Capacity Enhancement for Sustainability - Status of Regional Collaborations On Disaster Mitigation

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Building Hazard Risk Analysis Capacity by Deeper Understanding Approach

- 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.
- Improving accuracy and efficiency of numerical simulations according to the knowledge of root cause and drivers of target hazards.
- Deeper qualitative understandings such as possible weather and disaster patterns are crucial to develop strategies against natural hazards.

![Diagram showing the process of building hazard risk analysis capacity through a deeper understanding approach.]

- **Case Study Selection**
  - Geology, Bathymetry and Event Background Information
- **Observation Data**
- **Physical mechanism Identification & Advancement of domain knowledge**
- **Numerical Simulation & Modeling**
  - Accuracy & Efficiency Improvement
  - Better Predictive Capability
- **Analysis Methodology and Computing Tech**
- **Enhancement of Simulation Portal, Science Gateway and API**
- **Applications (Output)**
  - Risk Analysis, Early Warning, Hazard Management, Coastal Area Planning and Protection, Education, etc.
Typical Workflow for Case Study
(From Prof. CY Lin)

Questions

Hypothesis

Design your modeling work

- Resolution (domains)
- Physical and chemical schemes
- How many observation data you have?

Validation

Understanding the physical and chemical processes (mechanisms)

Disaster Mitigation Implications, and strategies proposed
Case Study by Deeper Understanding Approach
Realize Best Practices for Capacity Building

- 18 case studies of 6 types of hazards in 8 partner country had been Conducted
  - Tsunami, Typhoon & Storm surge, Dust transportation of biomass burning, Flood, Fire/Haze/Smoke monitoring, Lightning
- Values of Case Study commented by Prof. JN Liew (UKM, MY)
  - Case studies are important in meteorology
  - Assist in future field programs and numerical experiments design
  - Contribute to meta-analysis
- Deeper understanding approach:
  - 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
  - Integrate analysis pipeline and improve the distributed infrastructure
- More case studies of various types of hazards in different countries and more new partners as well as more engaged local user communities are happening
- More data/analysis methods/simulation engine/knowledge resulted from case studies will be shared
### Case Study is a core component of Deeper Understanding Approach

<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></td>
<td>Early Warning System of Indian Ocean</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>
</tr>
<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>
Collaborations Framework

• e-Science for the Masses: developing e-Science for hazard risk analysis with EGEE and EUAsiaGrid projects from 2008
  • APAN DMWG was approved and operational from 2014
  • DMCC was supported by EGI-Engage, EOSC-Hub and EGI-ACE from 2015
  • Environmental Computing Workshop in ISGC started from 2016
  • UND (deeper Understanding of Natural Disaster) funded by Asi@Connect during July 2018 - April 2021
  • Supporting Sentinel Asia disaster management cloud services together with NSPO and JAXA

• Approaches:
  • Case study oriented, deeper-understanding approach based, numerical simulation and ML enabled
  • DMCC/DMWG serves as a collaboration framework for Asia partners on disaster management and broader scope
  • Actively engages user communities, domain experts and e-Infrastructure/ICT/Application Support specialists working in concert
  • Case study could be reproduced online and all materials (data, tools, knowledge, etc) of a case study are open accessible

• Activities:
  • 2 meetings/workshops a year in every APAN meeting
  • Joint workshop with Environmental Computing Group at ISGC (annual event usually held in Spring)
  • Event: meeting, training, workshop, masterclass (ID, SG and NZ)
  • 5 events, including 4 trainings (@NZ, MM, BD, MY) and 1 Workshop were held from 2018 with support of Asi@Connect funding
Training & Workshop Events

• 8-9 Aug. 2018: UND Workshop and Master Class @APAN46 in NZ; 42 participants from 9 partner countries
• 19-20 Aug. 2019: Training @MM; 27 participants from 8 partner countries
• 25-27 Nov. 2019: Training @BD; 33 participants from 6 partner countries
• 15-17 Jan. 2020: Training @MY; 24 participants from 8 partner countries
• 24-26 Mar. 2021: Joint UND/DMCC/Environmental Computing Workshop @TW (ISGC2021 online); 25 participants from 10 partner countries
• 19 April 2021: Project Workshop (virtual event);
• Collaboration workshops @APAN 47, 48, 49, 50, 51, collaborated with APAN DMWG and DMCC
Building Practical Capacity by Case Study

- **Goal:** Develop risk analysis capability by federating all required resources from partners in Asia region and around the world.
- **Case study:** identify the target, requirements and solutions, etc.
- **Members:** users, scientists, data/infrastructure/application providers.
- **Typical outcomes:** open & shared repository for new knowledge to the event, the simulation processes, data, simulation facility, and collaboration model, …
• PH: water pollution, agriculture (mapping crops & mapping)
• ID: tsunami case study
• MM: flood, cyclone
• Infrastructure: federating ASEAN resources; EGI
• Simulation facility: WRF (LEXIS & LRZ)
• Data sharing and Open Science: OSDWG, EGI-ACE, data repository @TW
• Fire science and operational fire intelligence (WIFIRE project @UCSD)
Collaborations Beyond Asi@Connect Fund

• Collaboratively, we are able to achieve bigger goals - beyond the limits of resource and knowledge of each individual
  • Targeting on the commons is a good strategy of collaboration across boundaries
  • Federation with regional/international remote sensing communities are also happening
  • Capacity of all partner countries will be developed
• Through case study and deeper understanding approaches, capacity is growing systematically according to partners needs
• Regional e-Infrastructure could be growing accordingly
• APAN & ISGC are the best collaboration platform in the long run
• Note that, DMCC is still there and is extending to Agriculture if you all agree under the EOSC programme (EGI-ACE, Jan 2021-June 2023)
• Other funding opportunities: Another round of Asi@Connect; ASEAN, and any possibilities
Moving Towards Open Science (1)

- Disaster Mitigation Competence Centre has been part of EGI-Engage and EOSC-Hub from 2015.
- EGI-ACE: Jan 2021 - June 2023.
- Reusability, Reproducibility and FAIR open data.
- Supporting platform over EOSC-interoperable infrastructure is provisioned: Distributed cloud; HPC/HTC; ML-based big data analytics; web portal; Data analysis pipeline management; Data repository.

Implement the Compute Platform of the European Open Science Cloud and contribute to the EOSC Data Commons by delivering integrated computing, platforms, data spaces and tools as an integrated solution that is aligned with major European cloud federation projects and HPC initiatives.
Recent EGI-ACE Events

• 4 webinars are already scheduled for April-May. Additional ones will be added as we go. The scheduled events are:
  • Manage Singularity and Docker containers, Kubernetes clusters in the EGI Cloud, 28 Apr. 2021, 14:00 CEST
  • Providing controlled access to distributed resources and services with EGI Check-in: the user and provider perspectives, 05 May 2021, 14:00 CEST
  • Monitoring services with ARGO, 19 May 2021, 13:30 CEST
  • Deploying virtual infrastructures in the cloud with the Infrastructure Manager (IM), 26 May 2021, 14:00 CEST
• Full details and registration page for these webinars, and the recordings of the 2020 webinars are available at [https://www.egi.eu/webinars/](https://www.egi.eu/webinars/).
Climate-Resilient Agriculture for Disaster Risk Reduction (CRADR)

Asi@Connect funded project (Dec. 2020 - April 2021)

Collaborations of partners from AgWG, DMWG and Data Sharing

- **Objectives**
  - To exchange the evaluation of meteorological parameters impact on agricultural production for climate-resilience agriculture
  - To expand the use of STI for climate-smart agriculture by transferring technologies
  - To create resilience and build the capacity of participating countries in relation to meteorological impacts on agricultural production
  - To improve food security, livelihood and disaster resilience at local level

- **Expected Outcomes**
  - Good practices and lesson learn from the pilot study site
  - The improvement of optimization productive by STI at the study site
  - Information and disaster short-term impacts analysis
  - Sharing of technologies for climate change forecast towards climate-resilient agriculture and smart farmers
  - Improve climate change impacts awareness and resilience in agriculture aiming food security

Case study target: Phrae Province (Northern Thailand)
Future Collaborations and Events

• **Goals: Capacity Development**
  • More case studies of various hazards at different sites
  • Improve the collaboration model and regional infrastructure
  • Extension to agriculture and other application domains
  • Moving towards open science, starting from share & open data

• **Specific Topics from Today**
  • Indian Ocean Storm Surge Forecasting
  • Impacts of regional climate changes
  • Share & Open Data
  • Publish outcomes of case studies: in academic papers, compiled resource catalog, etc.
  • Data quality and uncertainty issues
  • Outreach: WIFIRE, LEXIS, EGI, and more ASEAN and regional/local collaborations

• **Planned events: APAN and ISGC are primary collaboration platform**
  • CRADR Workshop: 6-7 May 2021
  • APAN52: August 2021 (Yogyakarta, Indonesia)
    • DMWG, AgWG, OSDWG, AAI Workshop, CloudWG
  • EGI Conference 2021 (online): 19-21 Oct. 2021
  • APAN53: Feb. 2022
  • ISGC2022: 21-25 March 2022
  • APAN54: Summer 2022
Acknowledgement

• Special Thanks to Great Supports From EGI, Asi@Connect, NSPO/NARL, Sentinel Asia and Academia Sinica
• Grateful for the Excellent Leadership of all Coordinators and Event Organizers
• Also Appreciate all Contributions From Partners - BD, ID, IN, JP, MM, MY, NZ, PH, TH, TW, VN and CZ, DE