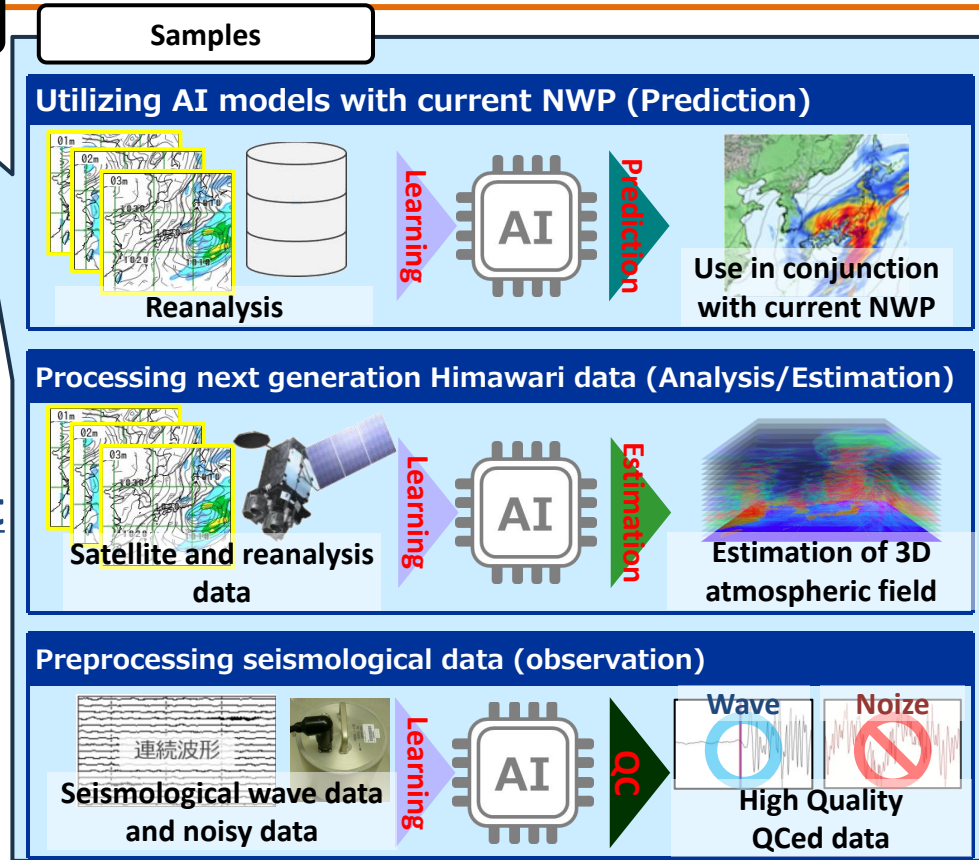
Toward realization

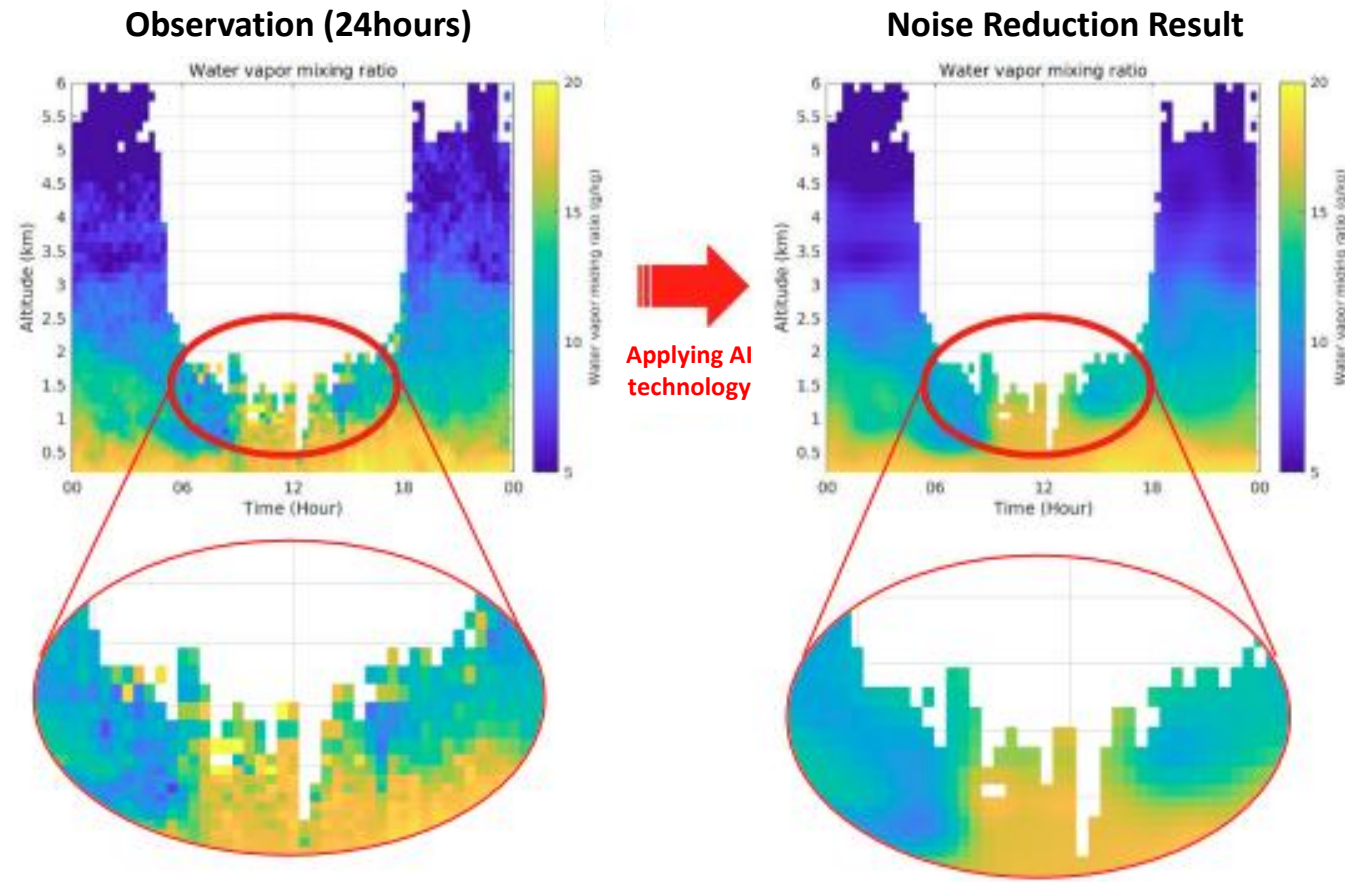
● Promote research and development of AI technology

- Utilizing domain (natural science) knowledge

● Develop and Enhance the environment and system

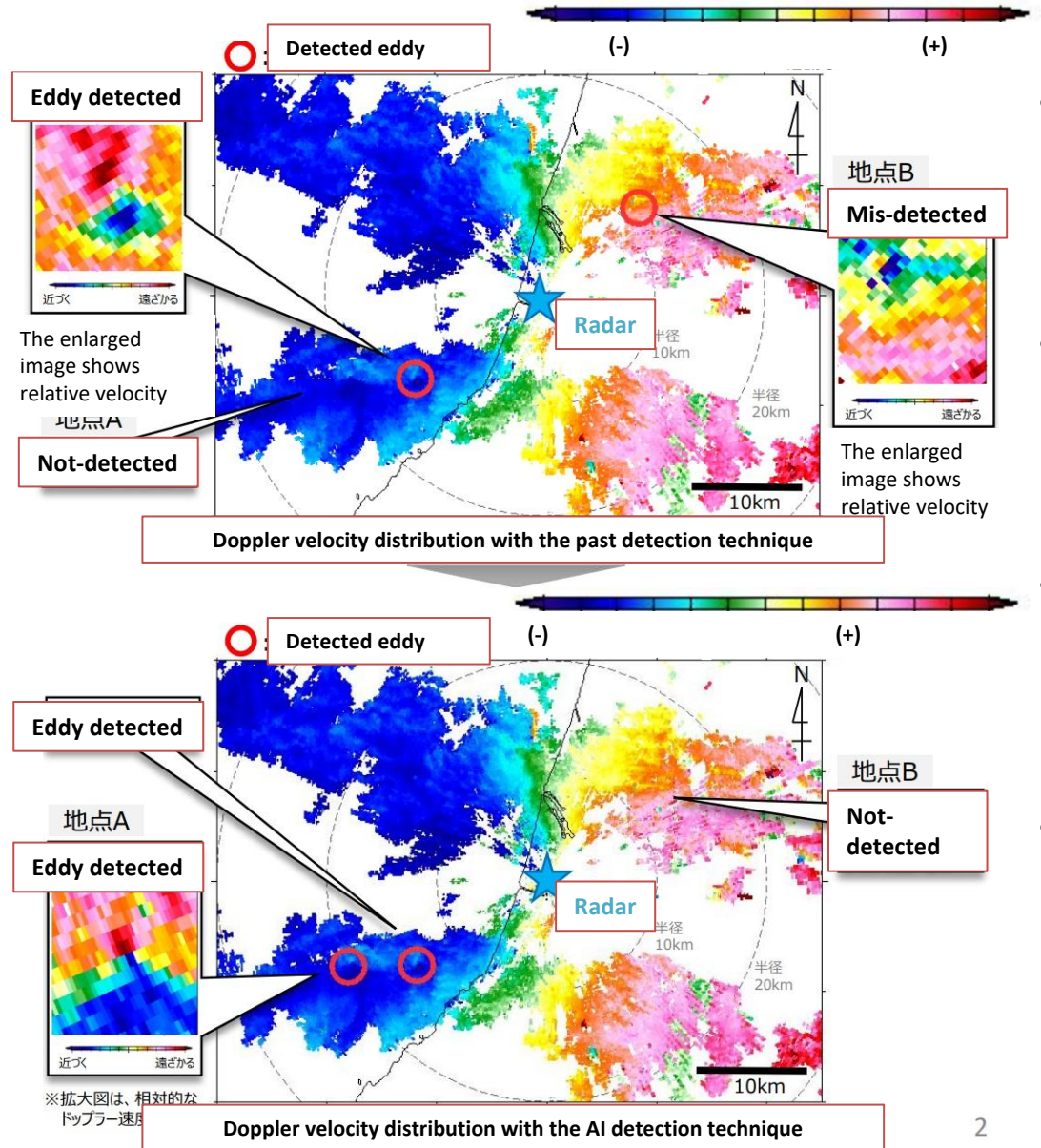
- Collaborating with public sector and academia
- Preparing of computing & human resource





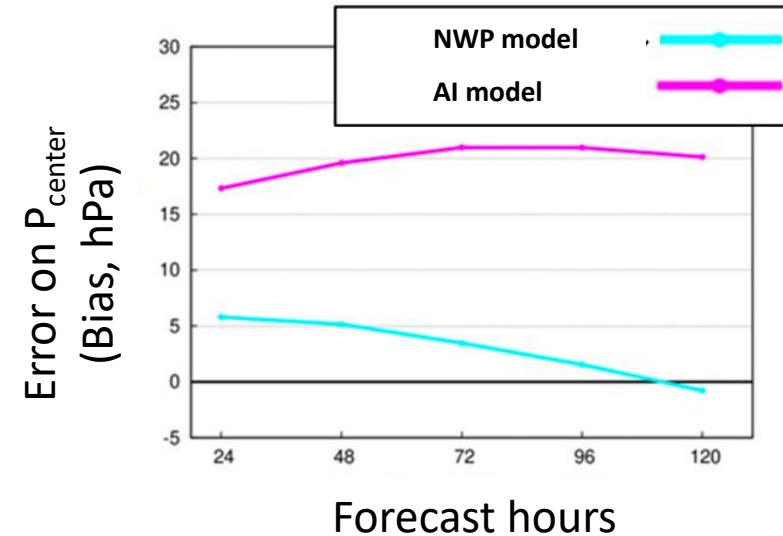
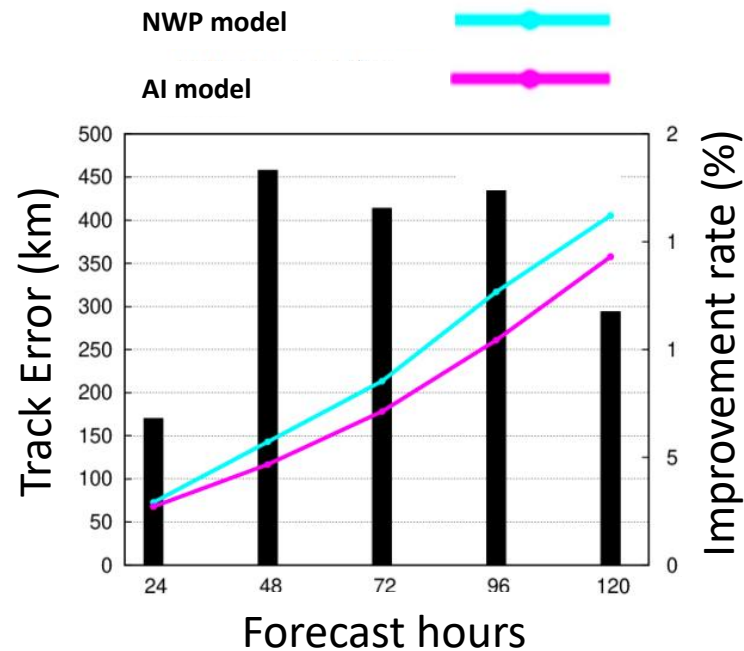
Sample of noise reduction of observation data

- Joint research with RIKEN AICS
- Noise reduction technique for water vapor lidar data was developed
 - The lidar observes vertical profile of atmospheric water vapor sequentially
 - The technique applies the noise reduction technique for conventional image data by supposing data as 2D image of temporal-vertical cross section.



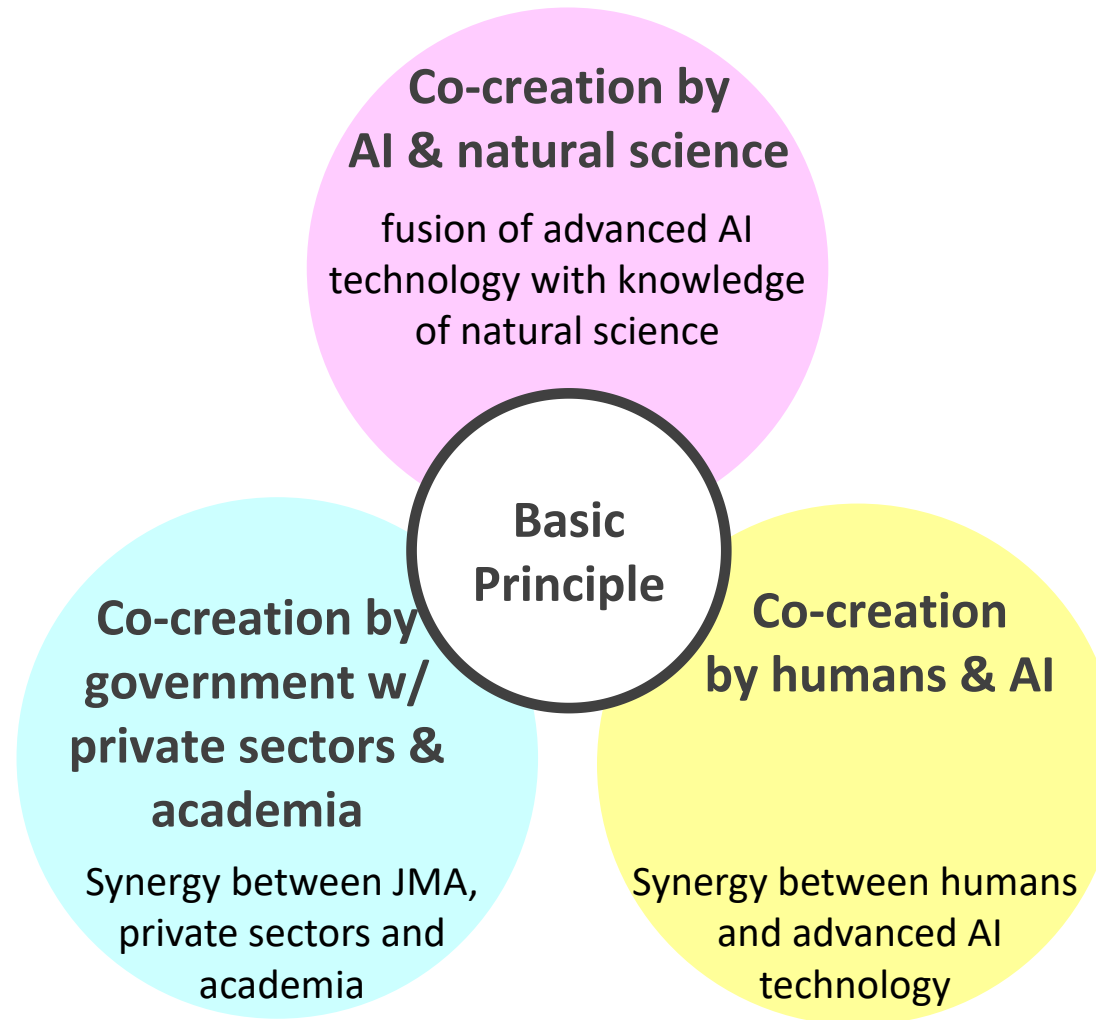
The sample of AI detection technique refinement
After JR East (in Japanese)

- Wind gust detection technique was developed by the joint research of JMA-MRI and East Japan railway (JR East).
- The upper eddy which bring wind gust is being detected by Doppler velocity data in real time in operation.
- The mis-detection was reduced by utilizing the AI detection technology which learns eddy and non-eddy data.
- Since November 2020, JR East has been using this technology for winter operations on the Sea of Japan side, where wind gust are more likely to occur.

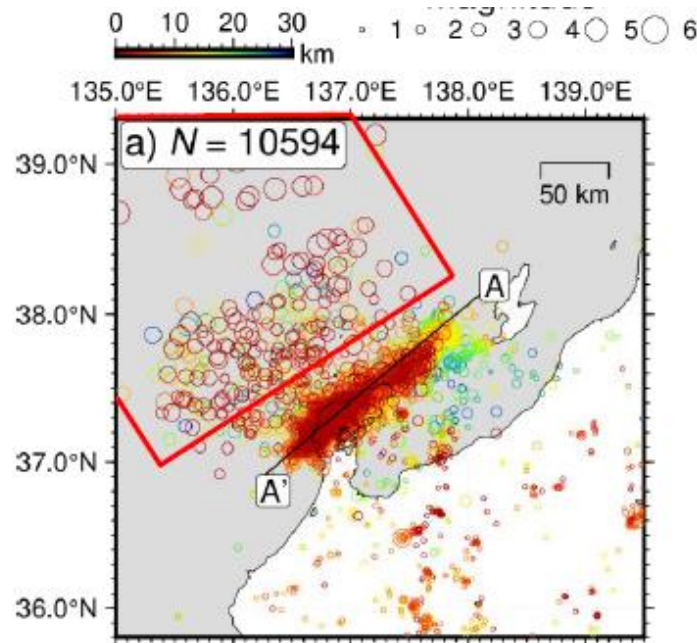


- JMA-MRI conducted feasibility study of AI models for TC forecast
- It was confirmed that the TC track forecast from Pangu-Weather model was better than JMA GSM, while the TC intensity forecast was not.
- The synergy of AI model and (conventional) NWP model might be able to bring the better DRR information.

JMA defined the basic principle of AI utilization as the following images. Based on this principle, JMA will promote the utilization of the advanced AI technology.

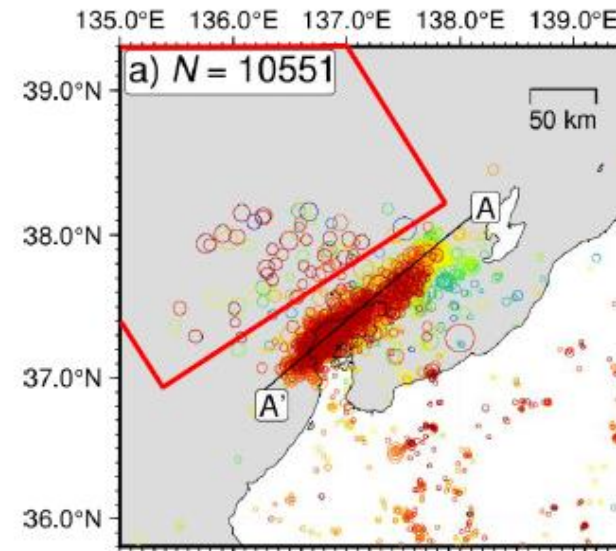


Conventional method



w/ AI

The mis-determined hypocenters out of the seismically active area (shown by red rect.) were reduced



Example of automatic hypocenter detection during the 2024 Noto Peninsula earthquake

- The automatic hypocenter detection accuracy was improved by using the AI technology which learned seismic wave data and noise wave data.
- By having the AI technology learn abnormal wave, it can automate the process of determining whether or not data can be used for “earthquake early warning” by staff.