Space applications for sustainable development and disaster resilience

14 November 2019

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Economic and Social Commission for Asia and the Pacific

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

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Part 1

Our work in space applications

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United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)

- Regional development arm of the United Nations for the Asia-Pacific region addressing transboundary challenges by promoting regional cooperation
- 53 Member States and 9 Associate Members
- The region is home to 4.1 billion people, or 2/3 of the world's population
- Multilateral platform for promoting cooperation among member States to achieve inclusive and sustainable economic and social development in the region

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Regional Space Applications Programme (RESAP)

- 35 member countries including all space-faring countries in Asia and the Pacific
- Close collaboration with global/regional initiatives
- Timely provision to countries affected by disasters: 400+ satellite images/products annually (over 12GB data) through RESAP network
- 24/7 service with free data and support from RESAP member countries, valued at over US$ 1 million
- Enhancing institutional capacities of developing countries on effective use of space-derived data and GIS

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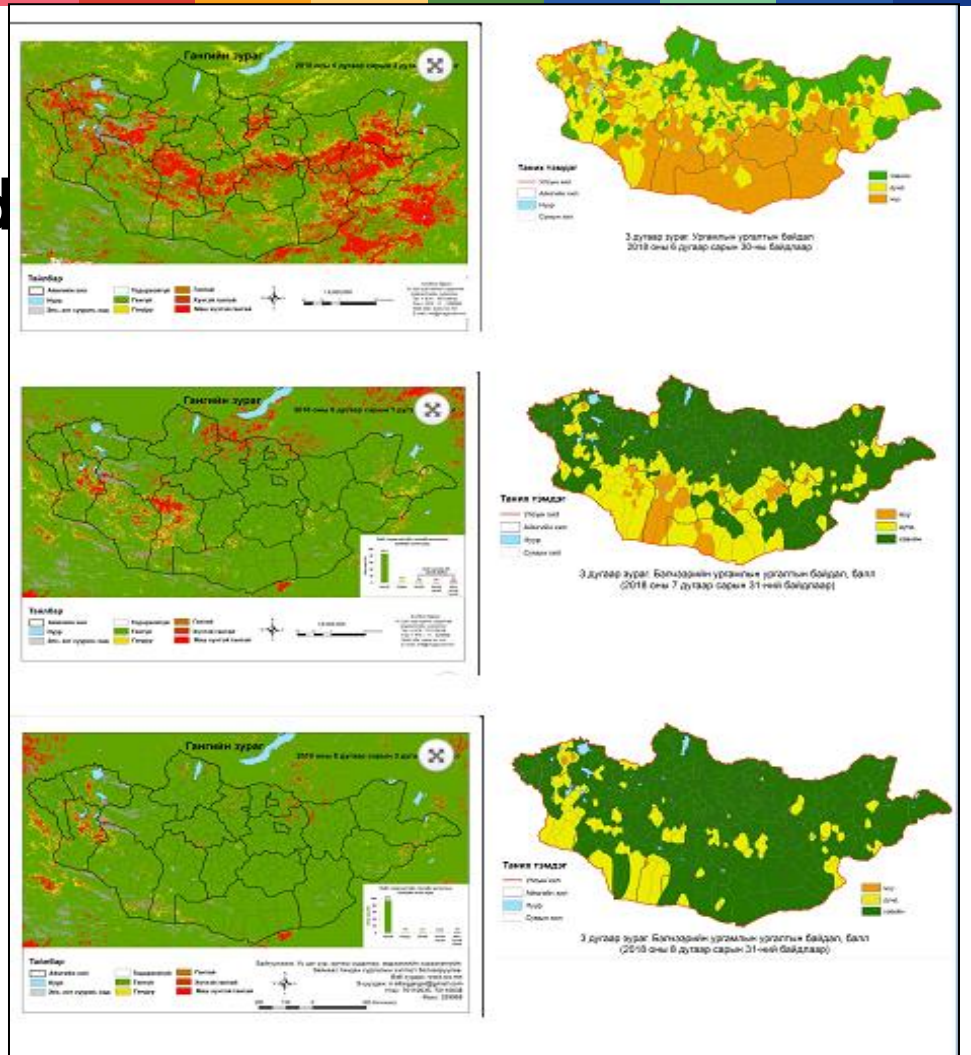
RESAP Geospatial information applications and capacity building

- Regional Cooperative Mechanism for Drought Monitoring and Early Warning
- Drought monitoring system *DroughtWatch* is operational in Mongolia
- Cambodia, Sri Lanka and Myanmar are testing and operationalizing their own systems



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ADVANCED TRAINING ON THE USE OF GEOSPATIAL INFORMATION TECHNOLOGY FOR DROUGHT RISK MANAGEMENT

Demand-driven technical training and capacity building through RESAP

Part 2

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

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High-level recognition of the use of space applications for sustainable development

ESCAP and Thailand co-organized the Third Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific on 10 October 2018, in Bangkok, Thailand.

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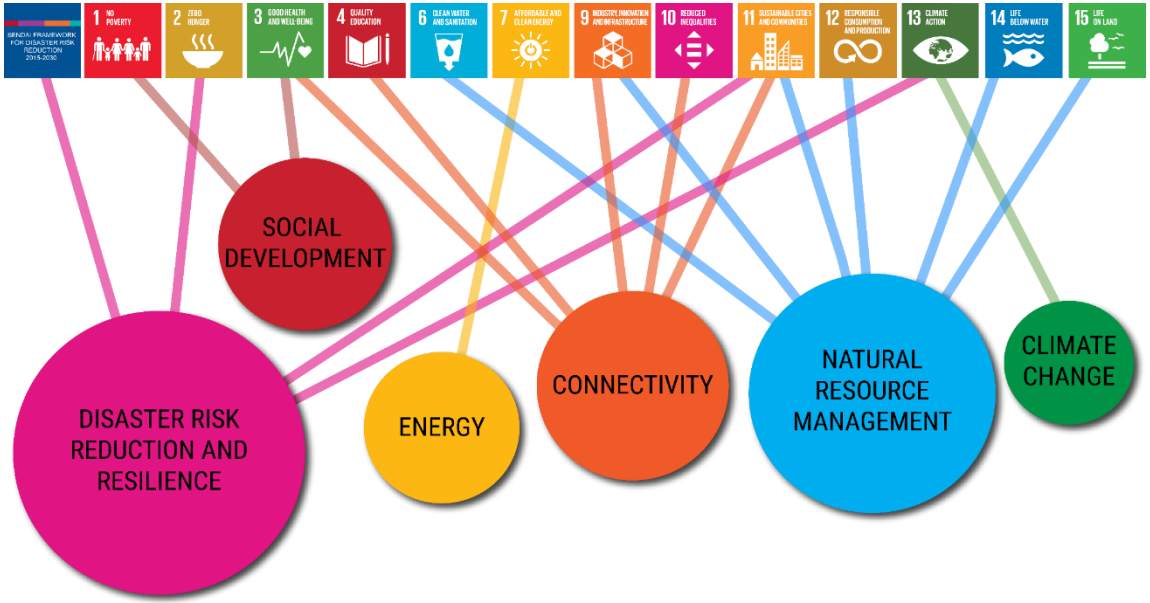
Integrating Geospatial Dimensions for a Sustainable Asia-Pacific



- 188 actions in six thematic areas, regionally-coordinated, inclusive and country-needs driven blueprint
- for 14 Goals of SDGs and SFDRR: where space applications can significantly contribute to global framework
- 37 Targets: as prioritized by the space community for the Asia-Pacific region
- Three implementation phases, each of a four-year duration, with a Ministerial Conference to be convened at the end of each phase.

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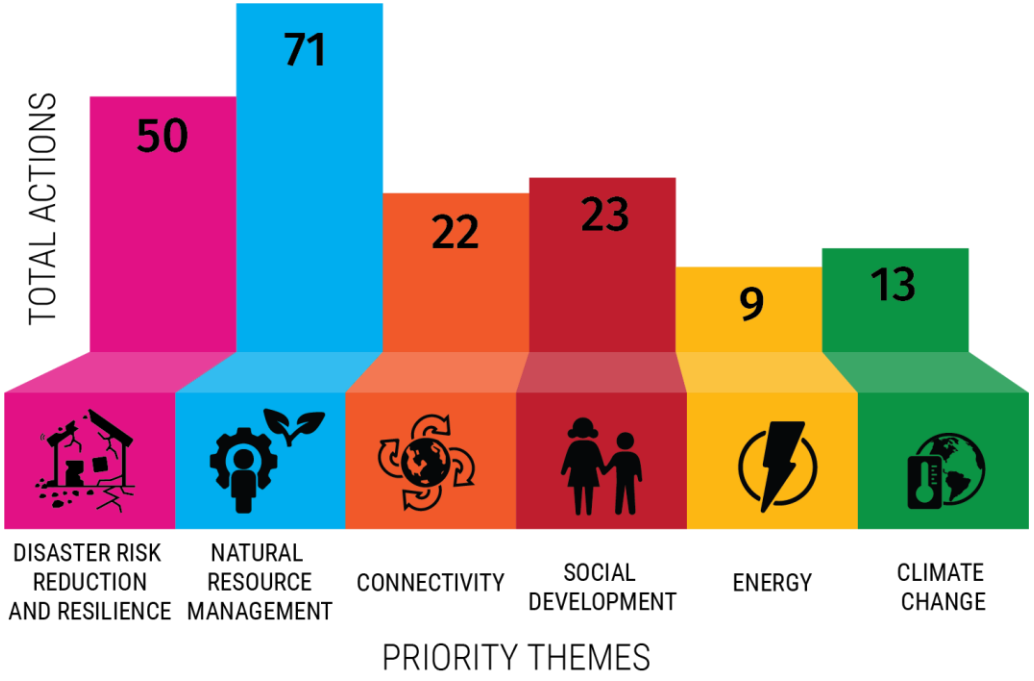
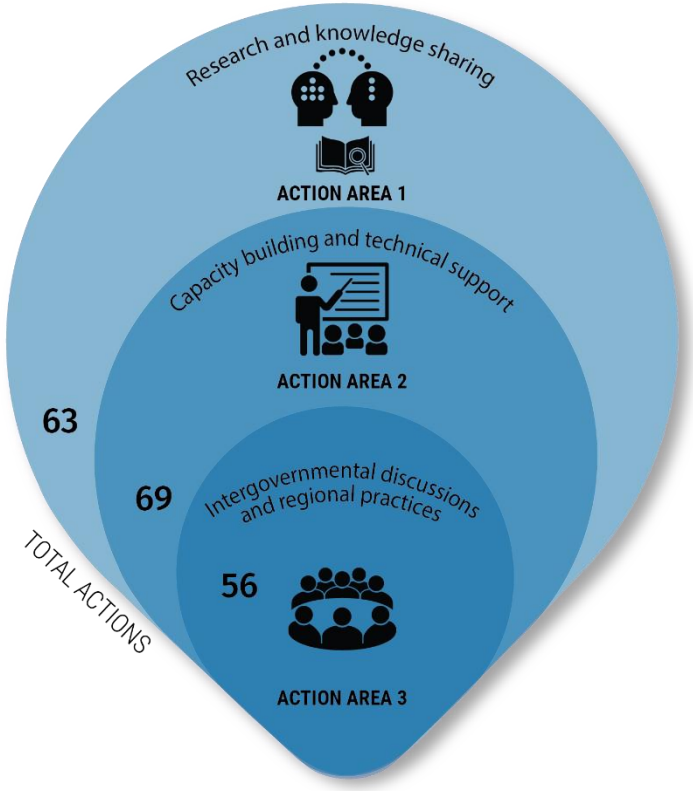


IMPLEMENTATION MODALITIES



188 Total actions

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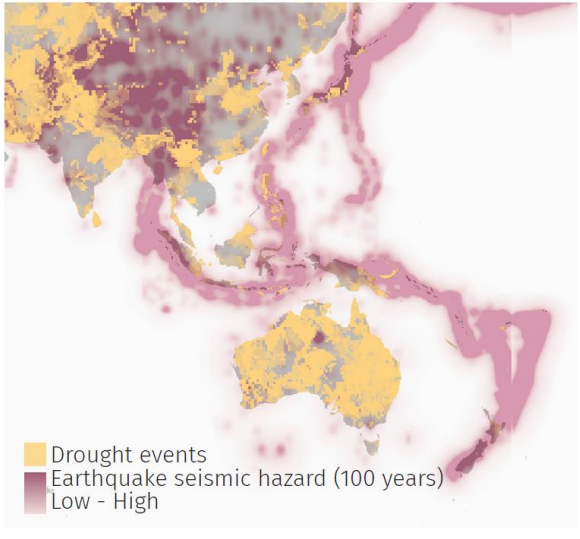
Theme: **Disaster Risk Reduction and Resilience**

Drought and Earthquake Frequency
(Source: ESCAP)



Asia and the Pacific is the most disaster-prone region in the world.

50 ACTIONS
3SDGs + SFDRR

Sub theme

- Innovation
- Risk Reduction
- Disaster Assessment
- Emergency Response
- Food Production
- Agroecosystem Resilience
- Precision Agriculture
- Climate Hazards

Sendai Framework for Disaster Risk Reduction 2015 - 2030

2 ZERO HUNGER

11 SUSTAINABLE CITIES AND COMMUNITIES

13 CLIMATE ACTION

Part 3

Way Forward: Implementing Phase I of the Plan of Action (2018-2022)

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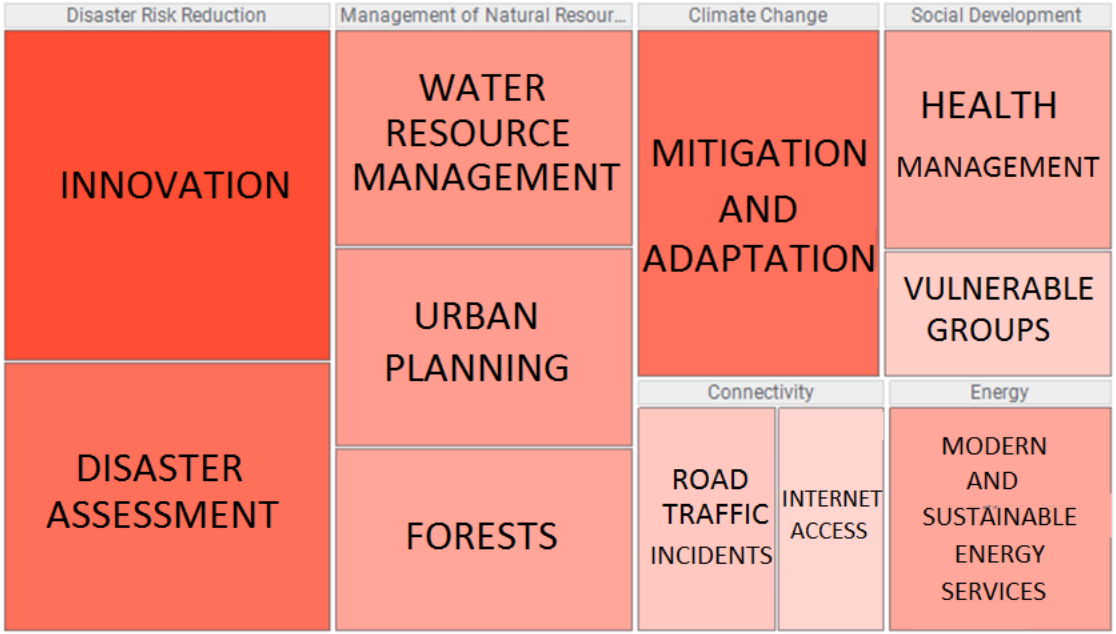
Country priority needs and contributions

Comprehensive survey to prioritize the most urgent steps to be taken during Phase I of the implementation of the Plan of Action (2018–2022)

Country Needs: most challenging topics by thematic area



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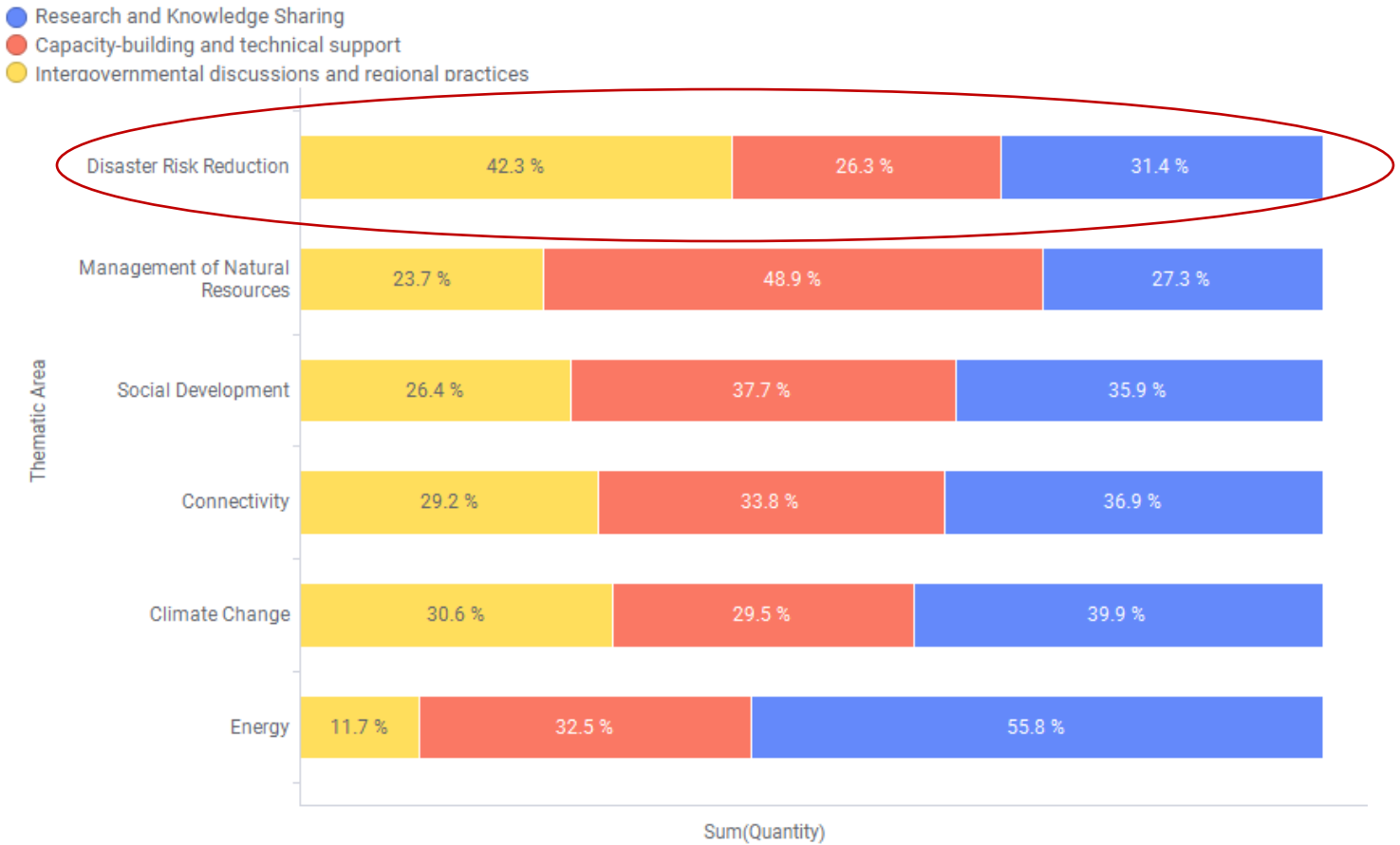
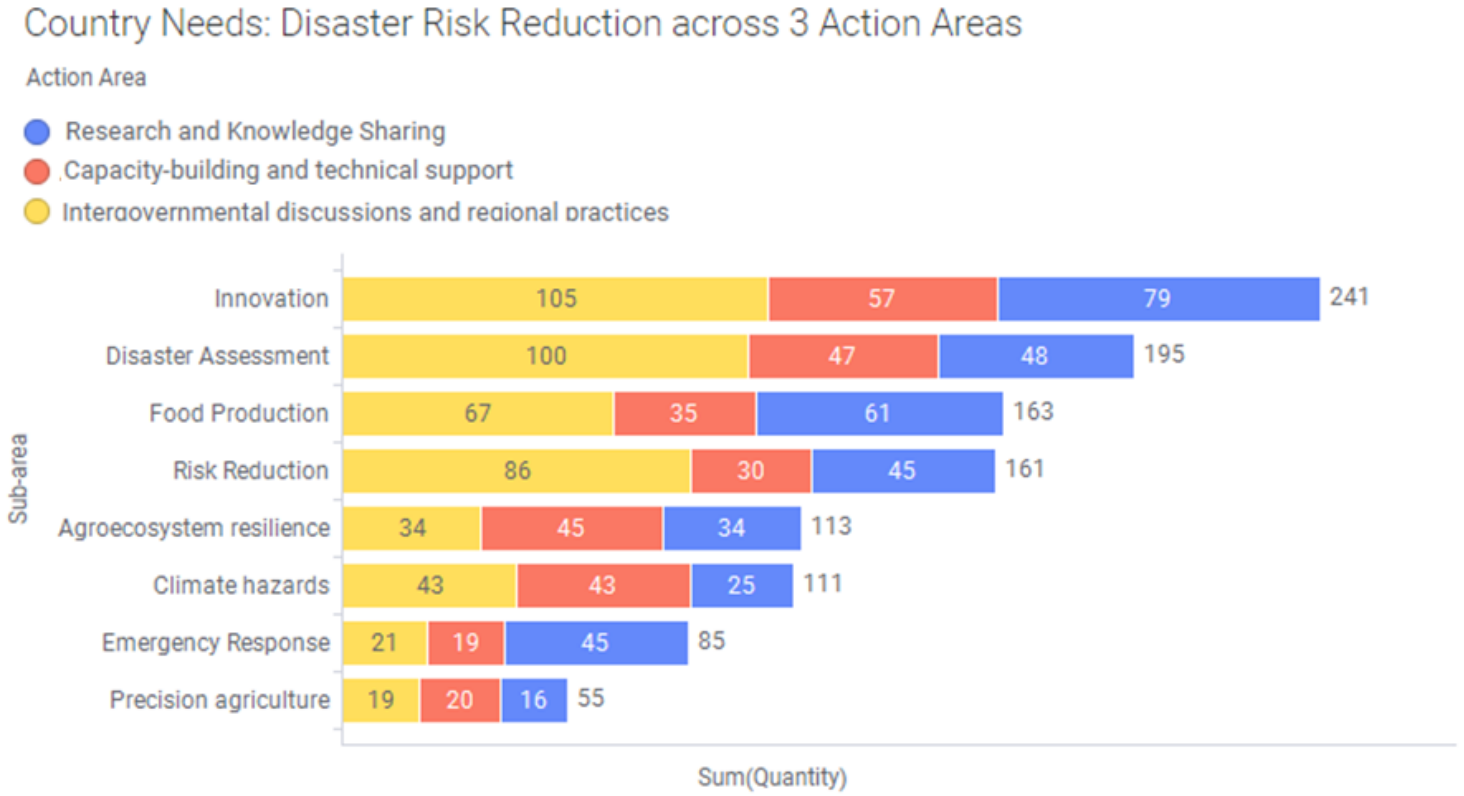
Country needs by theme and activity type



The biggest gap for DRR in the region is the lack of Intergovernmental Discussions and Regional Practices followed by Research and Knowledge Sharing



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UN-GGIM-AP

is one of the five regional committees of UN-GGIM. As the representing body of the National Geospatial Information Authority of 56 countries in Asia and the Pacific region, the UN-GGIM-AP aims to promote the use of geospatial information for identifying problems and finding solutions, so that the economic, social and environmental benefits of geospatial information will be maximized in Asia and the Pacific region.

ESCAP has taken over the secretariat of UN-GGIM-AP since November 2018, in order to strengthen the capacity of the member States in geospatial information management and to facilitate the dissemination of the outcomes and benefits of the activities of the Committee to the member States in the region.

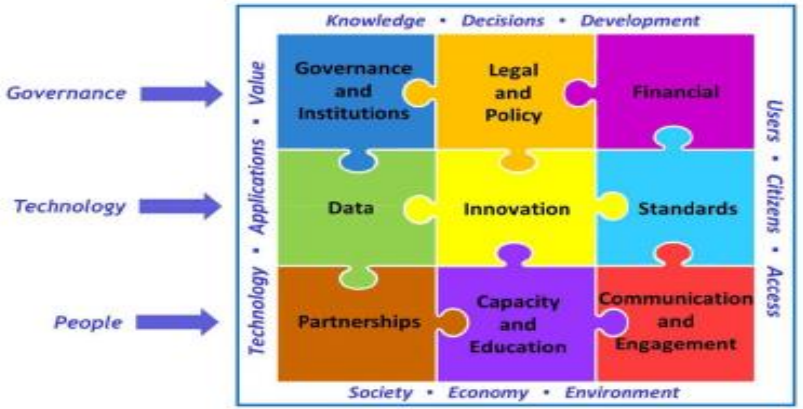
Working Groups:

- Geodetic Reference Frame
- Cadastre and Land Management
- Integrating Geospatial Information and Statistics

To support the global goals from the Sustainable Development Agenda and the Sendai Framework for Disaster Risk Reduction, UN-GGIM developed the

Integrated Geospatial Information Framework (IGIF).

The IGIF provides a basis and guide for developing, integrating and strengthening geospatial information management. Anchored by 9 Strategic Pathways, the Framework is a mechanism for articulating and demonstrating national leadership in geospatial information, and the capacity to take positive steps.



Strengthening institutional capacity on integrating geospatial and statistical data, with a focus on land accounts in Central Asia 2019–2021

- Enhance policymakers' knowledge and institutional capacity on statistical geospatial data framework and methodologies, tools, models, and good practices for land accounts.
- Support the initial development of strategies or action plans to promote a statistical geospatial data framework for land accounts in follow-up projects and activities.

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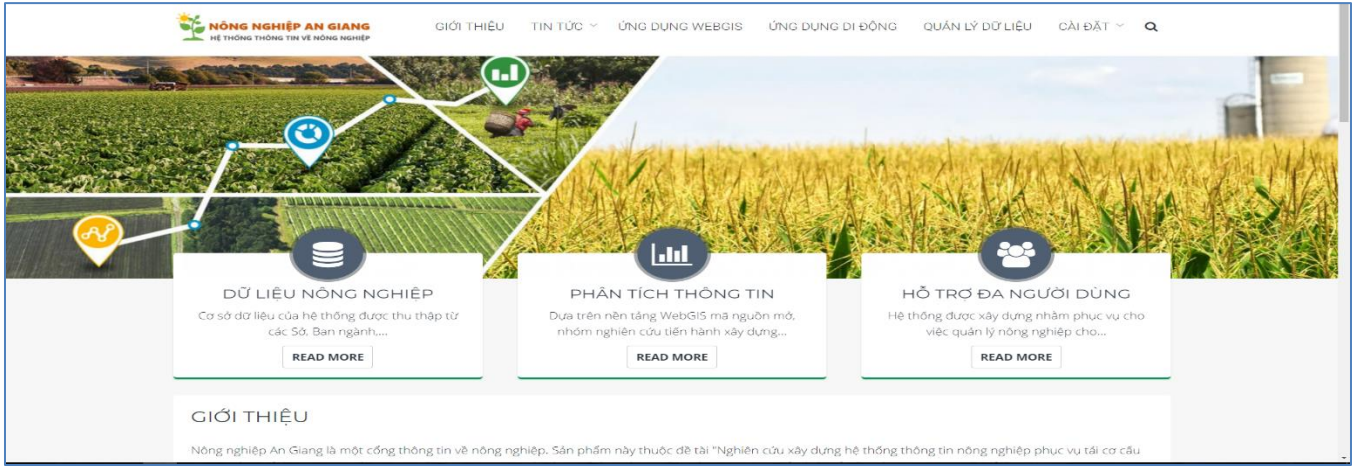
Developing common data format to improve the use and sharing of geospatial information for resilient and sustainable development 2018–2020

Pleiades imagery (10-10-2014)

SPOT imagery (29-03-2019)

- Build guidelines that would serve as point of entry for the storage, access and retrieval of geospatial data and information in a common format.
- Facilitate data sharing between end-users, providing them with crucial and commonly formatted information for better decision-making.
- Pilot countries in subregions: Cambodia, Indonesia, Thailand, Kyrgyzstan, Bhutan, Bangladesh, Mongolia, Fiji and Papua New Guinea.

Building resilient agricultural practices by integrating geospatial information for agricultural monitoring in the Lower Mekong Basin 2018–2022



- Strengthen the capacity of line ministries to identify suitable climate resilient agricultural practices through enhanced access to digital early warning monitoring information for climatic shocks.
- Develop a crop monitoring system and supporting data, information and applications which combines ground-based information with satellite data to calibrate the system to national conditions.

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Conclusion

- Bridge national demands and end users with regional information/service providers
- Engage end-users in multiple sectors including youth, academia and industries
- Strengthen implementation through enhanced partnership with regional and global stakeholders
- Leverage innovations in digitization, cloud computing, artificial intelligence, big data and IoT
- Guide national sustainable development and stimulate regional cooperation in support of the 2030 Agenda, Paris Agreement, and Sendai Framework for Disaster Risk Reduction, collectively the global sustainable development agenda

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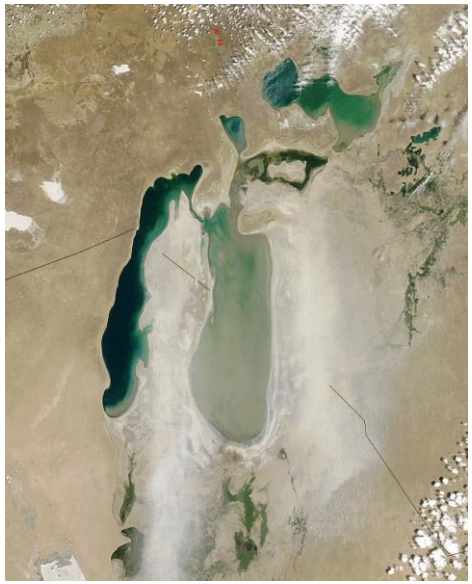

Thank you!

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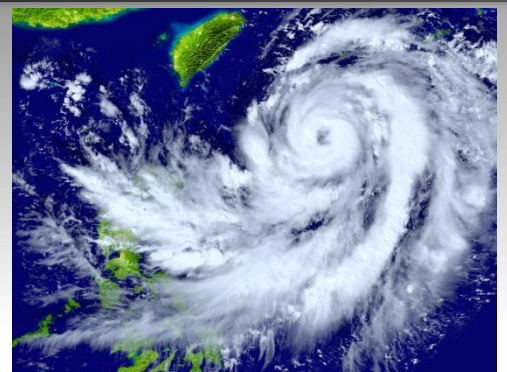
TECHNOLOGY INNOVATION FOR DISASTER RESILIENCE

7th Joint Project Team Meeting
Sentinel Asia, Bangkok
14 Nov 2019



Sanjay Srivastava

Chief, Disaster Risk Reduction Section
Information and Communications Technology and Disaster Risk Reduction Division

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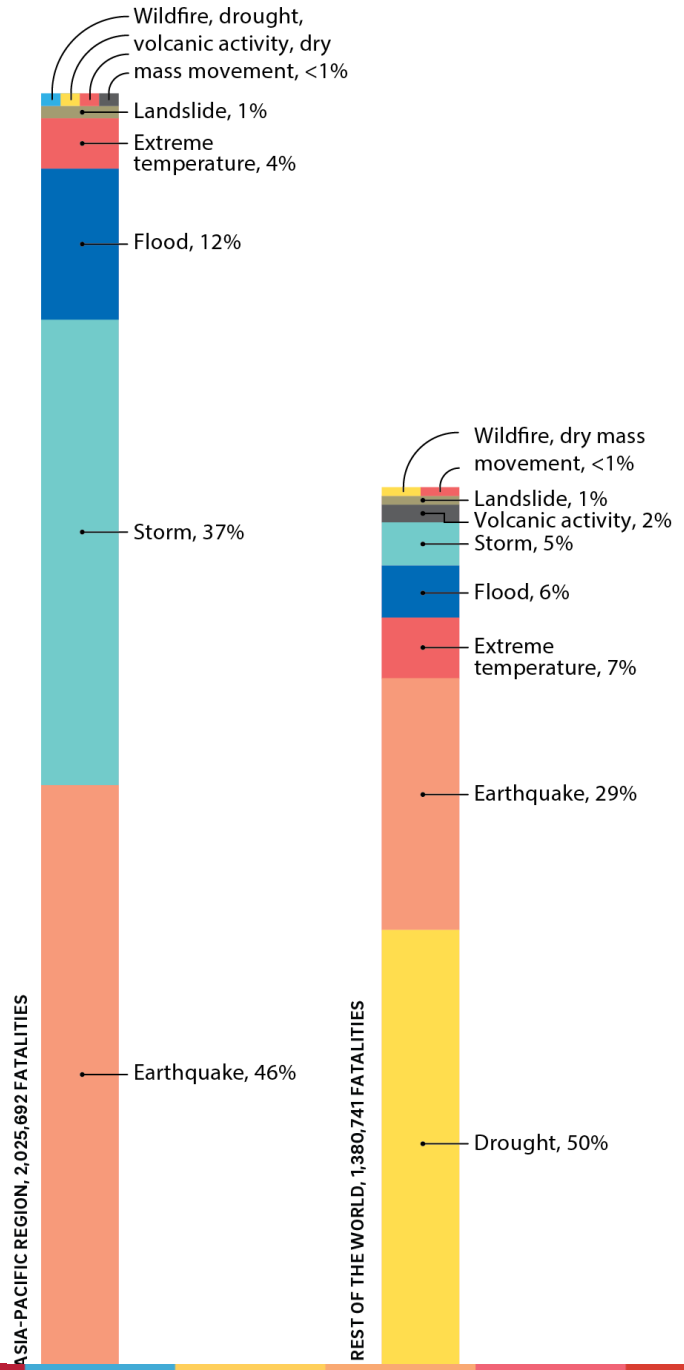
In Asia-Pacific region, the principal causes of natural disaster deaths were earthquakes and storms, followed by floods.

Fatalities from natural disasters, 1970-2018

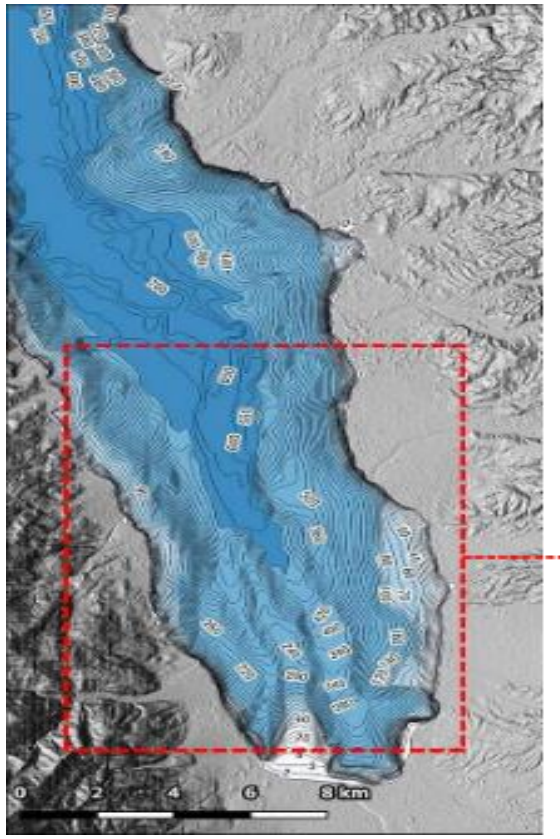


Asia-Pacific region: 2,025,692 fatalities

Rest of the world : 1,380,741 fatalities

Source: Based on data from EM-DAT (Accessed on 30 May 2019).
Note: From 1990, including data from countries of the former Soviet Union.

Indonesia's Earthquake and Tsunami of 28 September 2018 along the shores of Sulawesi's Gulf of Palu



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Risk complexities

coastal geomorphological contours

- The Palu earthquake and tsunami resulted in more than 2,000 fatalities with large scale damage and impacts.

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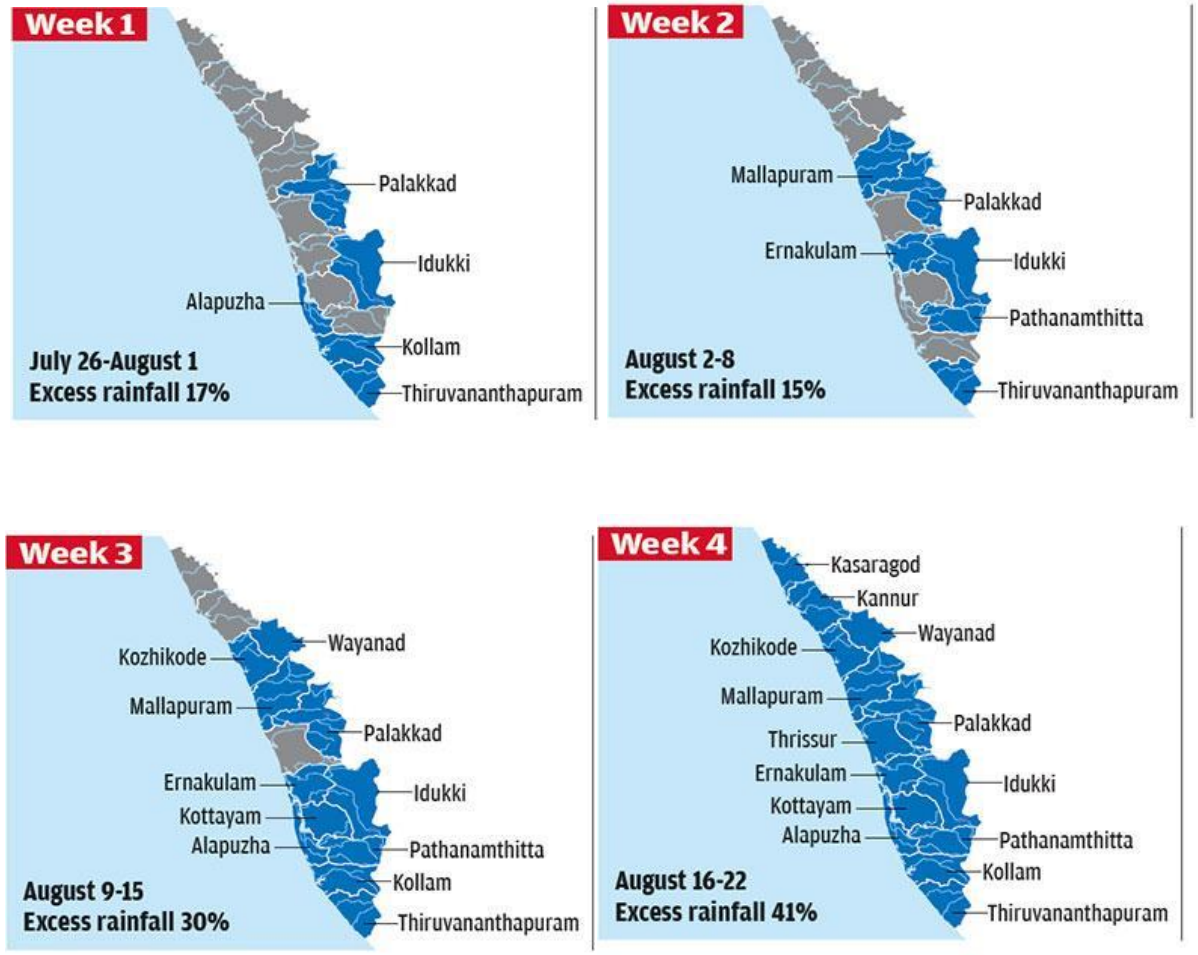
Kerala (India) Floods 2018:
Extreme event, cascading impacts



June – August 2018
Above 1000 dead

The torrential rains triggered several landslides and forced the release of excess water from 37 dams across the state, aggravating the flood impact

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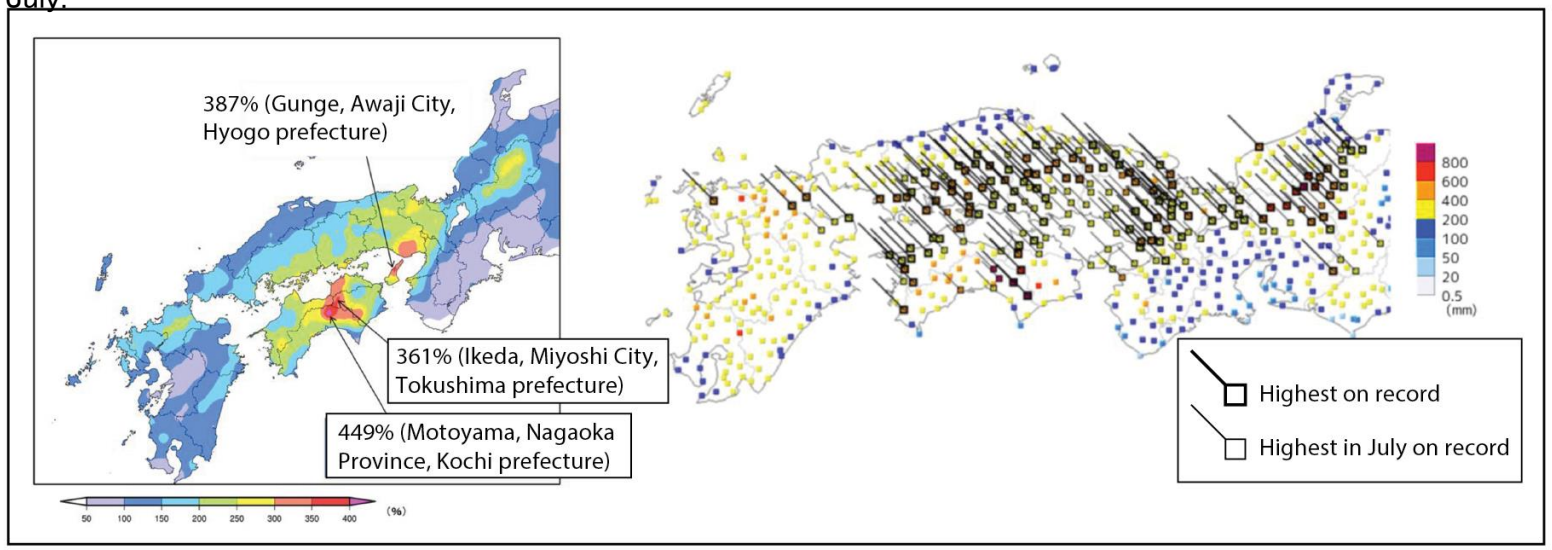
Heavy rainfall/ floods in Japan, 2018

Total precipitation as a percentage of the normal, July.

Maximum 72-hour precipitation during the event from Western Japan to the Tokai region



Source: JMA, 2018.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

In July 2018, record-breaking rainfalls particularly from western Japan to the Tokai region created a complex and unpredictable multi-hazard situation.

- Flooding caused rivers to breach their banks, carrying flows of debris and causing urban inundations.
- Eight dams in the area exhausted their flood control capacities.
- Prefectures in western Japan suffered significant economic damage.
- Around 232 people either died or went missing.

The heavy rain in July 2018 was followed by heat waves.

- This anomaly mean temperature was +2.8°C.
- The heat wave during the flood response phase, hospitalized 10,000 with heat-related illnesses. In Japan, the weather killed more than 300 in July 2018.

Disaster impacts have been outpacing the region's economic growth.

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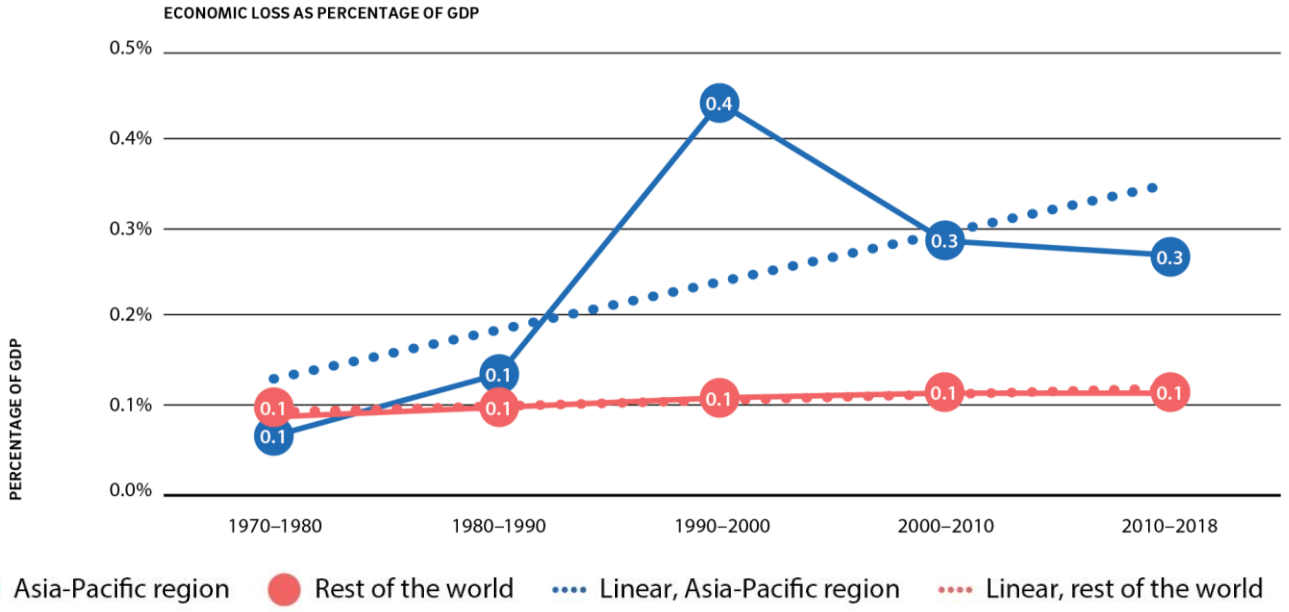
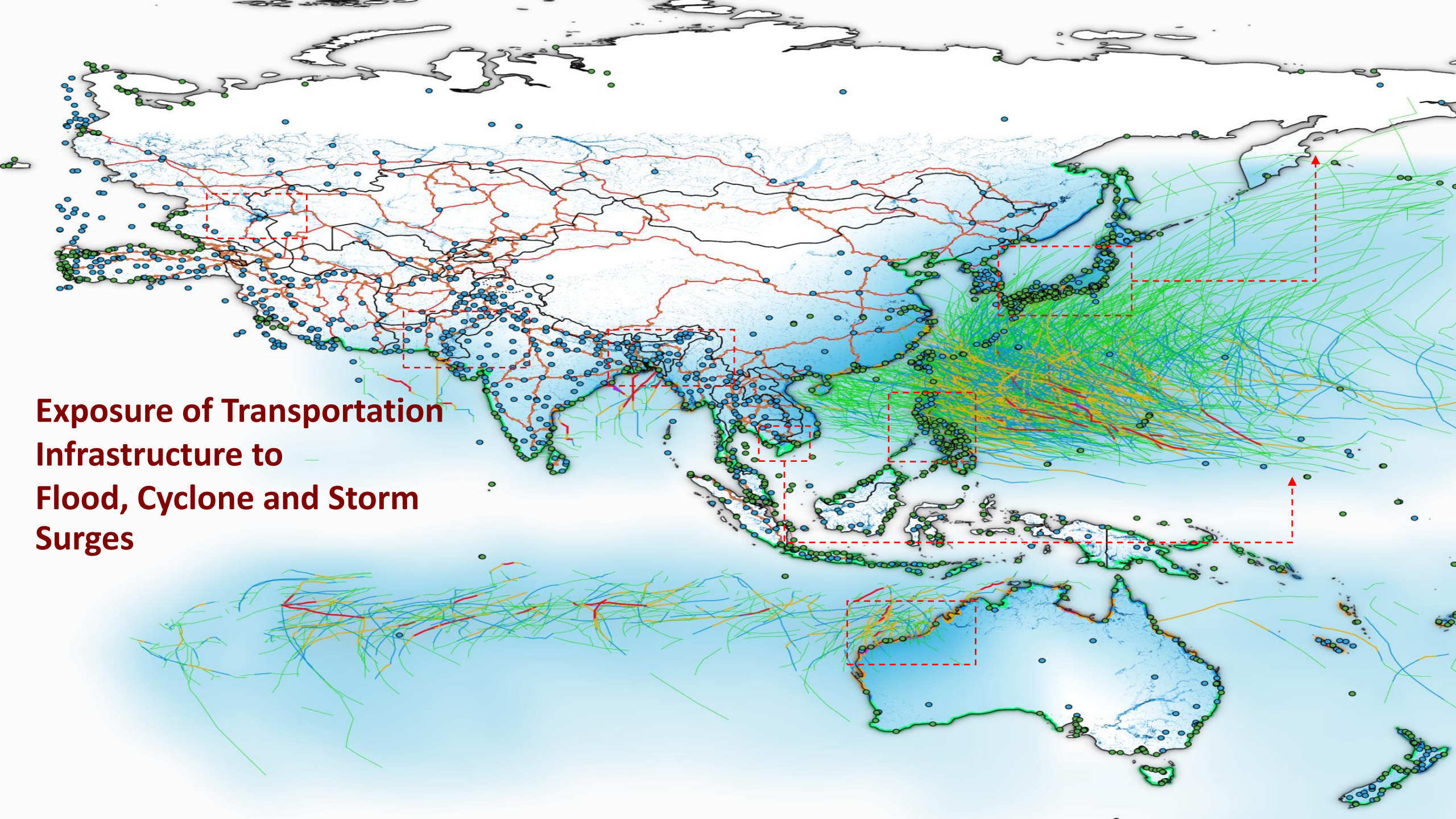
Average number of economic losses from natural disasters



Source: Based on data from EM-DAT (Accessed on 30 May 2019).

Between 1970 and 2018, the region lost $1.5 trillion due to disasters.

Disaster as a percentage of GDP cause more damage in Asia and the Pacific than in the rest of the world.


Exposure of Transportation Infrastructure to Flood, Cyclone and Storm Surges

With the inclusion of slow-onset disasters, annualized economic losses more than quadruple to USD 675 billion

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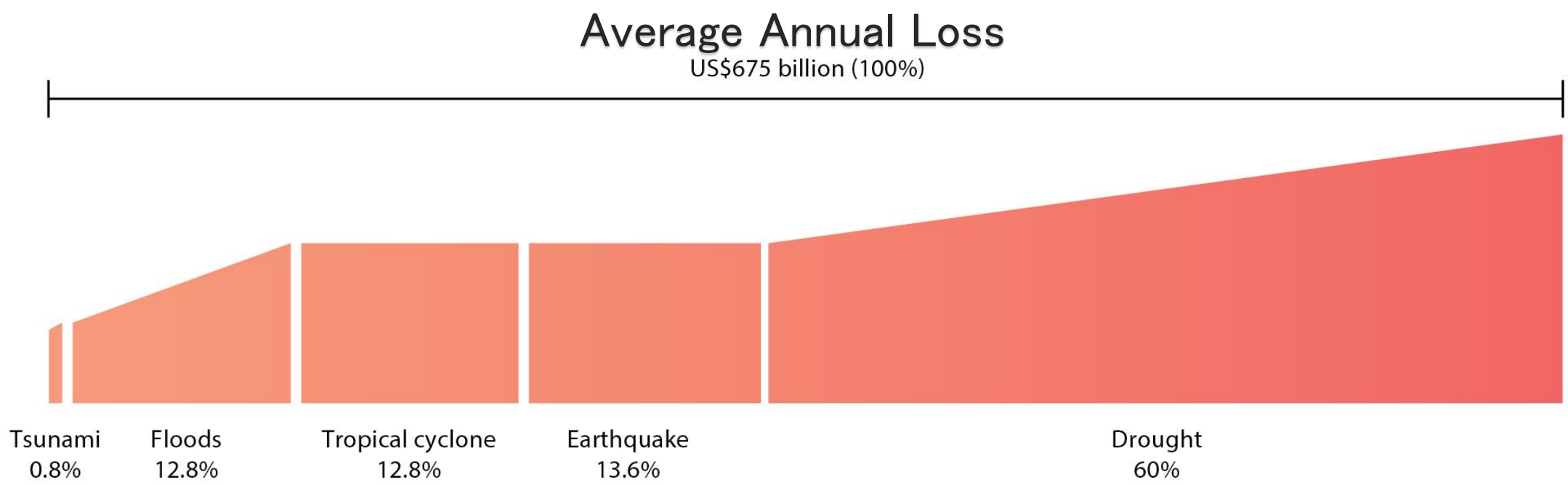
Region's Riskscape



Source: ESCAP based on probabilistic risk assessment.
Note: Volumetric analysis is a measurement by volume (impacted population, geographical area and economic losses).

Disaster resilience through big data and new technologies

- **Big Data mitigate the challenges of new climate reality**
- **Technology innovations enable adaptation to a new climate reality, empowering at risk communities**

Big data can help in all phases of disaster management

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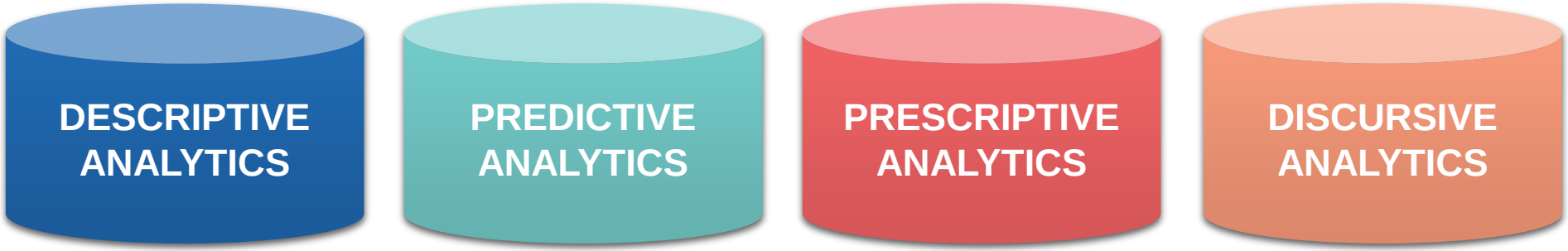


Using historical data to describe what occurred.

Focuses on predicting future probabilities and trends by linking static and dynamic data.

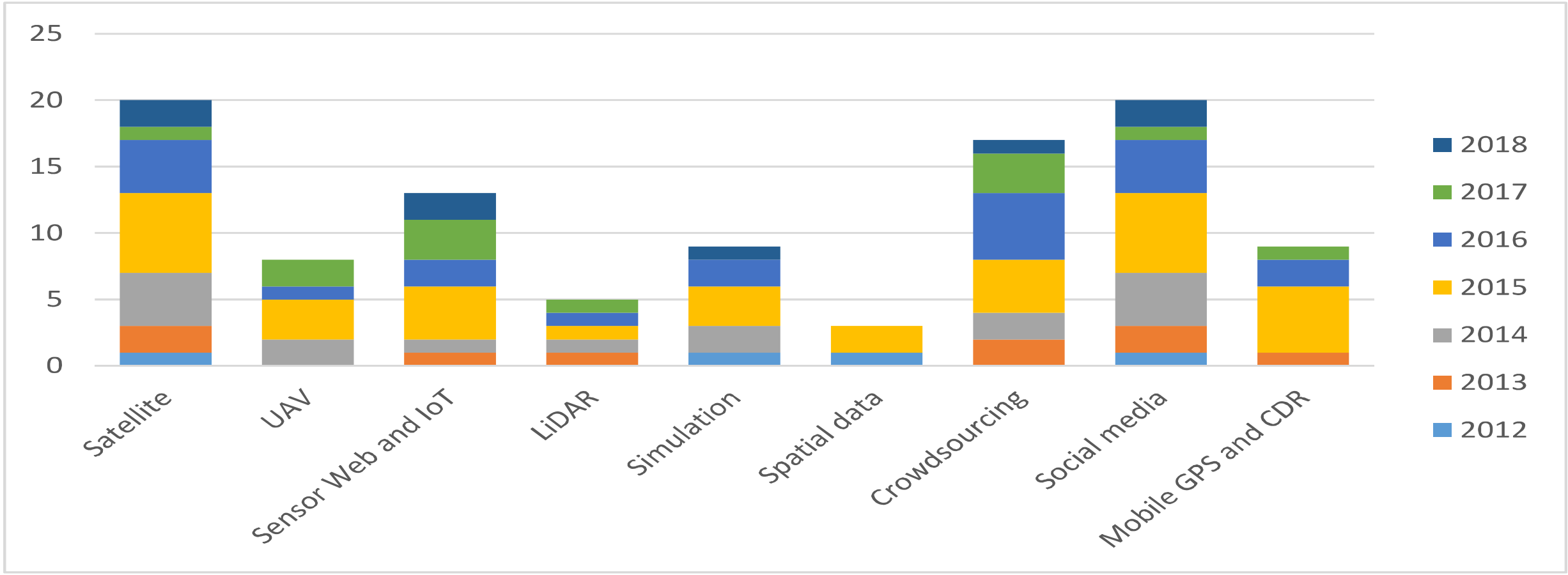
Policy making for disaster risk reduction.

Empowering community as end-users.

Big data can help in all phases of disaster management (pre-response and post-disaster situations) by filling in gaps in information flows in pre-, response and post-disaster situations, using four types of analytics: descriptive, predictive, prescriptive and discursive.

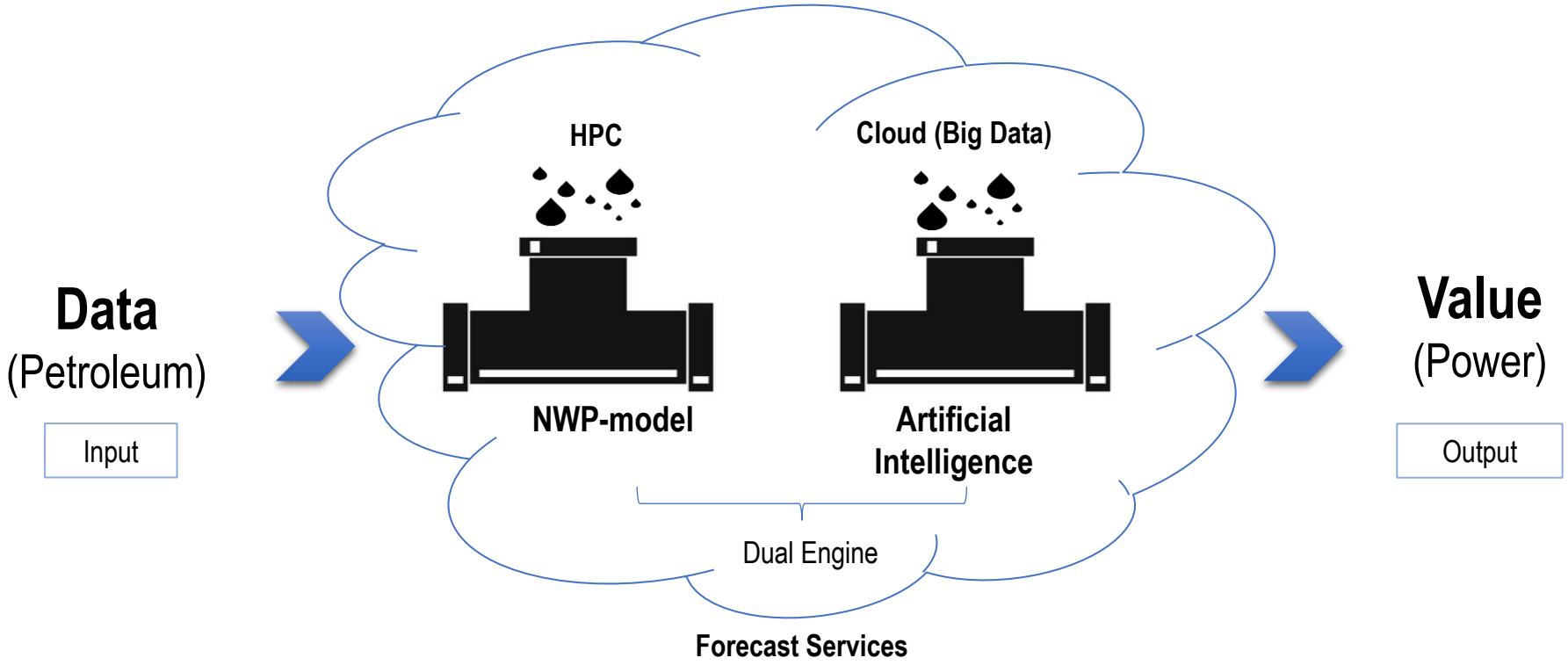
Big Data Sources in DRR

Increasing use of Satellite imagery, crowdsourcing, and social media



Source: **Manzhu Yu et al** reviewed articles by major data sources (2012-2018)

Gridded, Smart and Impact Based and Risk Informed Early Warning

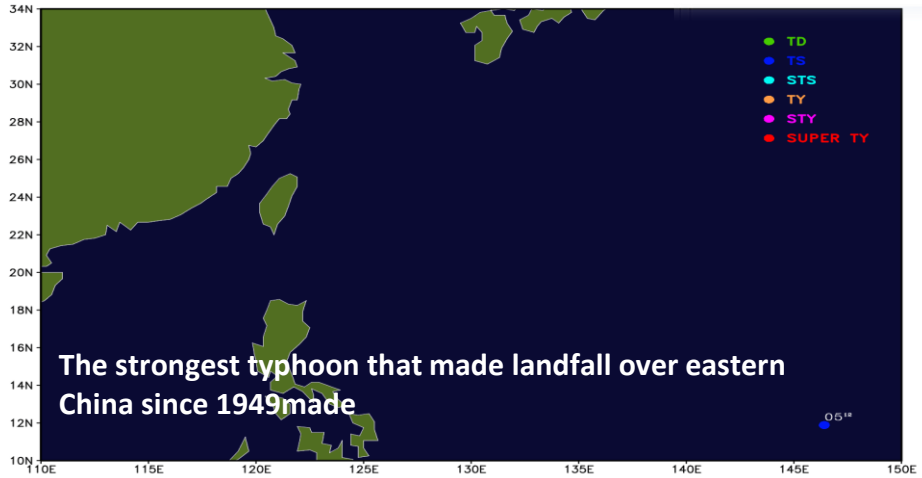


Source: CMA (2017)

Dual Engines for Meteorological Services:

Numerical Weather Prediction model + **AI** (Big Data Application)

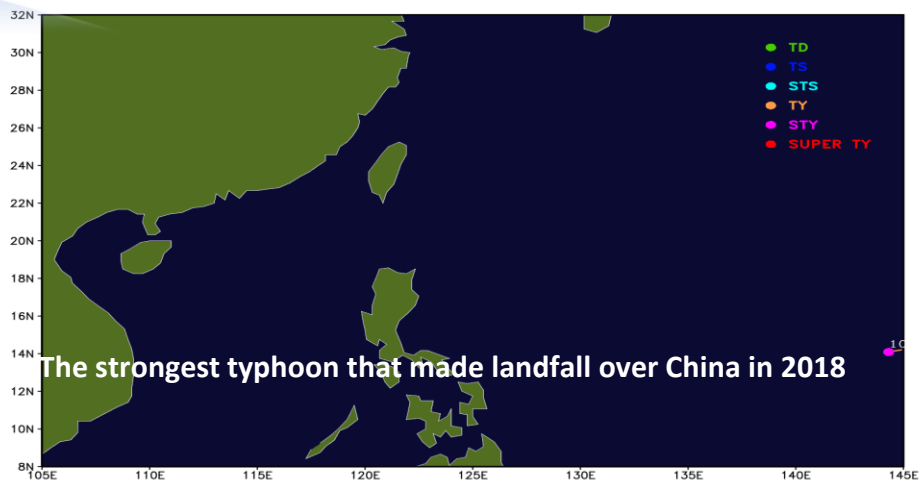
SAOMEI (2006)



SAOMEI made landfall over Zhejiang Province on 10 August 2006, with maximum winds up to 60m/s and minimum pressure 920 hPa.

SAOMEI killed **483 people**, 1.8 million people were evacuated, the total direct economic loss is around **19.65 billion** RMB.

MANGKHUT (2018)



MANGKHUT made landfall over Guangdong Province on 16 September 2018, with maximum winds 45m/s and minimum pressure 955 hPa.

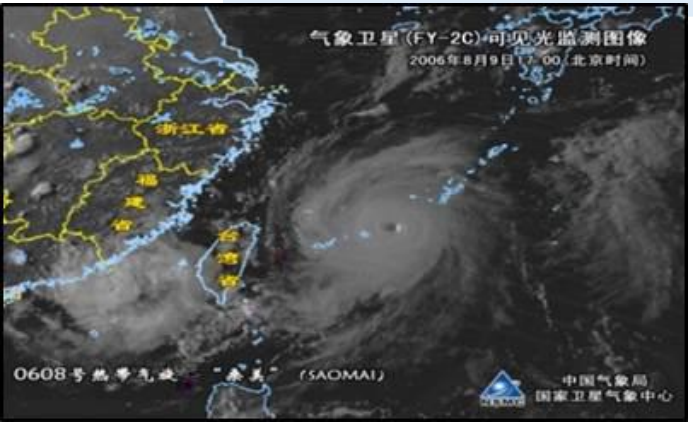
Only **6** people were dead due to MANGKHUT, 1.5 million people were evacuated, the total direct economic loss is around **14.23 billion** RMB.

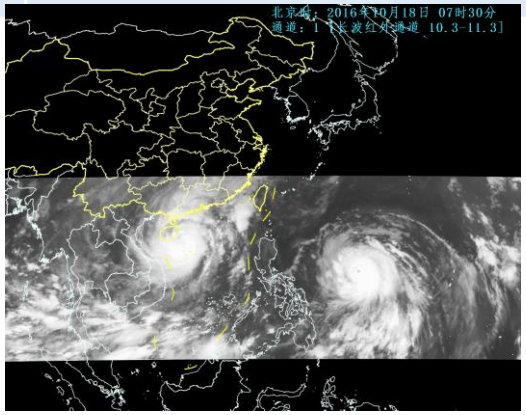
Source: WANG Jianjie, CMA 2019

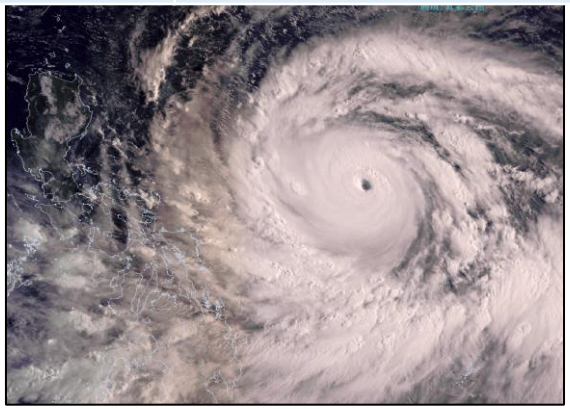
Improvements on Observations - Satellites

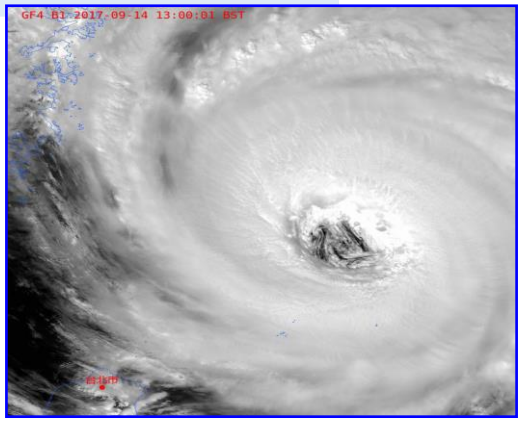
2006 → 2018

	2006	2018
Satellites on-orbit Geostationary Polar Orbit	3 FY1D FY2C¥D	8 FY4A¥2E¥2F¥2G¥2H FY3A¥3B¥3C¥3D
Time Resolution	30 min (FY-2)	5 min (FY-4A)
Horizontal Resolution	1.25km (FY-2)	500 m (FY-4A)
Channel Num.	5 Channel (FY-2) 3 Channel (FY-1A/B)	14 Channel (FY-4) 10 Channel (FY-3A/B)
Instrument Payloads	2(FY-1A/B) 1(FY-2A/B/C/D/E)	10 (FY-3D) 3 (FY_4A)): AGRI, GIIRS, LMI



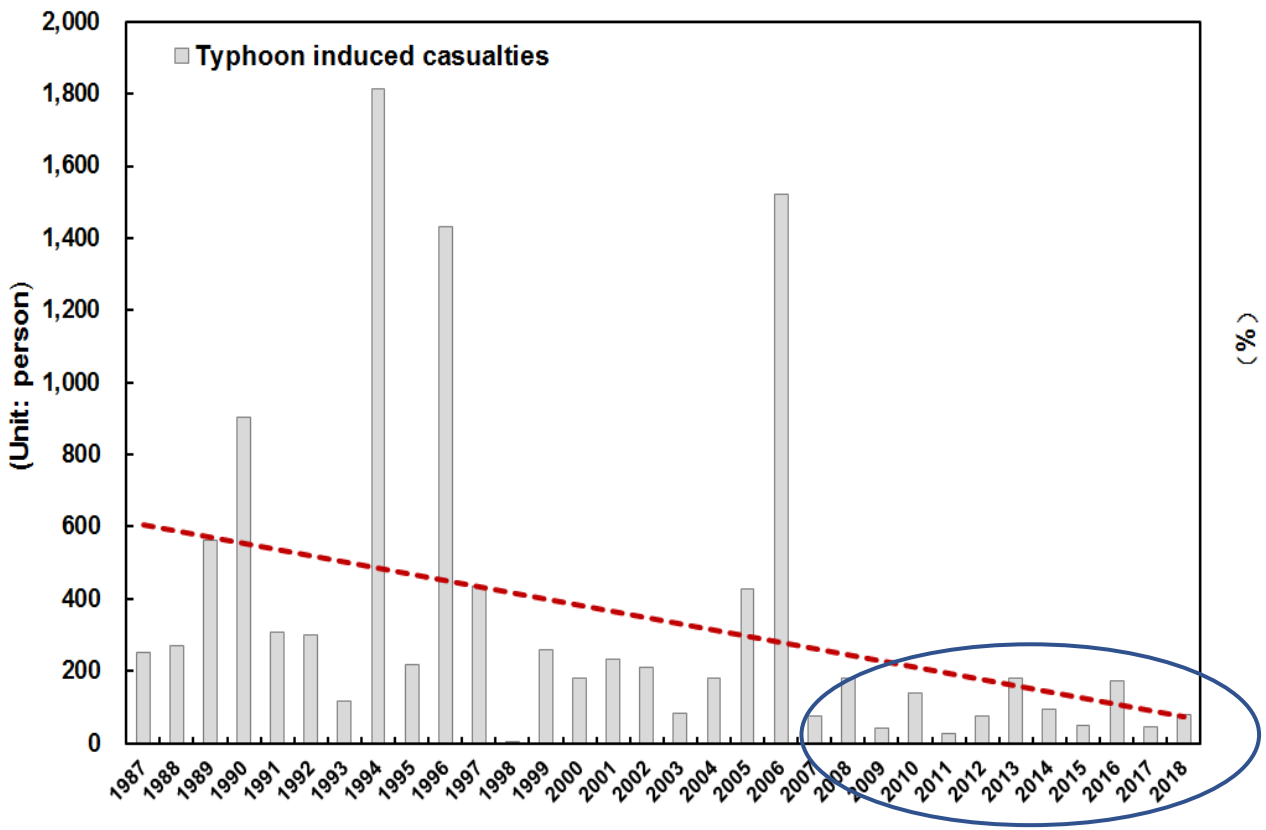


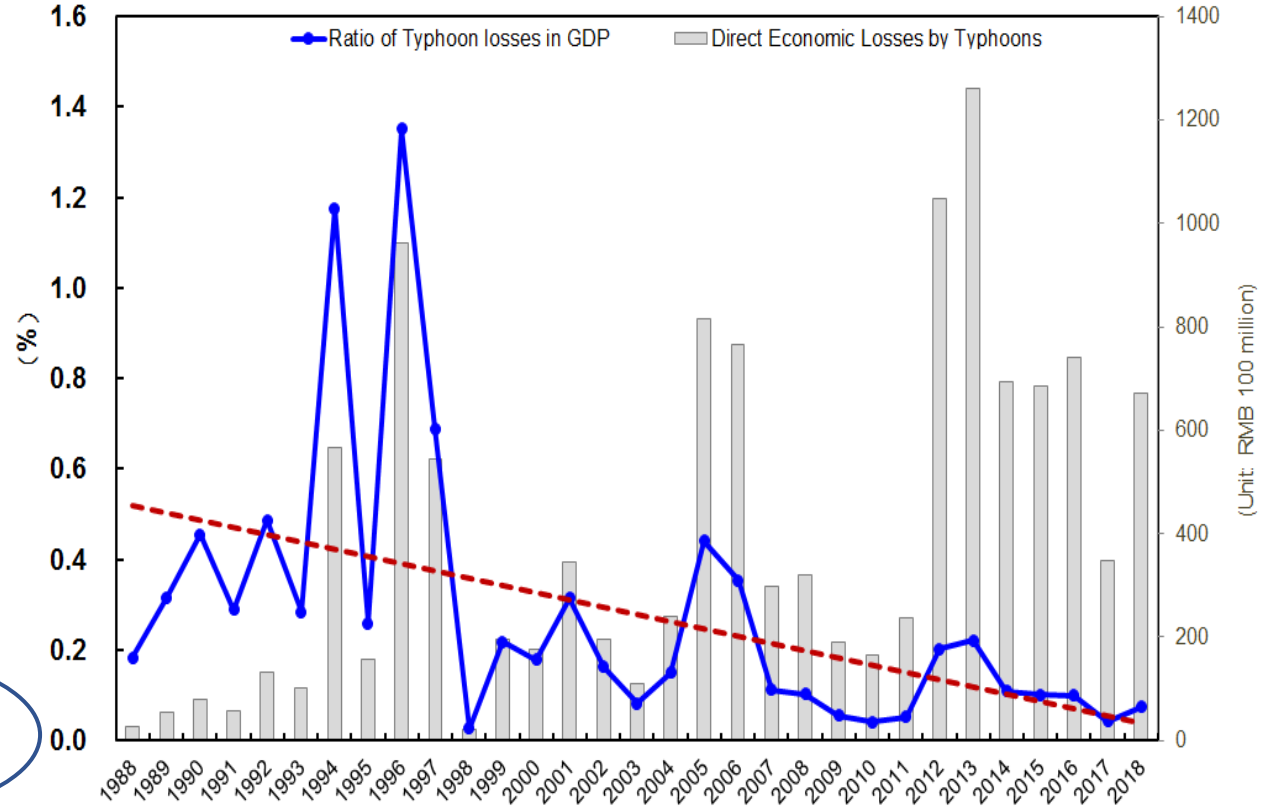




Source: WANG Jianjie, CMA 2019

China: Typhoon Induced Casualties and Economic Losses in past 30 years





Due to the improvement of typhoon forecasts and warnings, and more effective emergency responses for typhoon events, **the casualties and the ratio of typhoon-induced losses to GDP reduce remarkably**

Source: WANG Jianjie, CMA 2019

Impact-based forecasting to saves lives – Northern Vietnam flood, 2 July 2019

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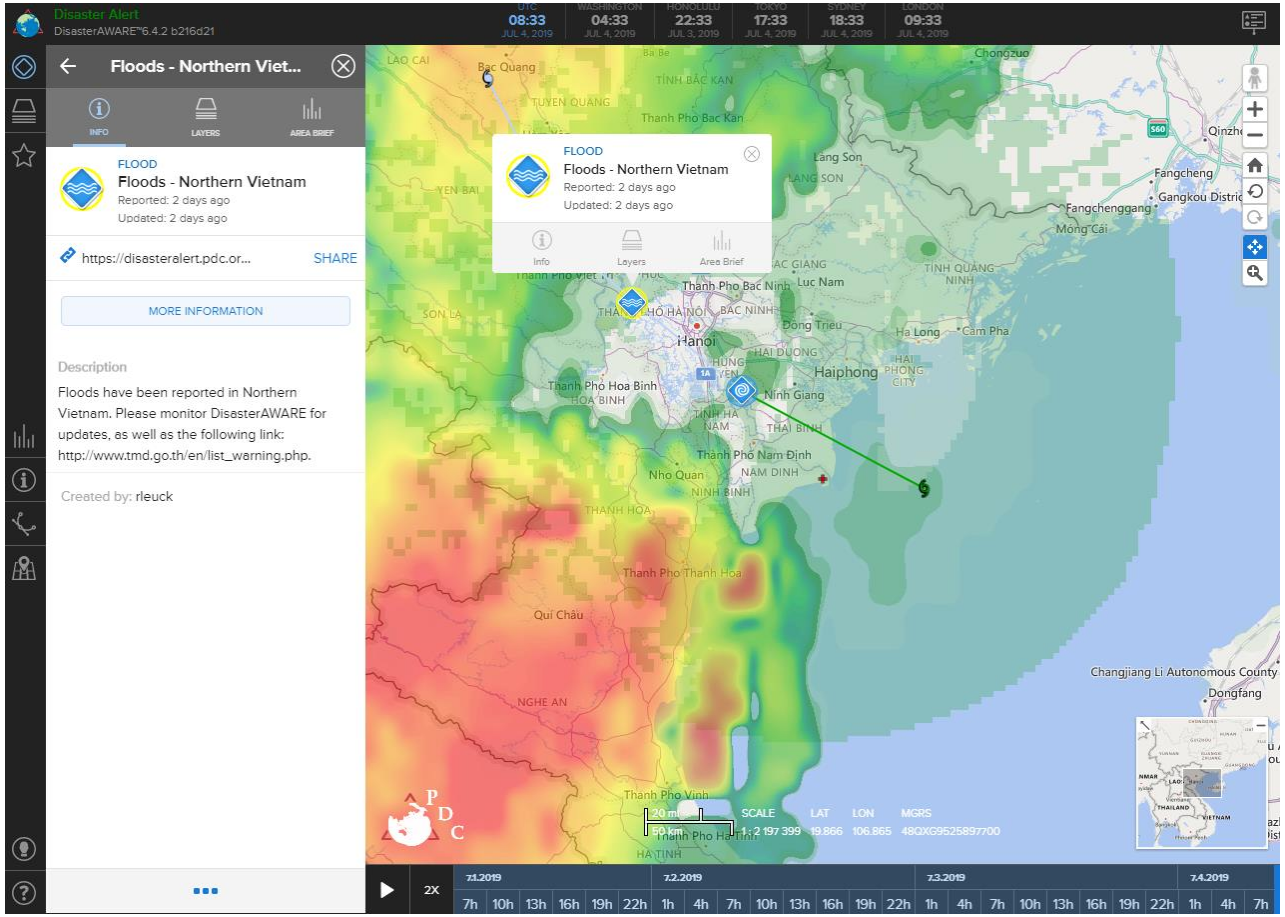


Source: Pacific Disaster Centre 2019.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Estimated population, household and capital exposure to 2 July 2019 flood.

Estimated data within 100 km of the event

19.2 Million	5.02 Million	77.2 Billion
people	households	capital

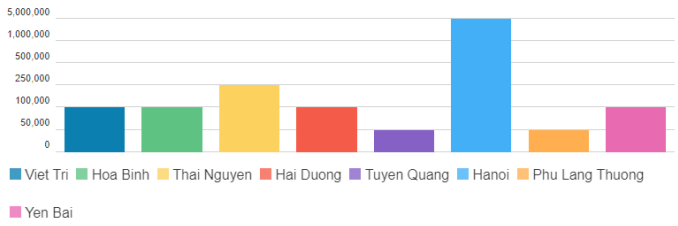
	Population					Capital USD				
	DISTANCE	TOTAL POPULATION	AGE 0-14	AGE 15-64	AGE 65+	RESIDENTIAL	SERVICE	INDUSTRIAL	SCHOOL	HOSPITAL
	0-10km	441,233	99,730	313,528	27,975	338 Million	447 Million	518 Million	178 Million	2.5 Million
	10-30km	2,664,384	602,219	1,893,236	168,929	2.27 Billion	3 Billion	3.47 Billion	1.19 Billion	16.8 Million
	30-100km	16,173,359	3,655,591	11,492,337	1,025,431	15 Billion	19.8 Billion	22.9 Billion	7.89 Billion	111 Million
	Total	19,278,976	4,357,540	13,699,101	1,222,335	17.6 Billion	23.2 Billion	26.9 Billion	9.26 Billion	130 Million

Population Data:

2017
Vietnam

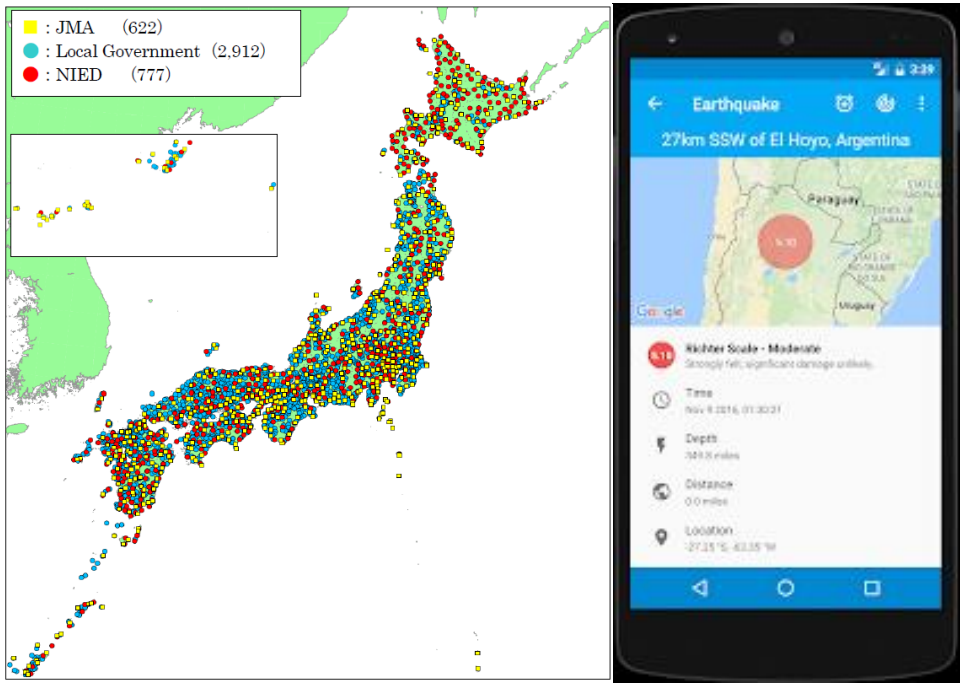
Total: 94,614,637
Max Density: 93,489 (ppl/km2)

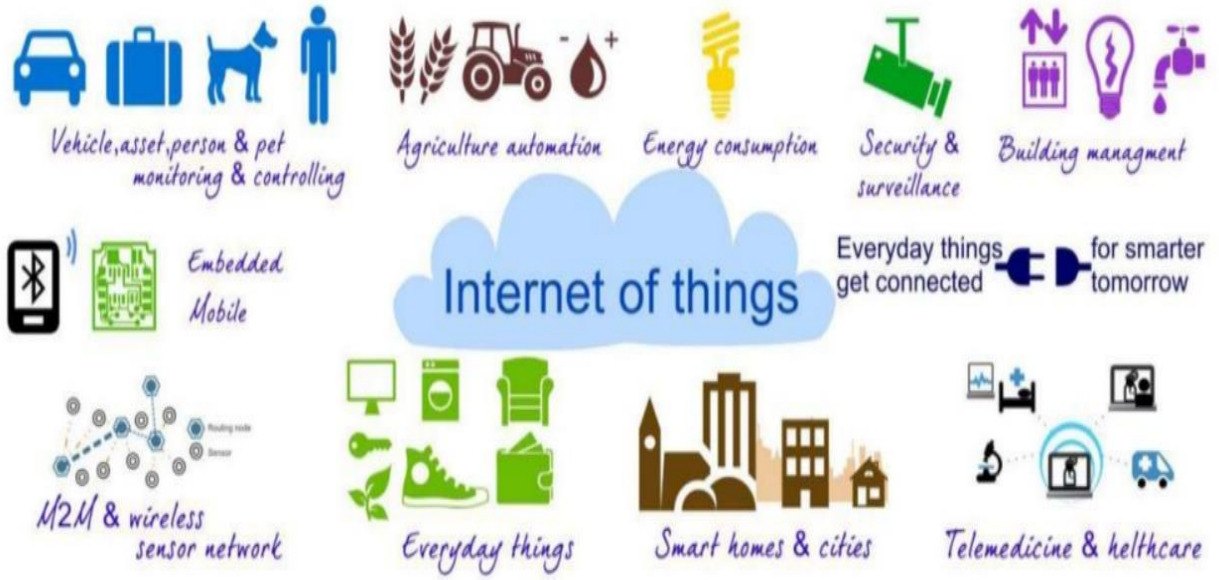
Populated Areas:



Early warning alerts and decision support systems with details on alert area, hazard distance; estimated population, households and capital; as well as infrastructure and critical facilities such as airport, seaport, emergency operation center, power plants, and hospitals.

Predictive analytics of IoT provides affordable earthquake early warning to communities





Source: Japan Meteorological Agency (2012), Android weather apps (2016) and Slideshare.net (2015)
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Startups like Zizmos (Stanford University) uses smartphone apps with cloud messaging services to detect motion and serve as seismic sensors in high-risk areas.

Emerging technologies such as digital identity and big data offer unprecedented opportunities for including and empowering people

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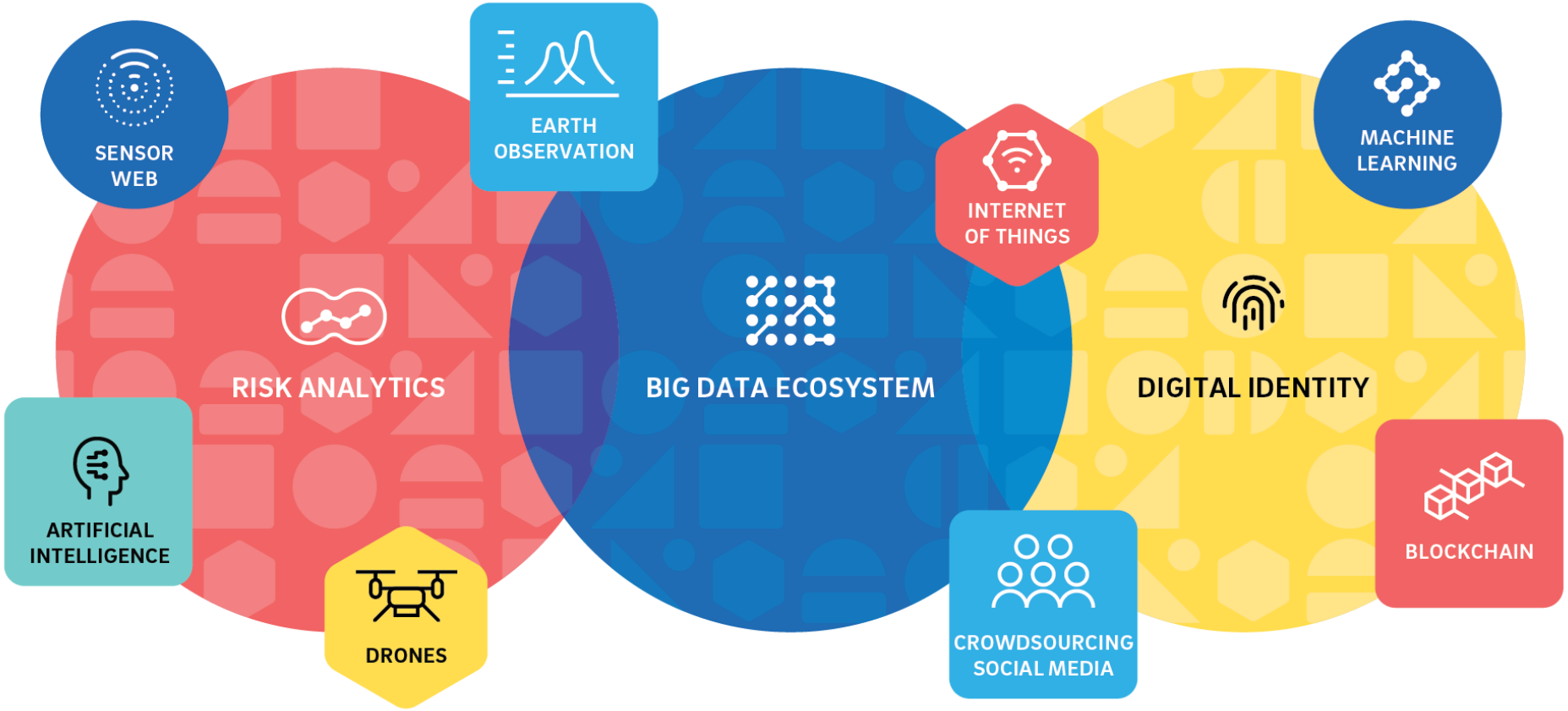
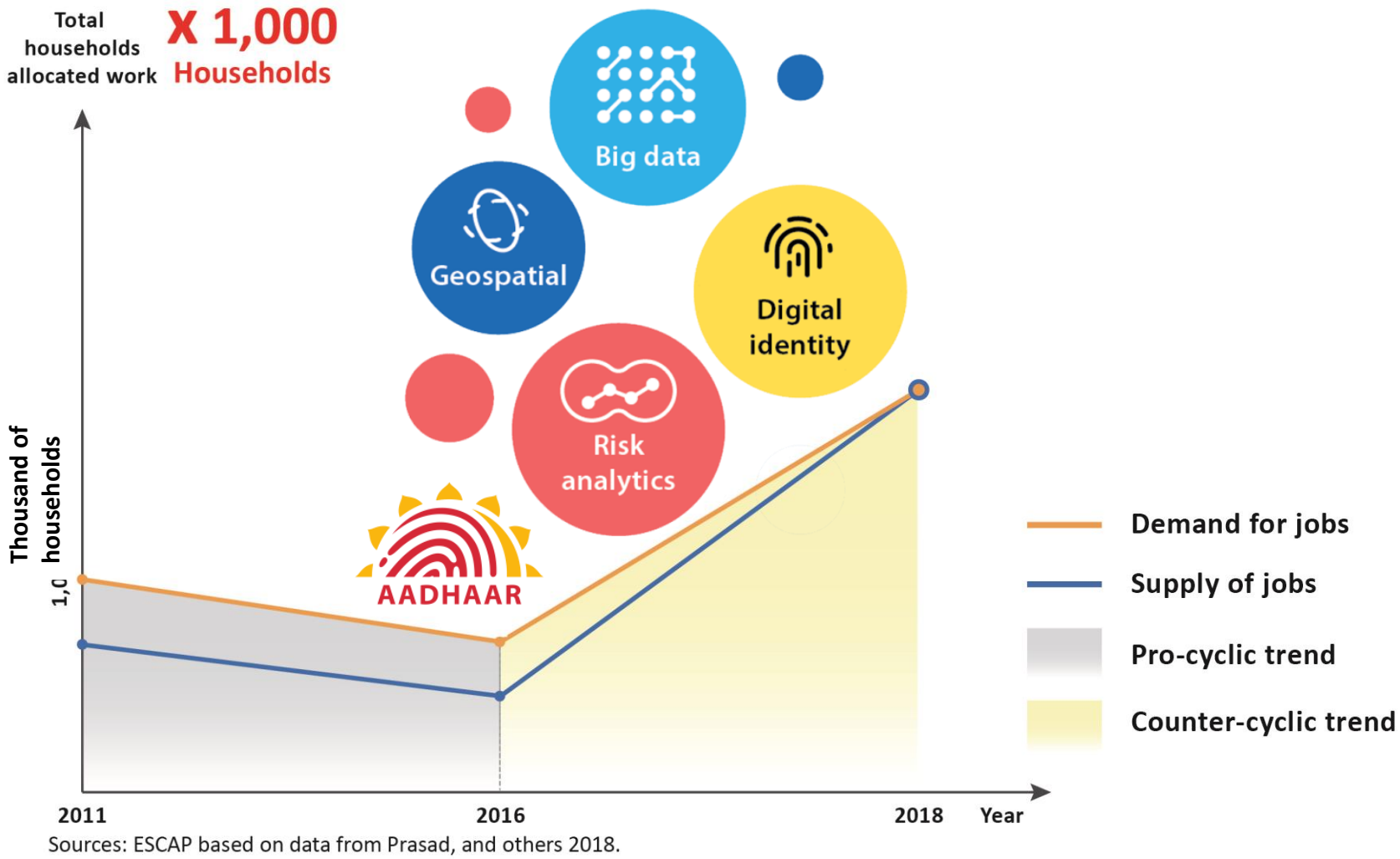


Making big data work for individual empowerment

Technology innovations enable adaptation to a new climate reality, empowering poor - at risk - communities

Innovations turned a pro-cyclic into counter cyclic policy interventions

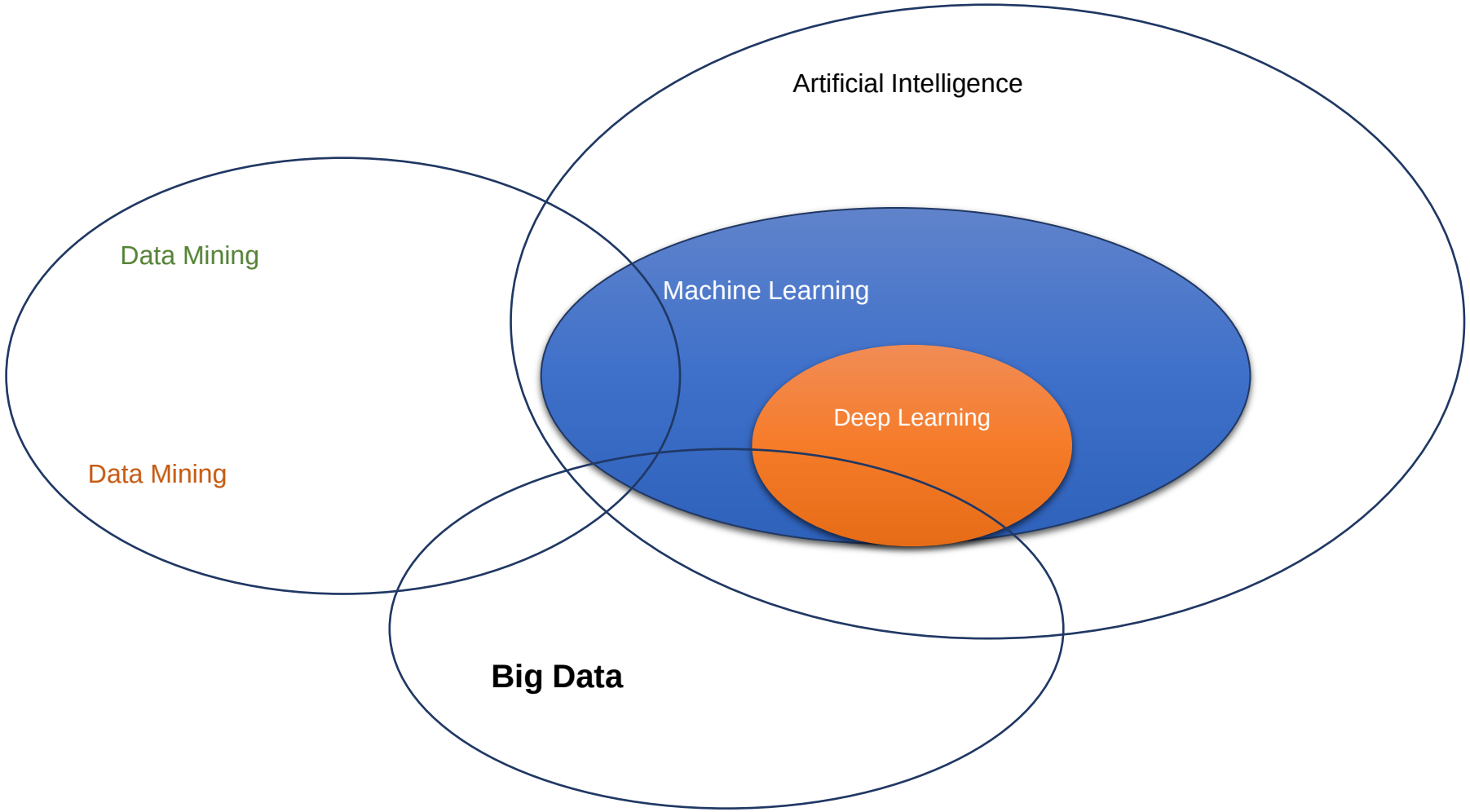
Benefited millions of drought affected poor and vulnerable famers/landless laborers in India

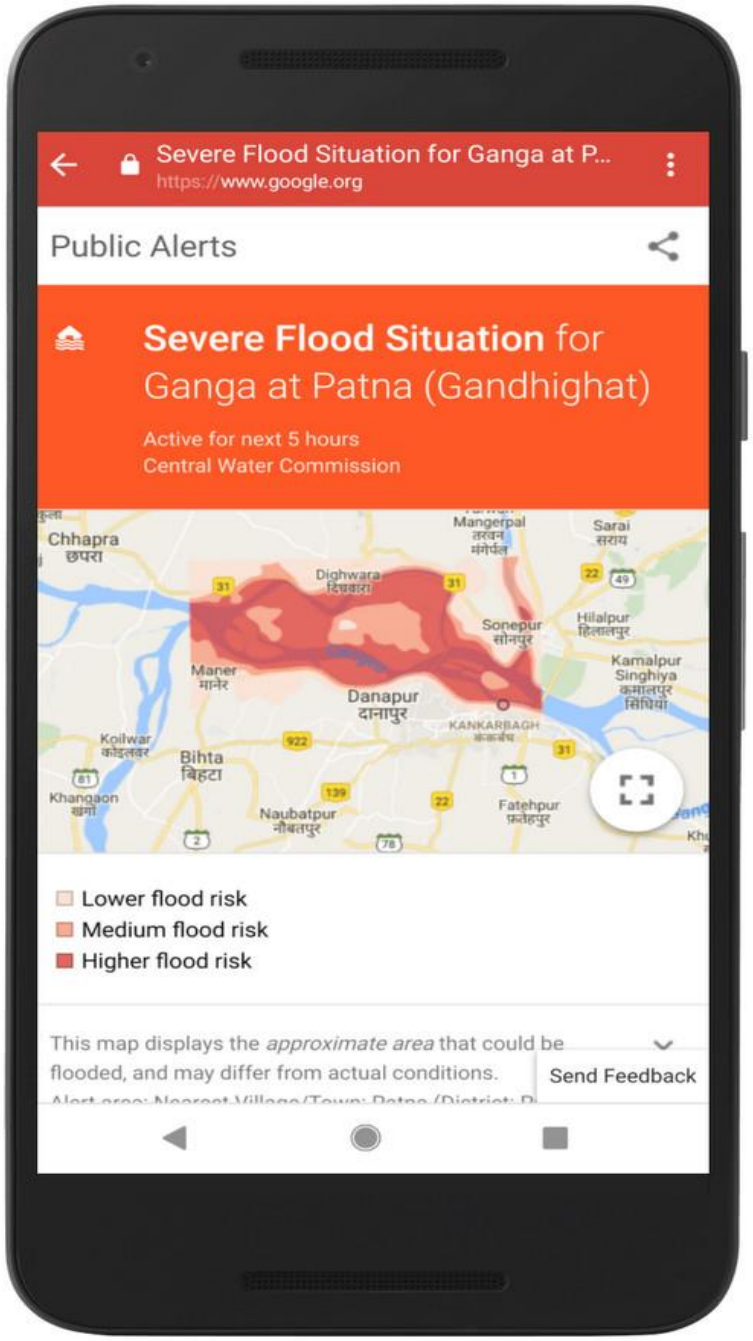


Sources: ESCAP based on data from Prasad, and others 2018.

Emerging trends:

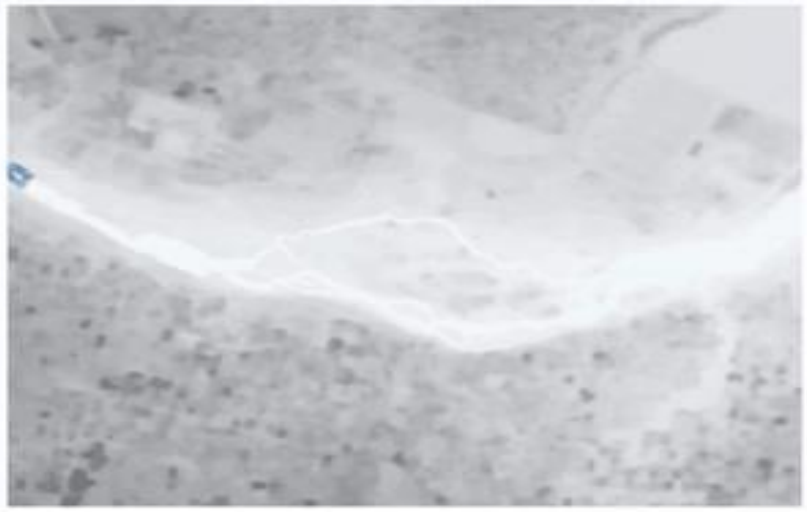
Big Data and its interface with Machine Learning





Global Google Public Alerts program (Big Data and Machine Learning)

AI-assisted flood predictions



AI and significant computational power to create better forecasting models through Google Public Alerts. A variety of elements—from historical events, to river level readings, to the terrain and elevation of a specific area—feed into these models.

It generates maps and run up to hundreds of thousands of simulations in each location to accurately predict not only when and where a flood might occur, but the severity of the event as well.

Three Key challenges

Big Data Collection

Challenges of dealing with large variety of heterogeneous data from different data sources- from sensors to crowdsourcing, including time series, semi-structured and invalidated data, and textural data; also noise and misinformation.

Big Data Analytics

Analytics yet to integrate reliably and accurately Crowdsourced data, from the disaster affected people, into the physical sensing data (e.g., satellite, UAV) and authoritative data (e.g., terrain data, census data).

Cyberinfrastructures

It's important for effectively integrate huge data from multiple sources for real-time decision making in the context of the emerging data volume of streaming videos, fast data transfer, and intuitive data visualization.

Thank you for kind attention !

For any query – please do consult:

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