

Regional Collaboration on Disaster Mitigation

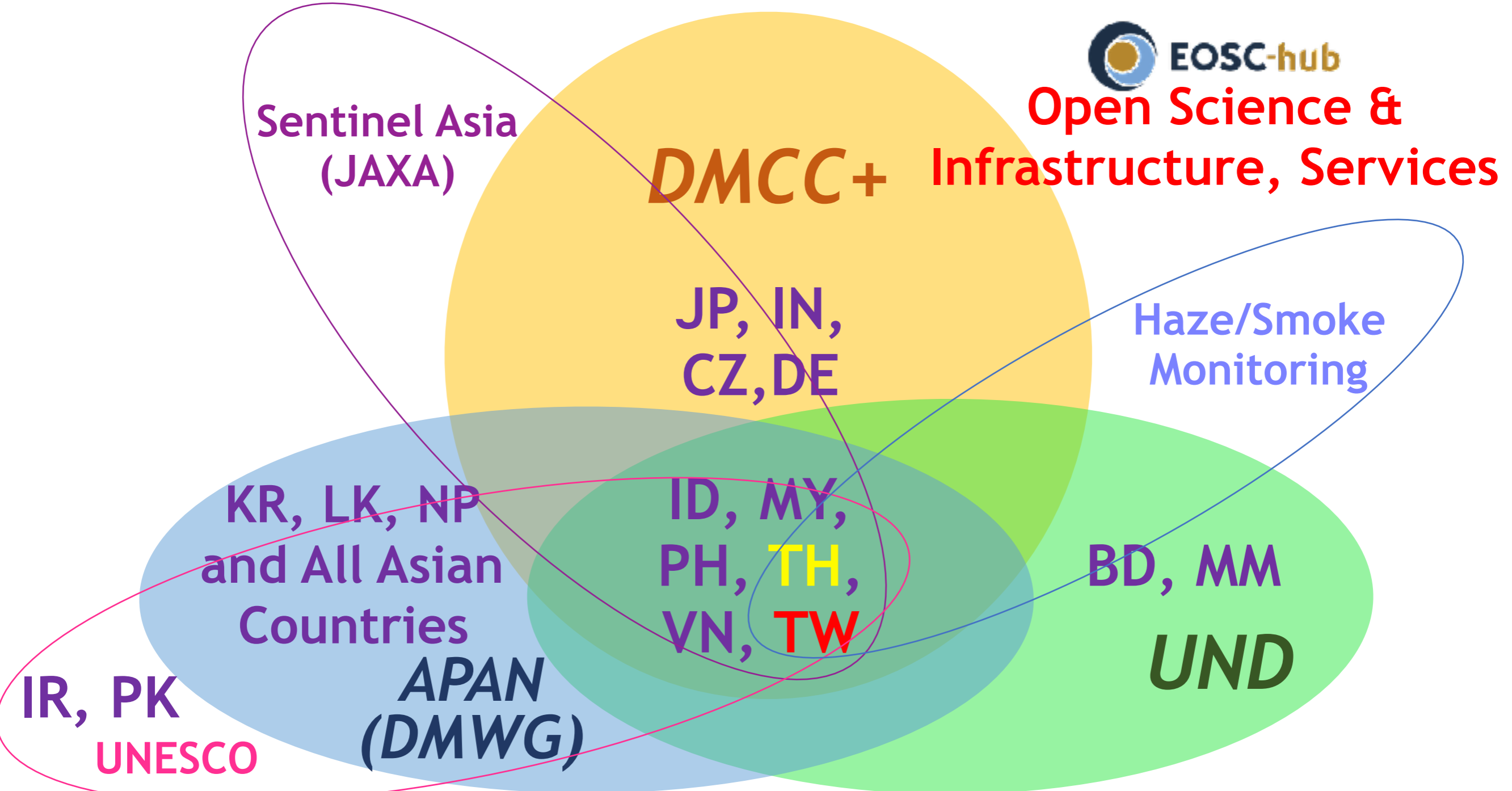
Eric Yen & Simon Lin

**Academia Sinica Grid Computing Centre (ASGC)
Taiwan**

ISGC2018

19 March 2018

APAN Serves as Regional Collaboration Platform



APAN: Enabling adv. R&E applications by networking & collaborations (NREN, Community, Application)

Asi@Connect: Leverage e-Infrastructure for public services by TEIN network

Approaches of Disaster Mitigation by Deeper Understanding

Simulation is conducted with optimal IC, BC and parameterization with best knowledge based on the observation data.

Having systematic risk analysis and profiling on underlying causes, drivers of the risks

Requirements

Scenarios Historical Cases Observation Data

Output

Science Discovery & Advancement

Knowledge of Underlying Science & Theory

Knowledge Base

Observation provides necessary description of current status of earth system to make NS start with best estimation of IC

Model Improvement

Event Modeling & Parameterisation

Numerical Simulation

e-Science infra, app, system perf and workflow optimization

Simulation & Analysis

Simulation Portal or Application Gateway Services

Models capture key atmospheric dynamics and use right physical parameterization so that samples of prediction can be generated accordingly

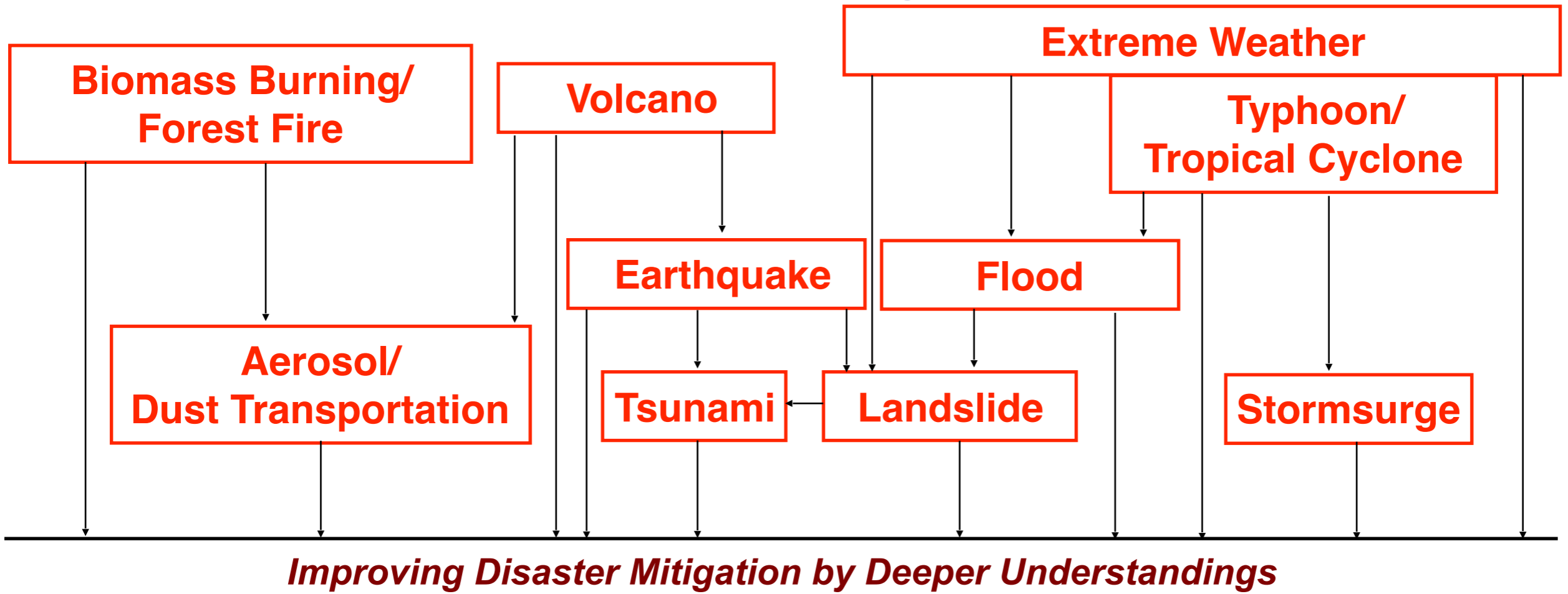
Data Common, Science Common
Community Engagement
e-Infrastructure Extension

Application & Services

Early Warning
Impact Analysis
Hazard Mapping
Case Studies

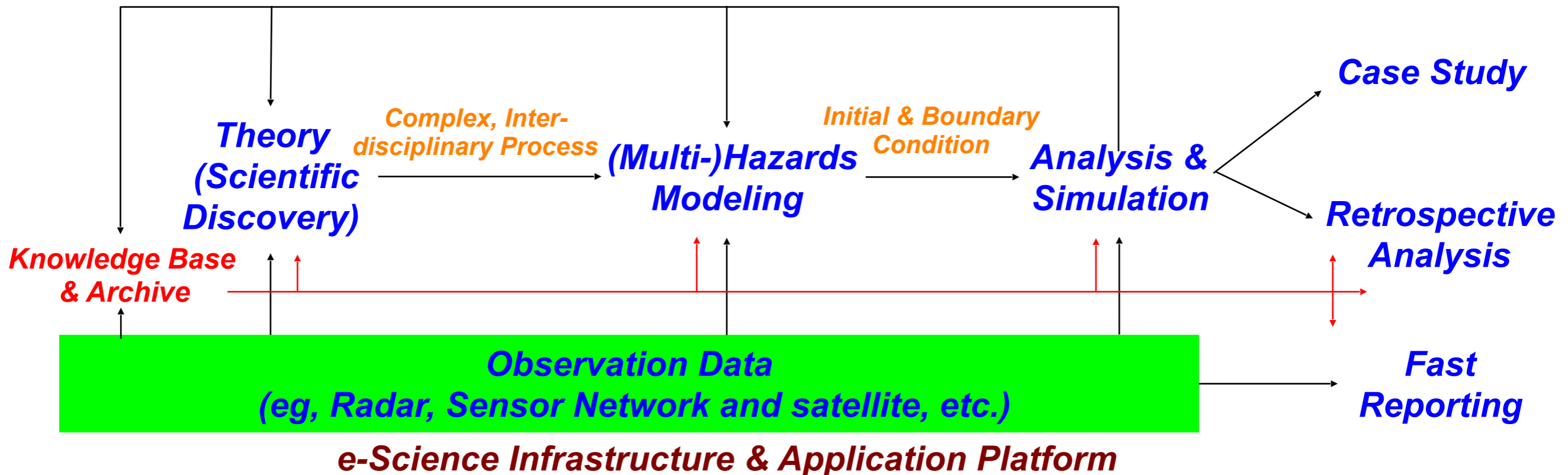
Whole process has to be carried out efficiently by scalable parallel computing schemes. Iteratively, new simulations with extra parameters may also be executed based on observation data.

Deeper Understanding on Multi-Hazards



Deeper Understanding

Model Enhancement



EOSC-hub mobilises providers from 20 major digital infrastructures, EGI, EUDAT CDI and INDIGO-DataCloud jointly offering services, software and data for advanced data-driven research and innovation.

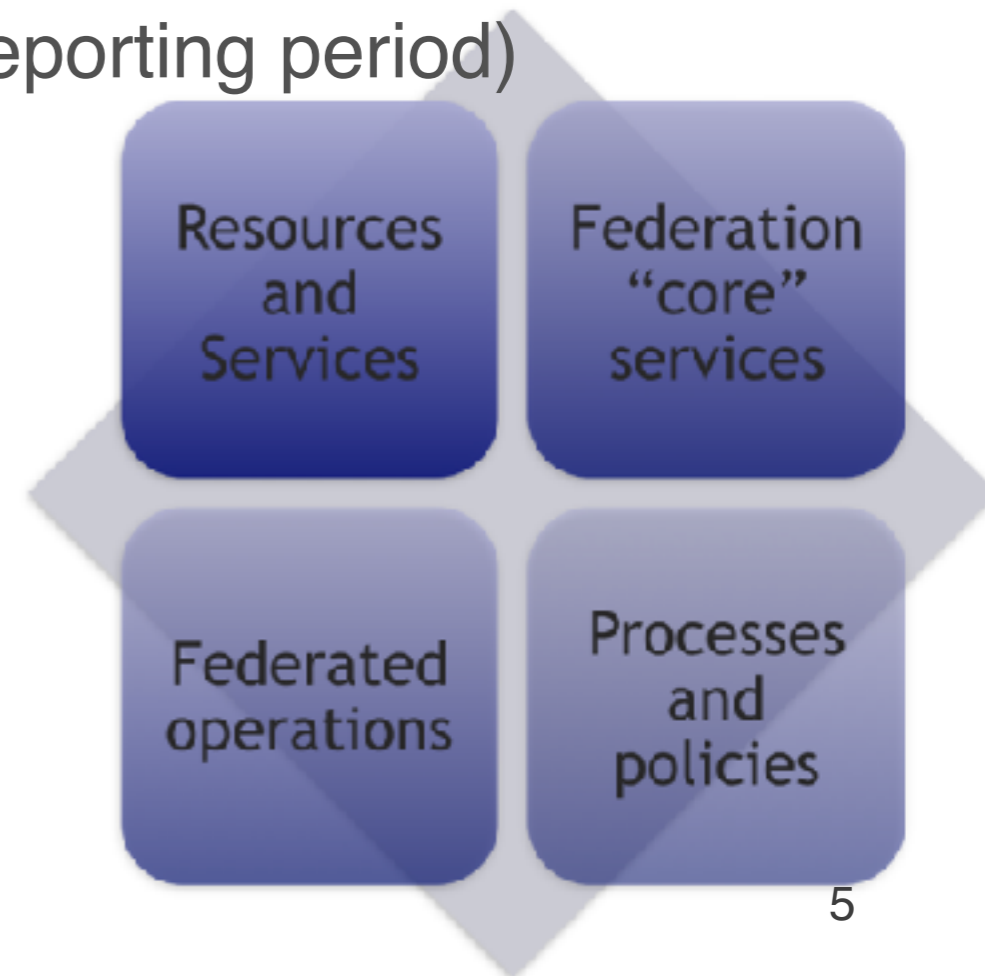
Project figures

- 100 Partners, 76 beneficiaries (75 funded)
- 3874 PMs, 108 FTEs, more than 150 technical and scientific staff involved
- 36 months: Jan 2018 – Dec 2020 (18 month reporting period)

Mission

The project will create the Hub a federated integration and management system for the future EOSC

Details about EOSC-Hub could be found at <https://indico.egi.eu/indico/event/3548/overview>



Tasks and leaders

Task nb., title	Task leader	Deputy/ technical leader	Represented Research infrastructure
WP8.1 ELIXIR / EMBL-EBI	Steven Newhouse	Susheel Varma	ELIXIR
WP8.2 Fusion / CCFE	Shaun de Witt		ITER
WP8.3 Marine / IFREMER	Thierry Carval		Euro-Argo, SeaDataNet
WP8.4 EISCAT_3D / EISCAT	Ingemar Häggström	Carl-Fredrik Enell	EISCAT_3D
WP8.5 EPOS-ORFEUS / KNMI	Luca Trani	Javier Quinteros	EPOS
WP8.6 Radio astronomy / ASTRON (SurfSARA)	Hanno Holties	Rob van der Meer	LOFAR, SKA
WP8.7 ICOS / University of Uppsala	Alex Vermeulen		ICOS, eLTER
WP8.8 Disaster Mitigation Plus / Academia Sinica	Eric Yen	Simon Lin	

CC overview (WP8+WP11)

WP8 supports the design, integration and dissemination of new, community-specific e-Infrastructure service platforms. [...] Activities are complemented by WP11 to deliver training to research communities and related relevant data providers and data scientists.

- Objectives
 - Running **proofs of concept** to test **the feasibility of use cases**, based on specific scientific and technical requirements defined by high impact research communities.
 - Conducting **pilots** to define and test the architecture of solutions.
 - Preparing the **production environments** to make platforms available to users beyond the CC.
 - Defining **business models to sustain the solutions** within EOSC after the end of the project.
- Members
 - **EGI Foundation**, CSC, ACK Cyfronet, ASTRON, CCFE (UKAEA), CEA, CESNET, CINECA, CNRS, EAA , EISCAT, EMBL, GFZ, GRNET, IFREMER, INGV, JUELICH, KIT, LUND, MARIS, MU, NOA, PSNC, SNIC (UU), STFC, SURFsara (ASTRON), ULG, AS (ASGC)

Tasks of DMCC+

- **DMCC+ will establish a regional collaboration platform of disaster mitigation by using numerical simulation and data management services. DMCC+ will:**
 - **Develop simulation models and scientific gateways to support workflows for hazard analysis.**
 - **Make existing regional e-Infrastructure compatible with EOSC framework, and expand those based on the latest technologies.**
 - **Make data, online services and derived science results available in EOSC.**
 - **Reach out to and support the user base in Asia and in partnership with EOSC-hub in Europe.**

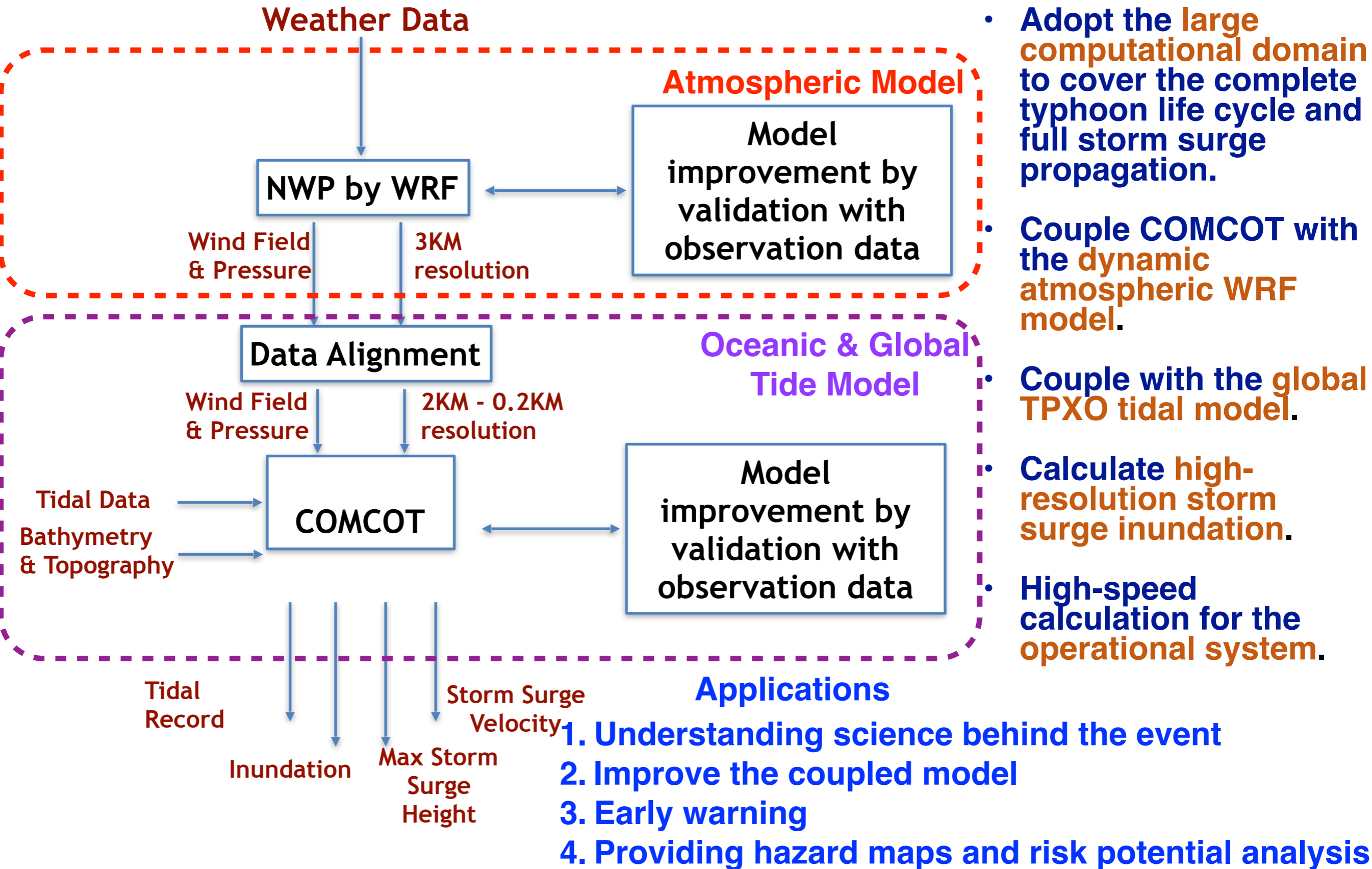
DMCC+ Activities

- **8.8.1 Develop simulation models and scientific gateways to support workflows for hazard analysis**
 - R&D an improved model for Storm Surge based on case study of Typhoon Haiyan [PM1-PM6]
 - Develop storm surge simulation facility with improved accuracy by combining atmospheric and oceanic model [PM3-PM9] [M6]
 - First Storm Surge simulation portal is online [PM10-PM12] [M12]
- **8.8.2 Make existing regional e-Infrastructure compatible with EOSC framework, and expand those based on the latest technologies**
 - Testbed construction for required EOSC components or services [PM4-PM20]
 - Interoperable and integration testing with EOSC framework [PM4-PM20]
 - Develop integration plan for iCOMCOT and Storm Surge applications with EOSC framework [PM3-PM9] [M9]
- **8.8.3 Make data, online services and derived science results available in EOSC**
 - Enhance the Science Gateway to provide data, simulation and case study reproduction services [PM9-PM21]: metadata, data search & access, AAI, etc.
 - Support reproducible case studies by Jupyter framework [PM13-PM24]
 - Publish the science gateway and online services to EOSC [PM13-PM30]
- **8.8.4 Reach out to and support the user base in Asia and in partnership with EOSC-hub in Europe.**
 - Dissemination and Training activities in APAN, ISGC, and local events in partner countries: at least 6 events are in schedule - APAN (Singapore and New Zealand in March and August 2018; Jan and August in 2019); ISGC in Taiwan (2019, 2020) [PM3-PM35]
 - Case studies on floods (VN, TH, BD, MM), storm surge (VN, BD, MM), dust transportation (TH, ID) will be conducted by working together with local user communities [PM3-PM30]

Planned Case Studies of DMCC+ & UND

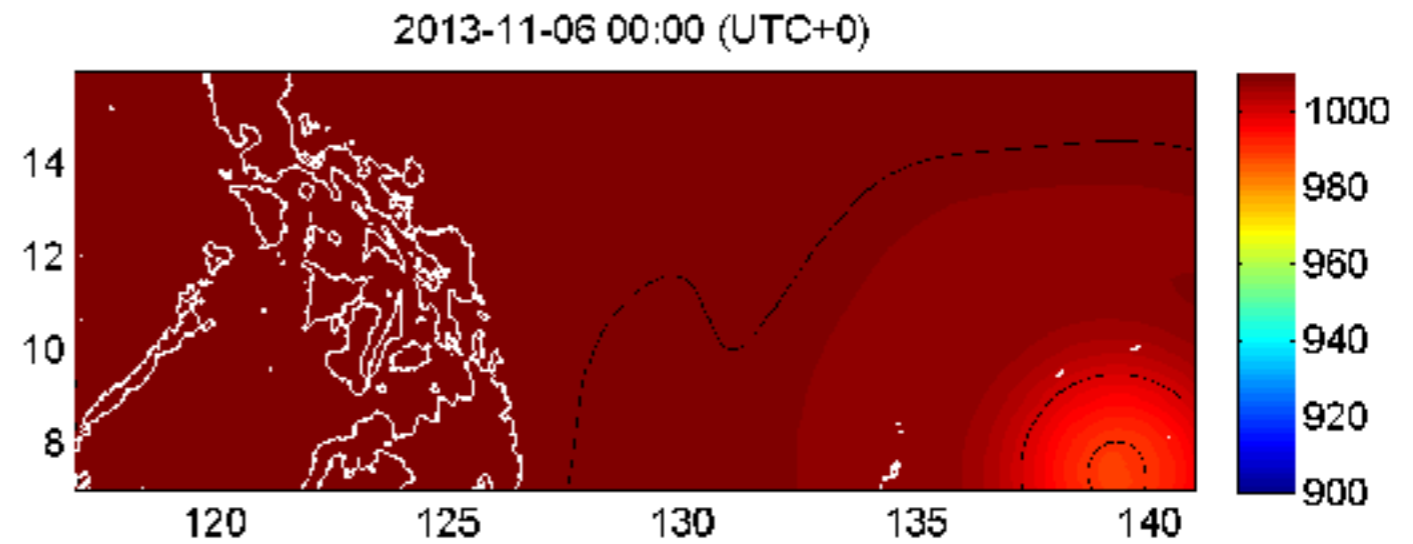
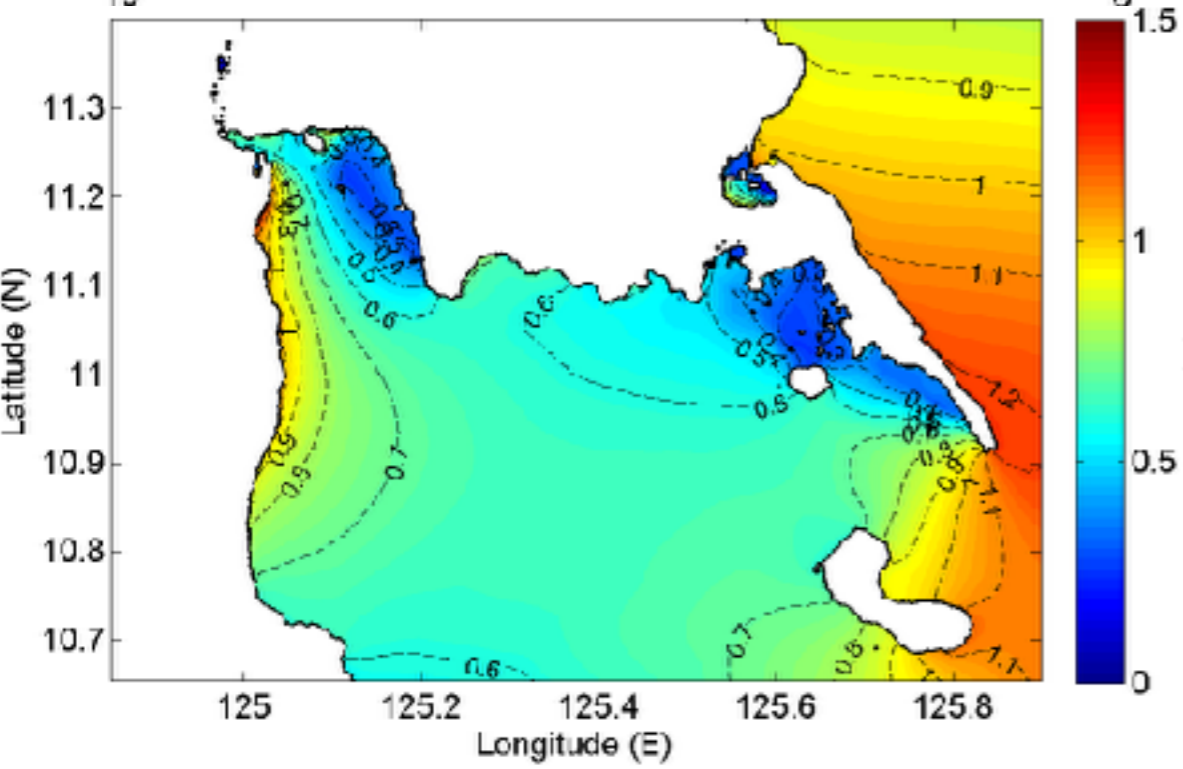
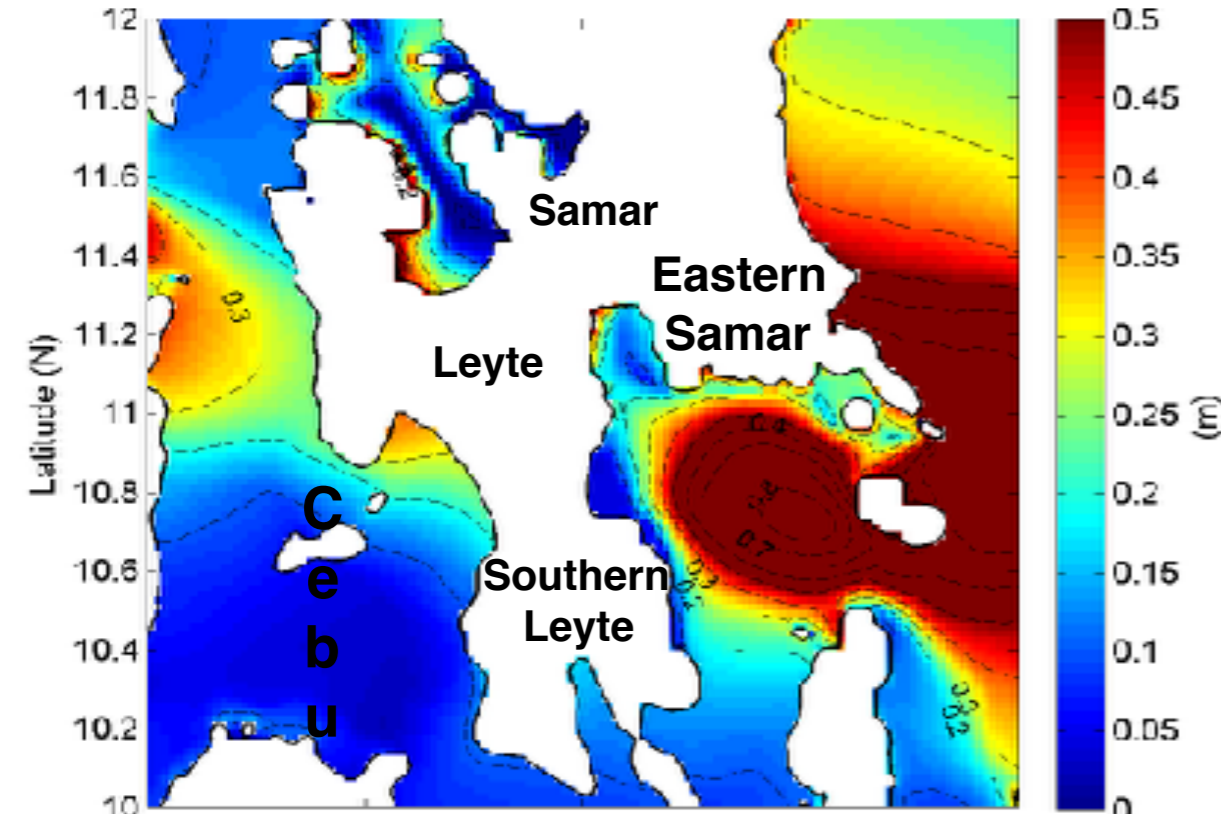
Case Studies	Goal	Duration	Partners & Tasks	Outcome (Science Gateway)
Storm Surge	Accurate modeling and simulation of storm surge by combining atmospheric and oceanic models	Jan'18-Dec'18 Jul'18-Sep'19	PH, TW BD, MM, VN	Storm Surge Simulation Portal
Flood	Accurate modeling and simulation on the weather event of the flood	Jan'18-Jun'19 Jul'18-Nov'19	TH, MY, VN, TW BD, MM	WRF Simulation on extreme weather event
Smoke & Haze Impact from Biomass Burning	Accurate modeling and simulation on the dust transportation	Jul'18-Feb'20 Jul'18-Jun'19	<u>TH, ID, TW</u>	WRF Chem Simulation on dust transportation
Tsunami	Tsunami Impact Analysis on Potential Tsunami Sources in South China Sea and Indian Ocean	Mar'18-Feb'20 Jul'18-Jun'19	JP, PH, VN, ID, IN, TW, BD	iCOMCOT-based Simulation Facility
EOSC Service Integration	AAI, OPS, Jupyter, Cloud, Data Management, Storage, ...	Mar'18-Jun'20	CZ, TW, ...	EOSC-compatible DMCC infrastructure
Regional Infrastructure	Distributed Cloud with container support	Mar'18-Jun'20	All	

A New Storm Surge Model for Typhoon Haiyan by Coupling Atmospheric and Oceanic Models

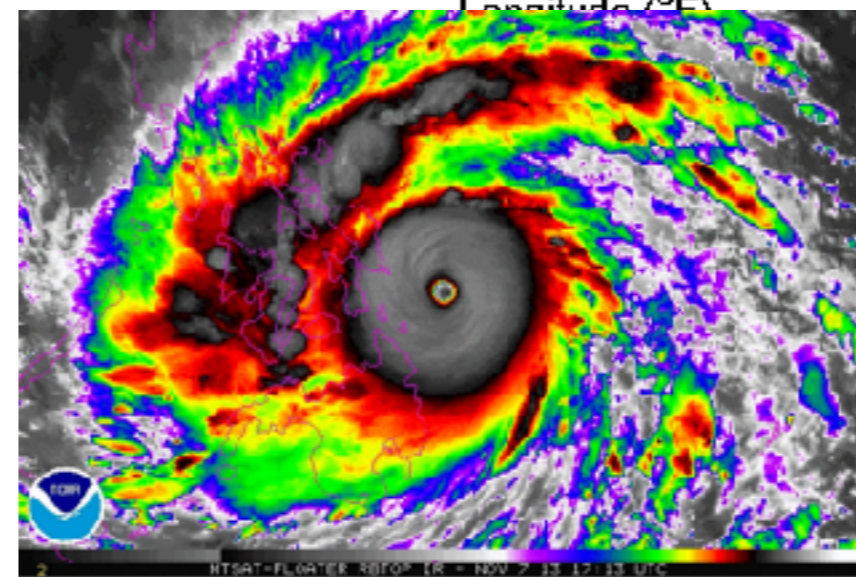


Storm Surge Modeling on 2013 Typhoon Haiyan by Coupling Ocean and Atmospheric WRF Model

Offshore Storm Surge Inundation Induced by Typhoon Haiyan

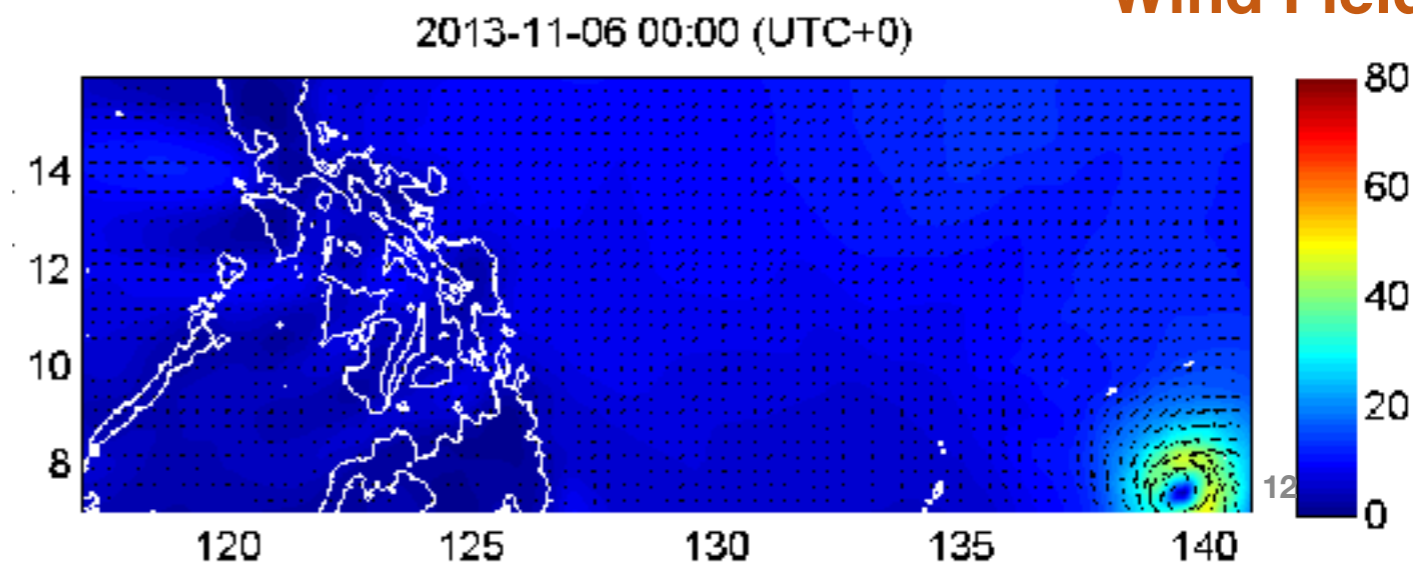


Pressure Field

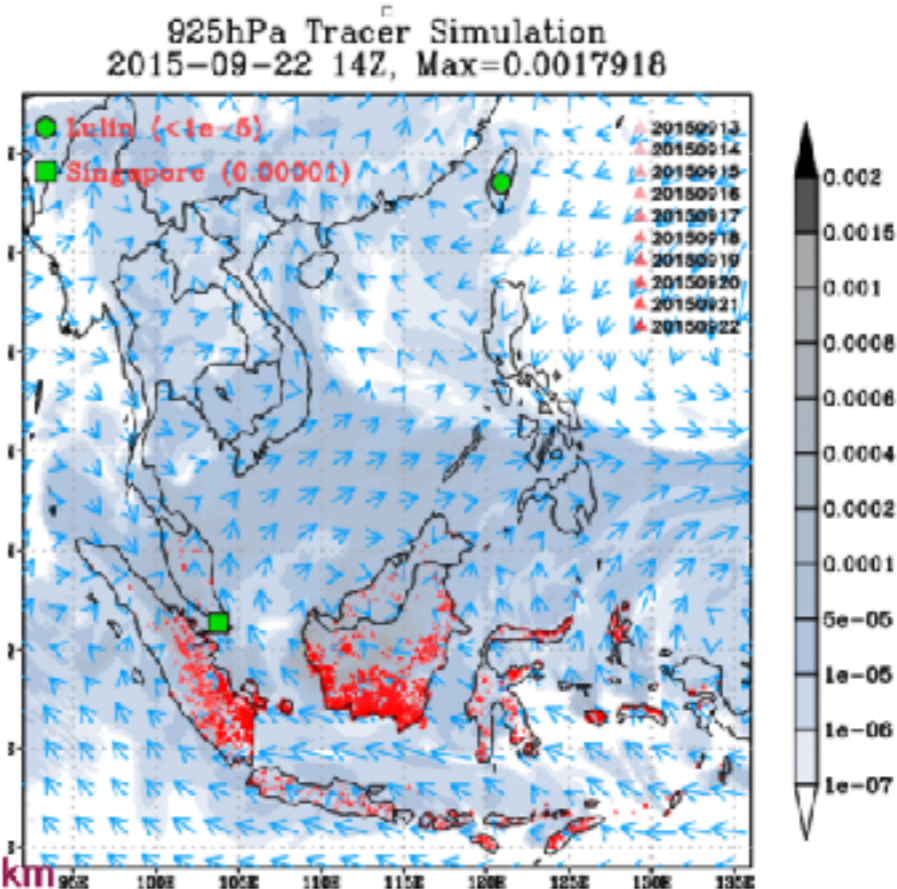
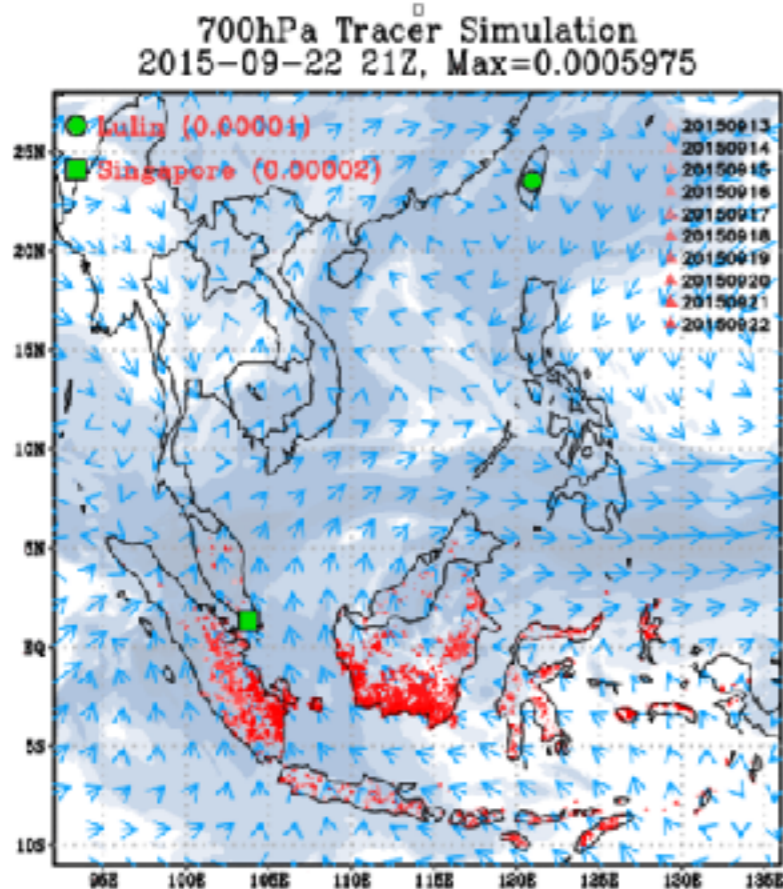
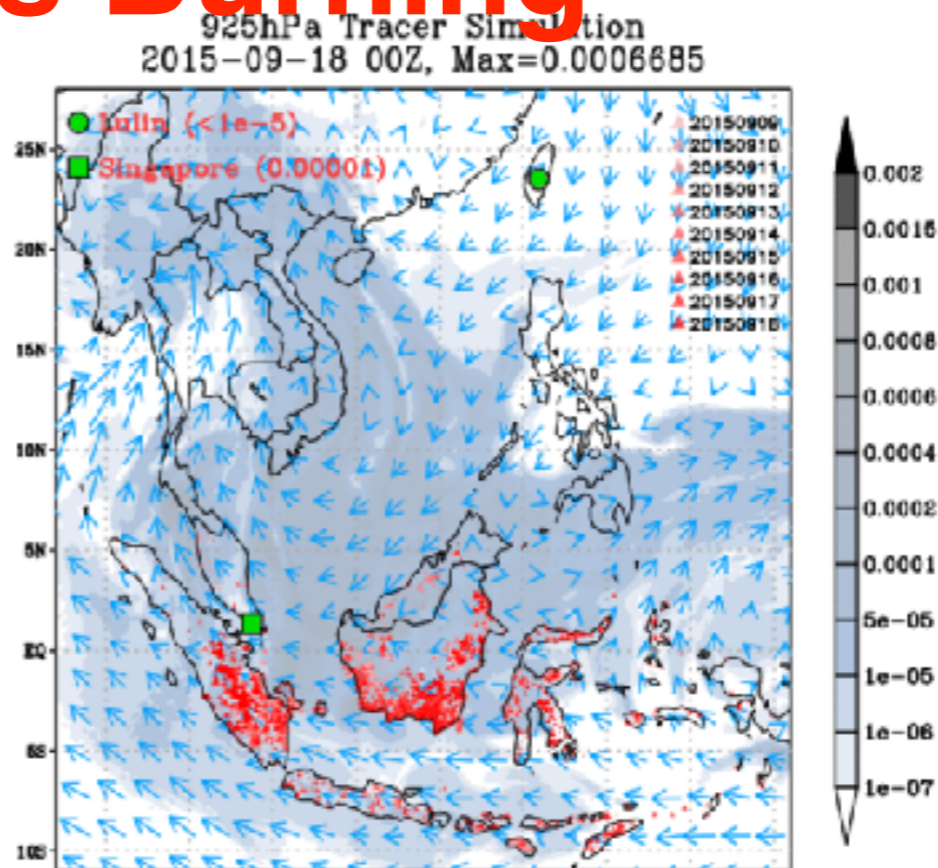
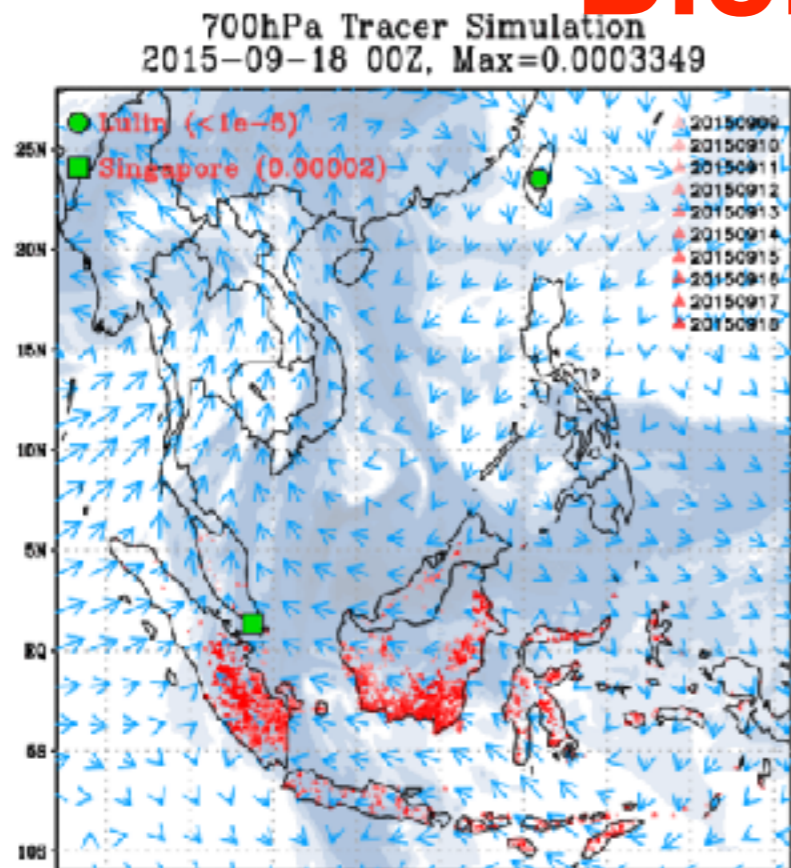


- *Asymmetric effect*
- *Topographic effect*
- *Hydrodynamic Pressure*

Wind Field



Long-Distance Dust Transportation from Biomass Burning

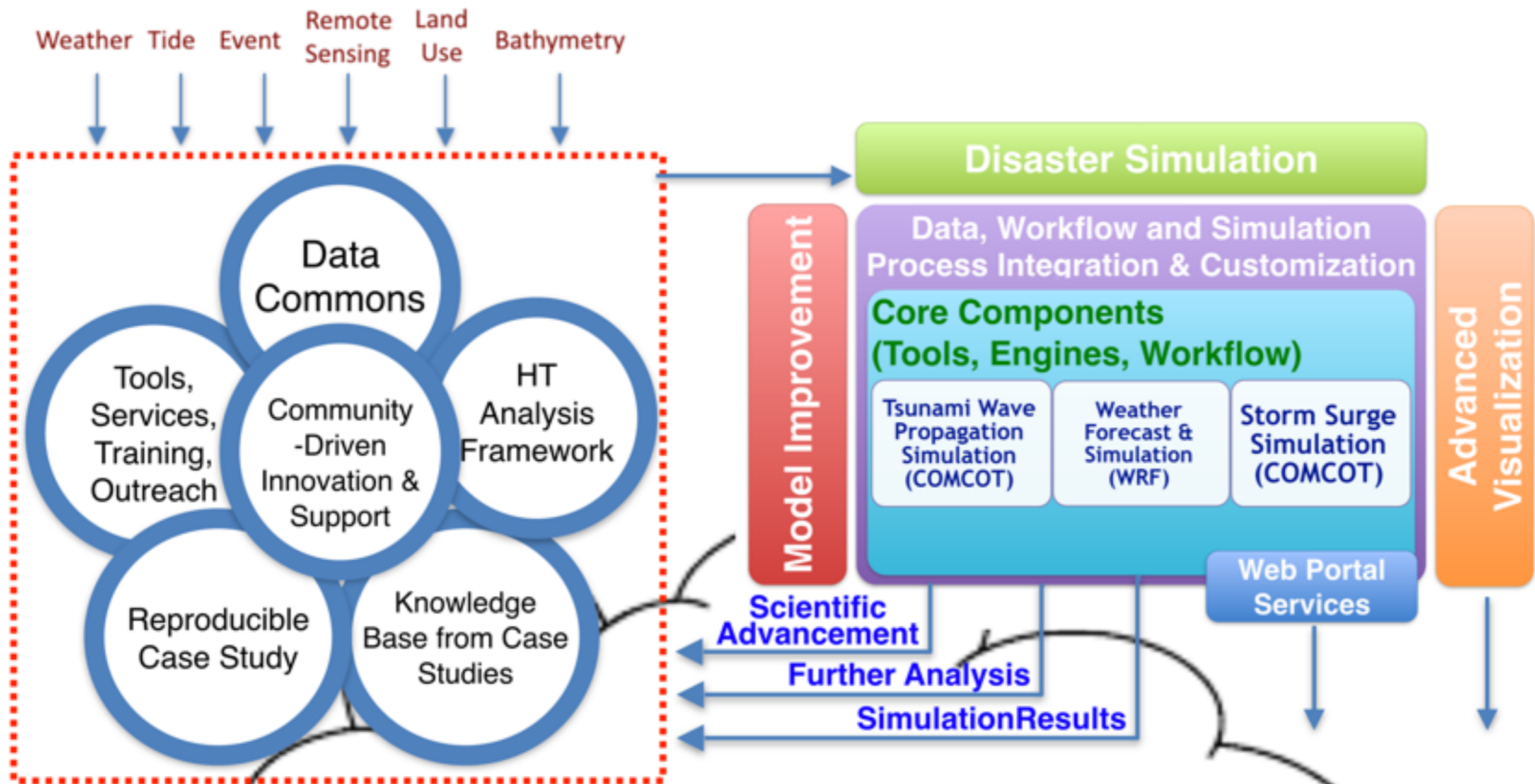


Resolution: 10 km

Hard to Achieve Accurate Simulation of Strong Typhoon, especially the Strongest Wind Speed and Lowest Pressure

- **We could achieve near observations by Higher resolution (<3KM) simulation**
- **Characterization of interactions between atmospheric and oceanic layers as well as land-sea**
 - **Eyewall contraction**
 - **Surface flux parameterization**

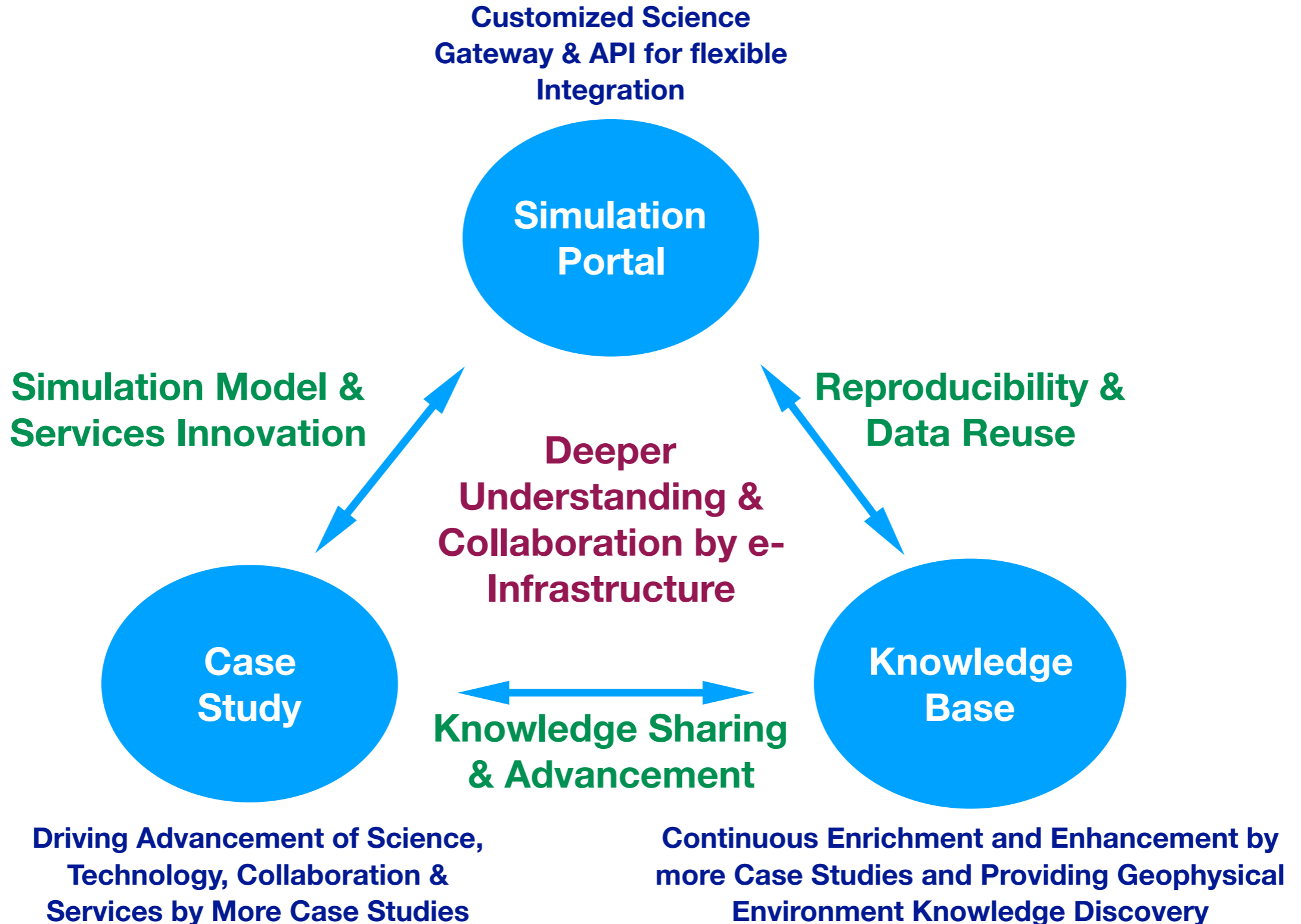
Open Science Platform of DMCC+



e-Science Infrastructure & Distributed Cloud Platform over EGI Integrated Resources in Asia Pacific Region



Open Collaboration Model for Disaster Mitigation Based on Deeper Understanding & Moving Towards Open Science



Future Events

- **19 March 2018: Environmental Computing Workshop at ISGC 2018, Taiwan (co-hosted by DMCC+)**
 - DMCC+ Project Meeting is held during lunch time
- **28 March 2018: Disaster Mitigation Workshop at APAN45, Singapore**
 - UND Kick-off meeting
 - All DMCC+ partners will present their case studies
 - Collaboration with APAN and UND (Asi@Connect project)
- **Routine Meeting of DMCC+: (tentatively) 16:00-17:00 on last Tue/Wed/Thur afternoon of every month**
- **16-20 April 2019: EOSC-Hub Week, Malaga, Spain**
 - Tech-Day for EOSC-Hub CCs
 - WP8 activity ...
- **6-10 Aug. 2018: Disaster Mitigation Workshop at APAN46, Auckland, New Zealand**
 - Both DMCC+ and UND project meetings will take place
- **Oct. 2018: Digital Infrastructures for Research**
- **Training & Dissemination**
 - Demonstration of Storm Surge Simulation Portal is planned at APAN46 (Oct'18)
 - EGI/EOSC-Hub technical training

Summary

- **Deeper Understanding Approach**
 - Three fundamental issues for deeper understanding: I.C., B.C. and Observation Data
 - Resolution and Computing Power are getting to be more important!
 - Interaction with Terrain structure often being ignored
 - Interaction of different Air systems are not easily predicted, look for potential pattern
- **Lessons Learned from Case Studies**
 - Importance of Mesoscale: Long-range Dust transport and Biomass burning are recently realized
 - Data is essential: Observation stations are often destroyed after the onset of major disaster events!
- **Future Perspectives**
 - Answering what-if questions
 - Disasters under global warming scenarios
 - Cross-scale modeling system
 - Capacity building and facilitate share of data, tools, resource and knowledge: DMCC+, UND, APAN DMWG, etc.