Disaster Mitigation Capacity Building by Deeper Understanding Approach in Asia

Regional Collaborations on Disaster Mitigation

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On behalf of this collaboration
Disaster Mitigation Competence Centre (DMCC) in EOSC-Hub

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Asia Regional Collaborations on Disaster Mitigation

DMCC
EOSC-Hub

EOCS-Hub: European Open Science Cloud Hub

Regional e-Infrastructure (Distributed Cloud)

APAN-EGI Framework

Simulation Portal

Case Study

Knowledge Base

Training

Conference Building

Dissemination

UN
Asi@Connect

Driving Advancement of Science, Technology, Collaboration & Services by More Case Studies

Progressive Enrichment and Enhancement by more Case Studies and Support Innovative Knowledge Discovery

Customized Science Gateway & API for flexible Integration

Distributed Cloud Infrastructure: Compute, Storage

Reproducibility & Data Reuse

Knowledge Sharing & Advancement

International Symposium on Grids and Clouds (ISGC)
<table>
<thead>
<tr>
<th>Disaster Type</th>
<th>Target Event</th>
<th>Partners</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsunami (TW)</td>
<td>Indian Ocean Tsunami (2004)</td>
<td>ID, TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Tohoku Earthquake &amp; Tsunami (2011)</td>
<td>TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Sulawesi (2018)</td>
<td>ID, TH, TW</td>
<td>Finished (based on current data)</td>
</tr>
<tr>
<td>Early Warning System of Indian Ocean</td>
<td></td>
<td>ID, TH, BD, TW</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Typhoon &amp; Storm Surge (TW)</td>
<td>Haiyan (2013)</td>
<td>PH, TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Soudelor (2015)</td>
<td>TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Pabuk (2019)</td>
<td>TH, TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Typhoon Usman (2018)</td>
<td>PH (ASTI and PAGASA)</td>
<td>Depends on status of data collection</td>
</tr>
<tr>
<td>Dust Transportation (Biomass Burning) (TW)</td>
<td>Tohoku Earthquake &amp; Tsunami (2011)</td>
<td>TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>IndoChina (2018)</td>
<td>TH, ID, TW</td>
<td>Finished</td>
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<tr>
<td>Flood (MY, TW)</td>
<td>Flash Flood Taipei, Taiwan (2015)</td>
<td>TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Sri Lanka (2016)</td>
<td>TW</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Malaysia (2018)</td>
<td>MY</td>
<td>Finished</td>
</tr>
<tr>
<td></td>
<td>Myanmar</td>
<td>MM, MY</td>
<td>Depends on status of data collection</td>
</tr>
<tr>
<td></td>
<td>1) Northern Thailand (2017) caused by typhoon Son ca; 2) TH (Nov. 2018)</td>
<td>TH, TW</td>
<td>Starting from the one with better observation data first</td>
</tr>
<tr>
<td></td>
<td>Cases of TH in 2017, 2016 and 2007</td>
<td>TH, ID, TW</td>
<td>Emission data are required (e.g., PM2.5, PM10, CO/CO2, SO2, NOx, O Zone, etc.)</td>
</tr>
<tr>
<td>Simulation Portal, Platform &amp; Infrastructure (TW)</td>
<td>Development, Integration &amp; Improvement</td>
<td>TW, PH, MY, ...</td>
<td>COMCOT-Surge Portal ongoing</td>
</tr>
<tr>
<td>Lightning (TW)</td>
<td>Bangladesh</td>
<td>BD, TW</td>
<td>Depends on status of data collection</td>
</tr>
</tbody>
</table>
Regional Collaborations on Disaster Mitigation by Deeper Understanding Approach

**Regional Collaborations on Disaster Mitigation by Deeper Understanding Approach**

- **Tsunami: Sulawesi Earthquake (2018)**
  - Validation of simulation results by observation data at Pantoloan

- **Biomass Burned Dust Transportation: Indochina (2018)**
  - 700 hPa 06 UTC
  - 700 hPa 06 UTC
  - 925 hPa 05 UTC
  - 925 hPa 08 UTC

- **Storm Surge: Typhoon Pabuk (2019)**
  - Validated by local observation data from Thailand partner (HII)

- **76T at Tak Province [2018 March]**

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**Additional Information:**

- PM10 — PM2.5
Case Study based on Deeper Understanding Approach

• Quantify risks and Reduce (Vulnerability x Exposure x Hazards) by evolved knowledge of physical processes behind the disaster events, as well as by improved numerical simulations
• Activities
  • To translate evolving scientific advancement into accurate numerical simulations
  • Understanding the trends of changes of hazard impacts
  • Develop risk analysis and mitigation capability
  • Buildup flexible/dynamic collaboration models of all parties
  • Improve the infrastructure to support all these actives and required resources federatedly
• Facilitate reproduction and resource sharing of event simulation: Simulation model, tools, parameters, input data, numerical experiments and outcomes, publications, etc.

Improved Vertical Wind Field Structure and Eyewall Contraction for Typhoon Haiyan

Storm Surge Modeling on 2013 Typhoon Haiyan by Coupling Ocean and Atmospheric WRF
Open Application Framework

- Aim to capture the knowledge learned from disaster case studies and support knowledge sharing, reuse and repurposing for broader applications
  - Application-driven
  - Support federation of resources and access to managed services covering data, tools, case studies, expertise and visualization
  - Support rapid spread of knowledge, access to high performance and validated simulation facility, workflow to conduct case studies, as well as reuse and repurposing of all resources in the platform

- Core Components
  - Data Commons: promote collaboration, reuse, repurpose, as well as knowledge transfer and sharing
  - Root Cause Analysis and Simulation Development
  - Value Added Products and Services
  - Distributed Cloud Infrastructure
The Regional Collaboration Keeps Moving Forward

- Extension of case studies and engagement of local communities based on deeper understanding approach
  - More disaster types & use cases (at least one case study in one partner country)
    - Wildfire (monitoring), thunder, air pollution, sand storm in addition to tsunami, storm surge, extreme weather, flood, dust transportation
- More Asian countries have been engaged and are conducting their local/regional case studies
  - MY(Flood, leader), TH(Fire, Agriculture, leader), BD(Lightening), PH(Tsunami, Storm Surge), VN(Flood), ID (Tsunami, Haze)
  - Local user communities engagement (through training and APAN meeting)
- More regional partners: ID, IN, JP, MY, PH, TH, TW, VN, MM, BD
  - potential partners: NZ, NP, MN, LK, AU, KR
- More application fields: agriculture, SA and Disaster Charter, Ecology and Biodiversity, cascaded hazards, etc.
- More regional collaborations: APAN, UNESCO, SA, Remote Sensing, Asian Center for Water Research, Upper ASEAN Wildland Fire Special Research Unit, ASEAN Hydroinformatics Data Centre, ASEAN Center for Biodiversity, etc.
- Good to have engagement of local communities and to have different participants from all partners in each training event
Future Works

• More case studies are happening in next few years
  • Several case studies of different hazard types had been conducted by the simulation portals

• Capacity building for dealing with more complex multi-hazard scenarios

• Topographical structure might be changed after a disaster. Related data has to be updated accordingly in time. Such changes should be also recorded in the open application framework.

• Extending to agriculture area leading by JP, TH and TW

• Extending to space-based resource federation and applications

• Systematically, efficiency, AAI, advanced data analysis, GPU/Container/Jupyter over cloud are also our focus

• APAN and ISGC are primary collaboration framework of all partners and also for extension of this collaboration
Acknowledgement

• Special Thanks to Great Supports From EGI, Asi@Connect, Academia Sinica and all Partner Institutes
• Also Appreciate all Contributions From Partners