

e-Science Initiatives in PH

John Robert MENDOZA

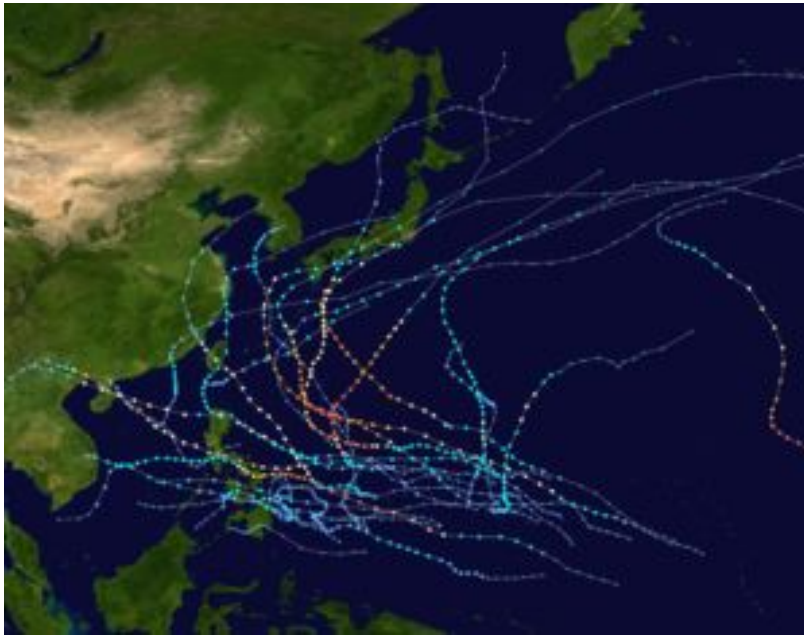
Advanced Science and Technology Institute

bert@asti.dost.gov.ph

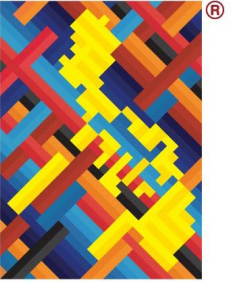
ISGC 2016

Academia Sinica, Taipei, Taiwan

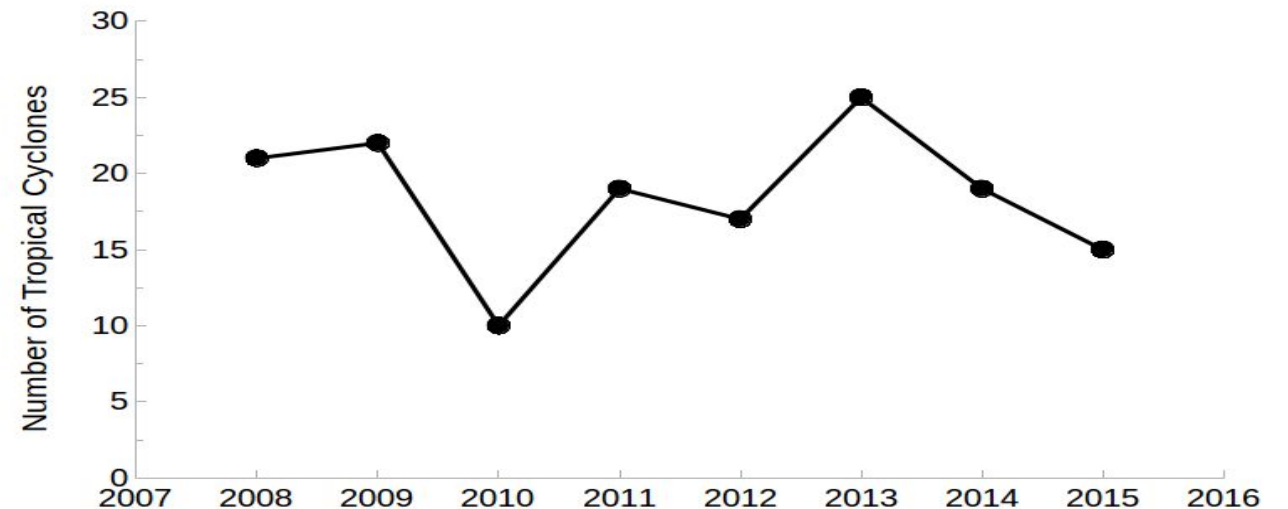
16 March 2016



It's more fun in the
Philippines



Number of Tropical Cyclones per Year



Long-term average: 19.5 tropical cyclones per year [1]

Population: 92,337,852 (11,855,975 concentrated in Metro Manila)

Density: 343.16/km² (43rd in the world)

[1] Cinco, TA et al. (2016), Observed trends and impacts of tropical cyclones in the Philippines, Int. Journ. Clim., doi: 10.1002/joc.4659

National Key Result Areas

In 2010, by virtue of Executive Order (E.O.) 48 issued by the President of the Philippines, all government agencies are mandated to orient their programs, projects and activities towards the development in the following key result areas (KRA):

- Transparent, accountable, and participatory governance
- Poverty reduction and empowerment of the poor and vulnerable
- Rapid, inclusive, and sustained economic growth
- Just and lasting peace and the rule of law
- **Integrity of the environment and climate change adaptation and mitigation**



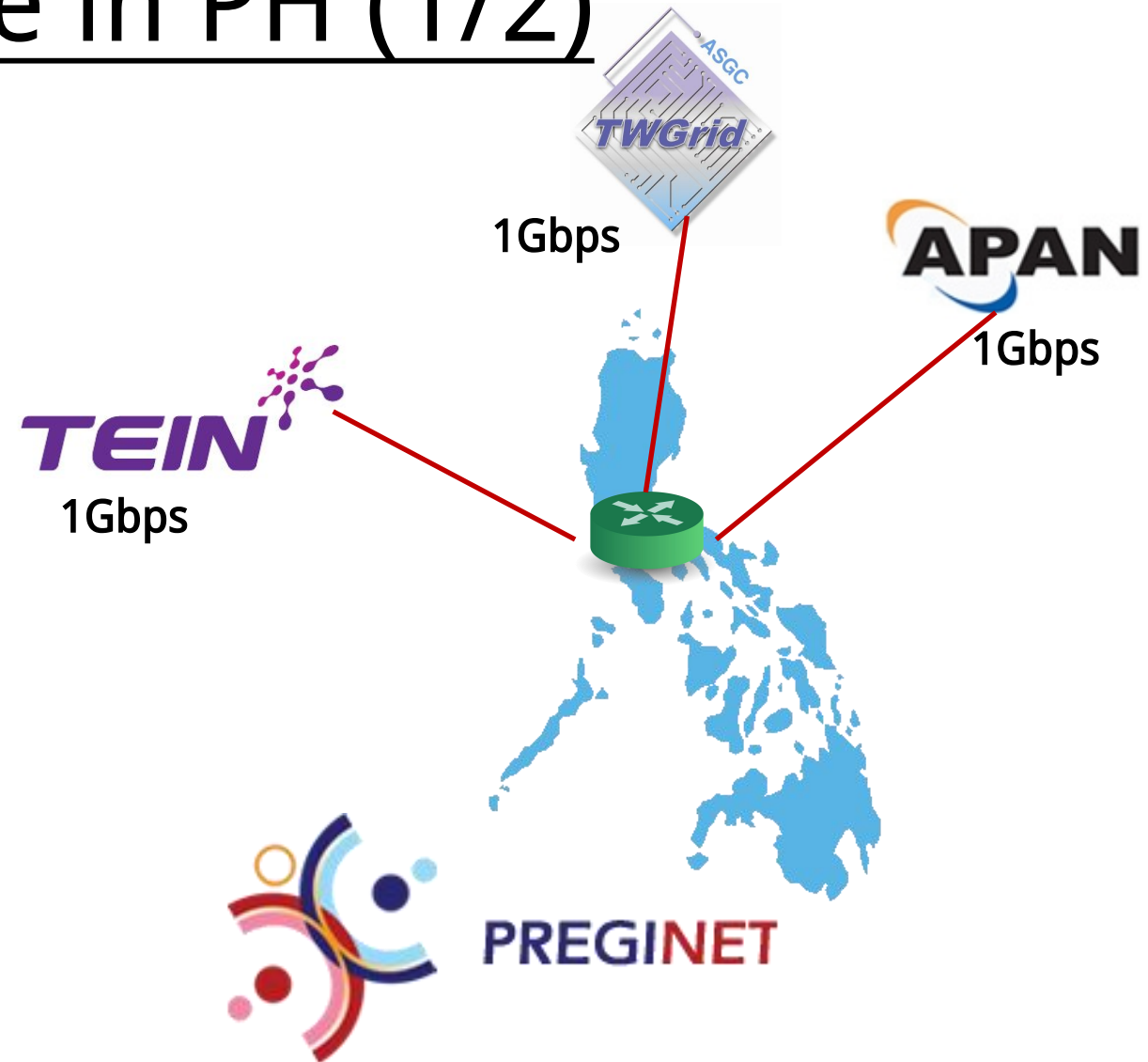
- **Advanced Science and Technology (DOST-ASTI)** is a line agency under the Department of Science and Technology mandated to undertake long-term research activities in the field of microelectronics and communications technology.
- Main activities focus on the following thematic areas:
 - Government
 - Health
 - Enterprise
 - Environment
 - Education



Evolution of e-Science in PH (1/2)

- **The Philippine Research, Education and Government Information Network (PREGINET)**

- Enhanced network connectivity among local academic and research institutes
- Facilitate formation of user-communities in scientific areas
- Connected to International RENs
 - AI3 (since 1998)
 - APAN (since 2004)
 - TEIN (since 2006)
 - ASGC
- IPv6-enabled since 2001



Evolution of e-Science in PH (2/2)

- **Philippine e-Science Grid (PSciGrid)**
 - Started in 2008 with a \$300K grant
 - Launched to the public in July 2010 (ASTI, UP, ADMU)
 - Grid Applications:
 - Meteorology (HRM, GrADS)
 - Bioinformatics
 - 16 Nodes/128 cores and 9TB of storage grew to 50 nodes by 2010
 - Participated in EuAsia grid project, PRAGMA, and EGI-Inspire
 - Received additional funding in 2013 for expansion



Objectives:

- Develop cost-effective platforms and applications for real-time monitoring and forecasting of environmental parameters;
- Automate data gathering and transmission of existing manual approach;
- Decrease maintenance cost of the products or services to be developed;
- Establish and maintain the nationwide environmental monitoring network; and
- Provide solutions for the mitigation of environment-related disasters.

Output

- Total number of weather stations deployed as of date:
 - Automated Rain Gauges (ARG) - 876
 - Waterlevel Monitoring Stations (WLMS) - 546
 - Automated Weather Stations - 86

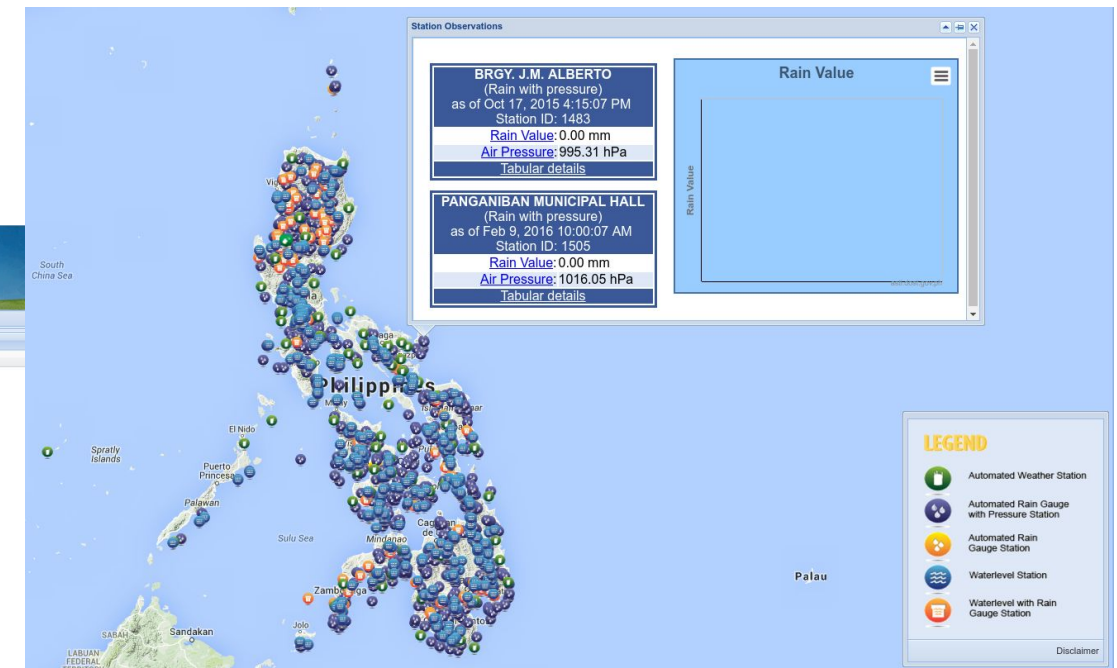
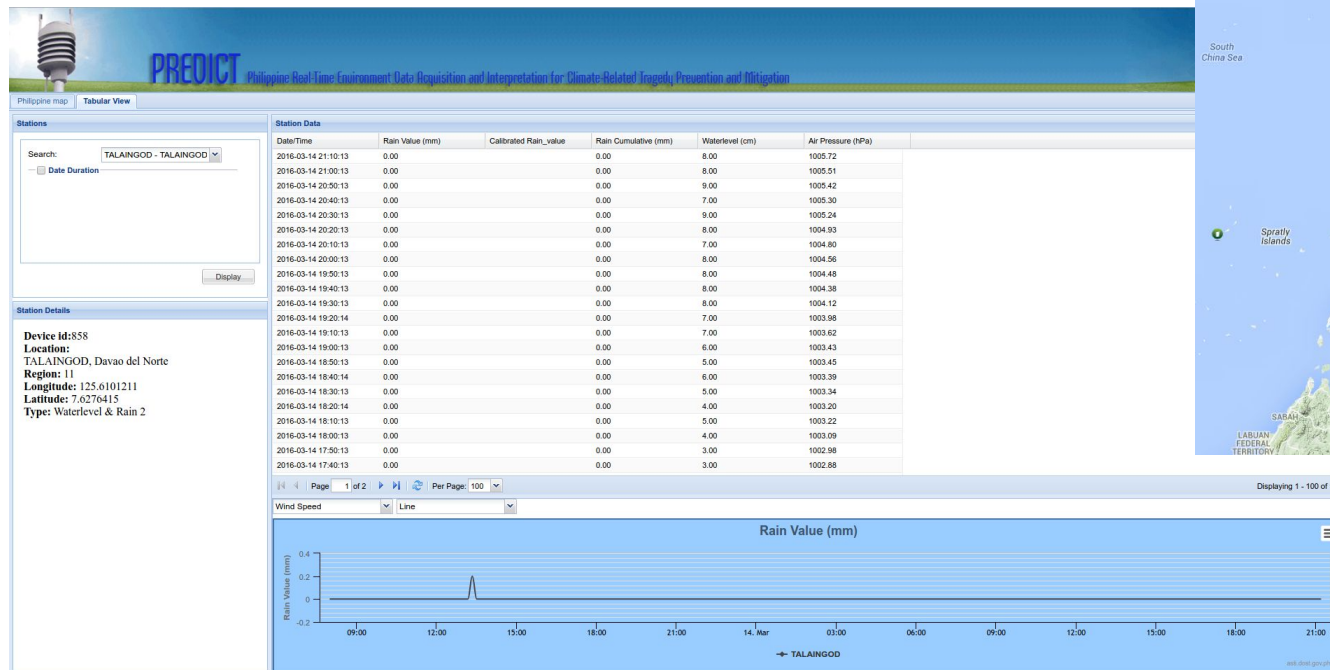


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PREDICT

Philippine Real-Time Environment Data Acquisition and Interpretation for Climate-Related Tragedy Prevention and Mitigation

- Web API service available for third-party visualization and processing (free of charge!)
- Data collected are visualized online:
<http://fmon.asti.dost.gov.ph/>



Project NOAH

- Nationwide Operational Assessment of Hazards (NOAH) Program
 - Started in 2011
 - undertake disaster science research and development
 - advance the use of cutting edge technologies
 - recommend innovative information services to the government
- More info at:
 - <http://noah.dost.gov.ph/>
 - <http://blog.noah.dost.gov.ph/>

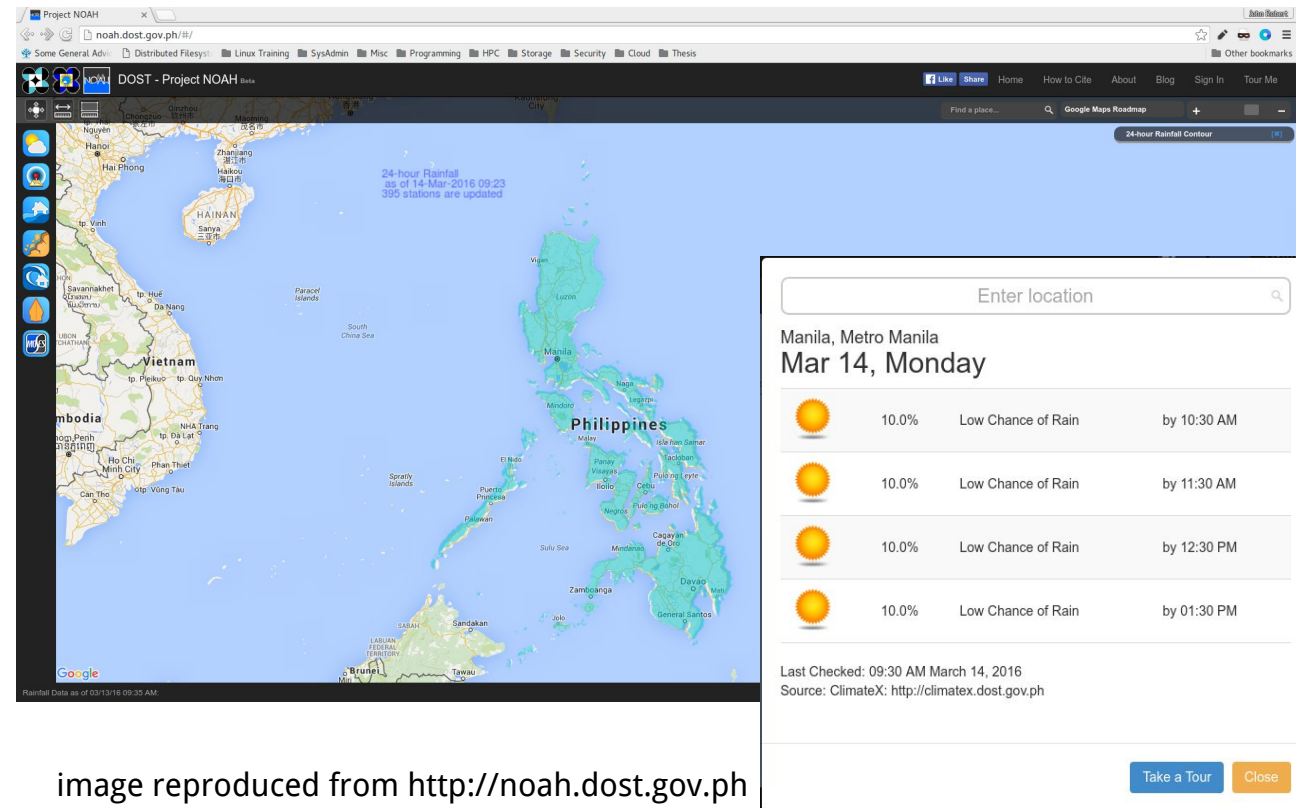


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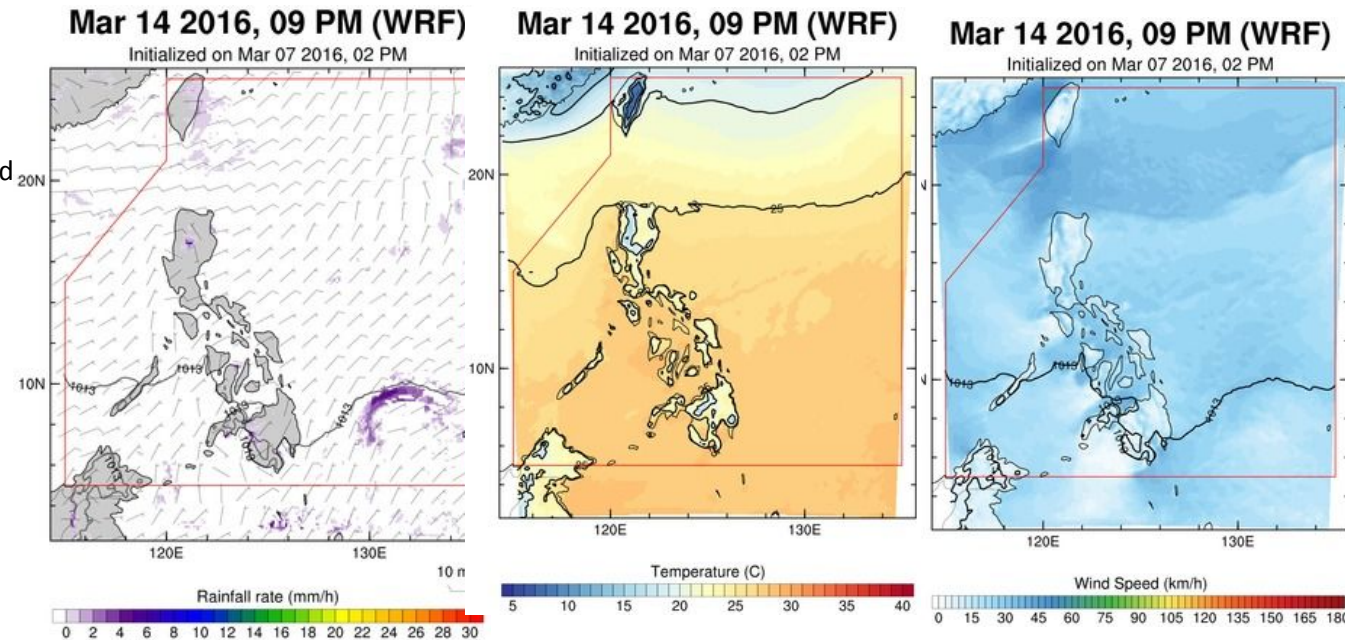
Nationwide Operational Assessment of Hazards Weather Information Integration for System Enhancement

Objectives:

- Extend the temporal range of weather forecast to 7 days with PAGASA, ClimateX and NOAA
- Improve the accuracy of the weather forecasts by assimilating data from the ground, radar and satellite measurements into numerical weather prediction model
- Provide the forecast accuracy validation protocol for the model outputs

Results:

- Two fully operational WRF forecasting system
- Quality-control protocol for automatic weather stations
- 3.7% and 10% improvement in wind and rainfall prediction, respectively upon assimilating AWS and Doppler radar measurements
- Improved rainfall prediction using an updated land use
- Model is produced 4 times a day; 4km and 12km resolution
- Most recent model output and data archives are available:
<http://wise.asti.dost.gov.ph>
<http://202.90.159.150/thredds/>



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Project Rebuild



PROJECT ReBUILD

- **Objectives:**

- Multi-hazard and socio-economic profiles of target areas
- Risk maps of target areas
- Vulnerability and Adaptation reports
- Impact models (Flood)
 - Simulation provided by Gerris 2D on ASTI HPC

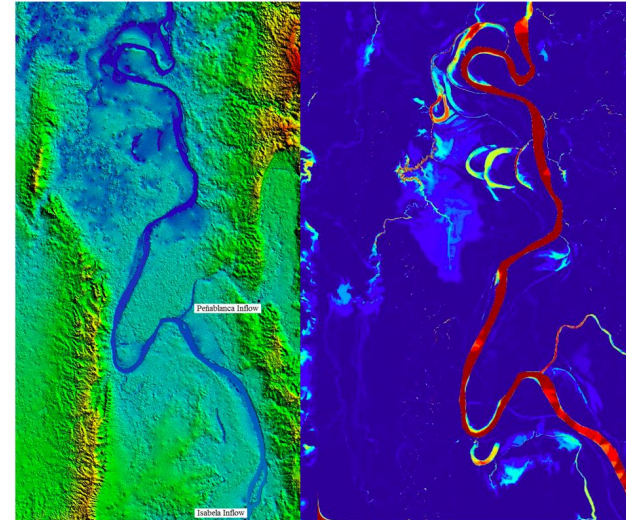
- **Results:**

- Reduction in degradation rates of critical environmental and natural resources
- Reduction in mortalities, morbidities and economic losses from natural hazards and environmental degradation
- Provision of climate resilient livelihood options for the vulnerable communities

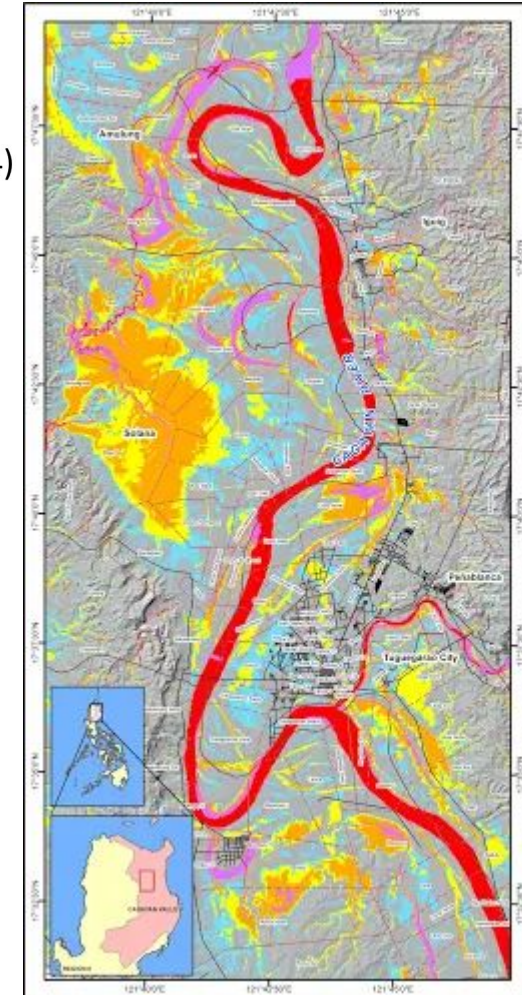
- **More information:**

<http://www.projectrebuild.org>

Flood Simulation: Cagayan 5-Yr RRP with Present (2014)
Land Cover Condition and Current Rainfall Regime



Cagayan Floodplain Boundary with Inflows



3000 Rice Genomes Project (3kRG)



- Analysis results for variant discovery are stored and executed in ASTI
- Over 120 TB of downloadable data
- Methods for download:
 - WebDAV
 - iRODS
 - Regular HTTP
- More info at:
<http://iric.irri.org/resources/3000-genomes-project>

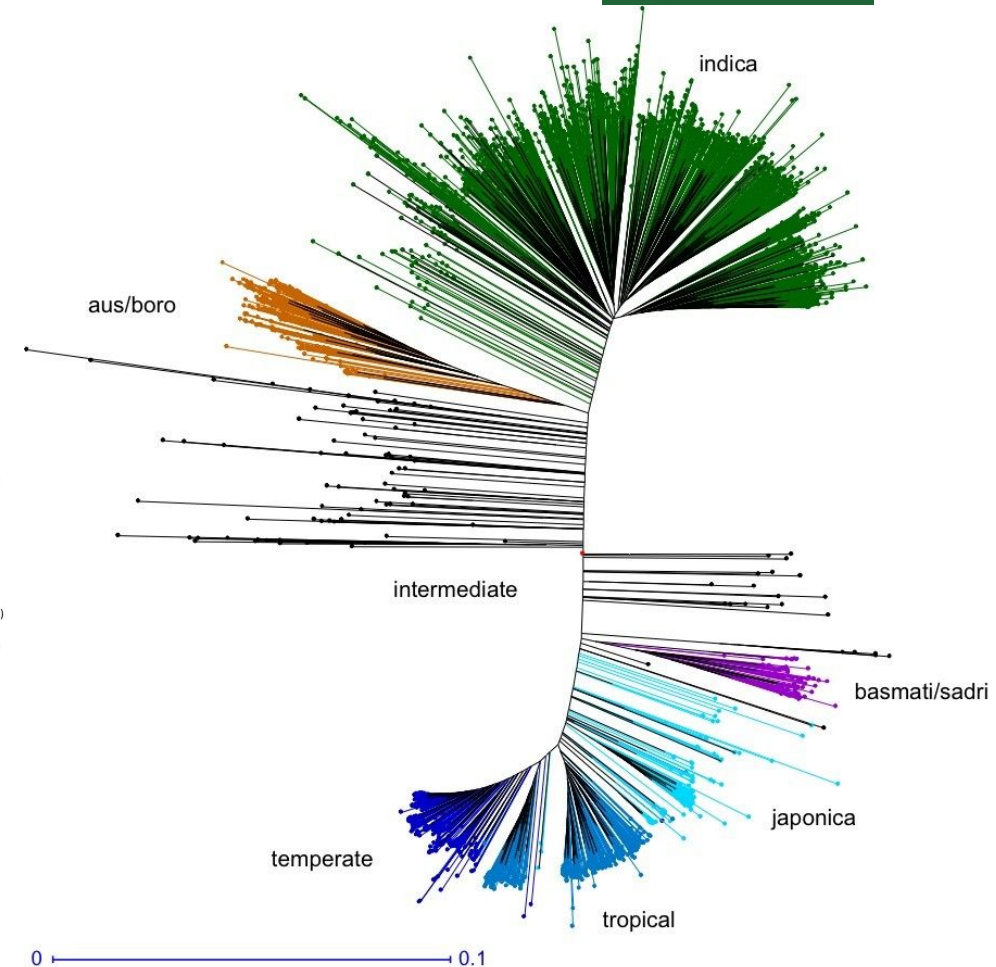
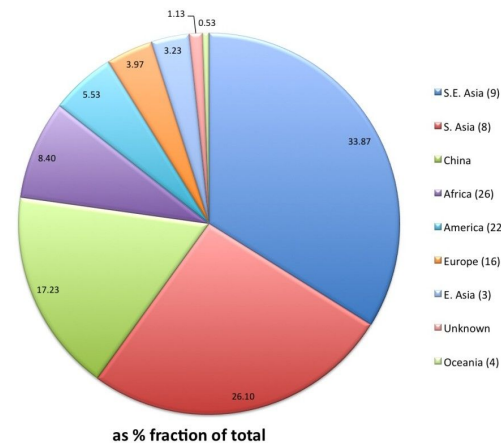
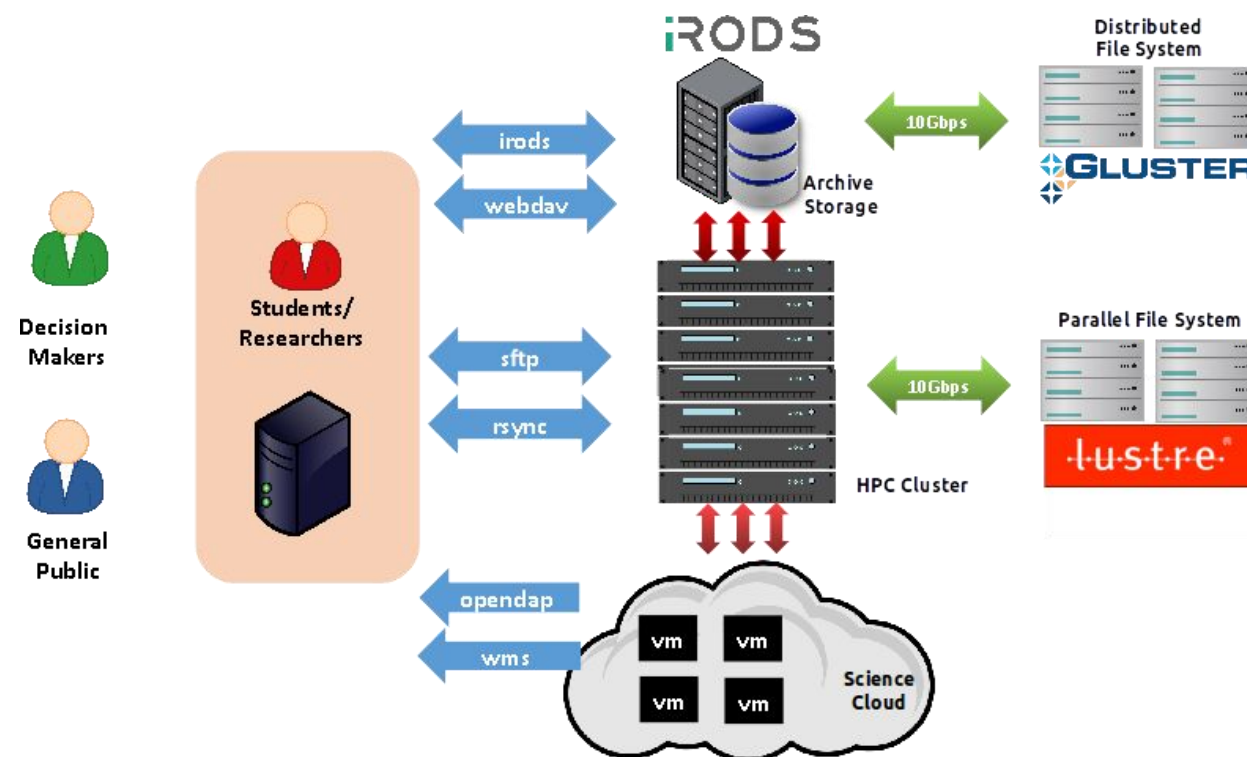


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<http://gigascience.biomedcentral.com/articles/10.1186/2047-217X-3-7>

Objectives

- Accommodate mix workloads required by users
- Unify access to large common datasets
- Provide tools and services that promote sharing and collaboration among users
- Rapid preparation and execution of workloads
- Provide a durable storage platform for preserving any form of scientific data





COMPUTING AND ARCHIVING RESEARCH ENVIRONMENT

- **Compute Infrastructure**

- 10 Cabinet Racks
- 60 computing nodes
- 3000+ Processor cores
- 4 NVIDIA Tesla GPU
- 14+TB aggregated memory capacity
- Multiple 10Gbps Ethernet Interconnect

- **Storage Infrastructure**

- Long-term storage facility (Replicated over two data centers)
 - 1440 TB of usable storage capacity
- Parallel File System (LustreFS)
 - 720 TB maximum storage capacity
- Users can interface with the facility using a variety of access protocols:
 - iRODS
 - HTTP (OpenDAP, WebDAV)





COARE

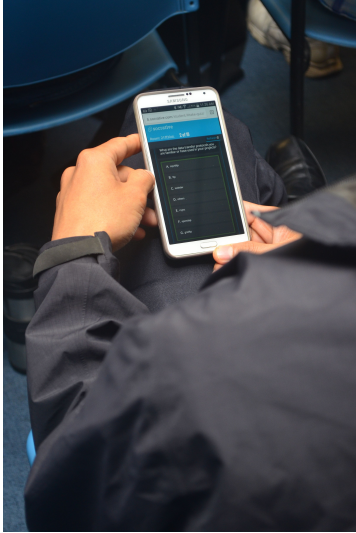
COMPUTING AND ARCHIVING RESEARCH ENVIRONMENT



Application Areas

- Flood modelling (Gerris)
- Molecular Dynamics (NAMD)
- Numerical Weather Prediction Modelling (WRF)
- Climate Modelling (RegCM)
- Bioinformatics Pipeline (BWA, GTK, etc.)
- Data Analytics (Spark)
- OGC Services (WMS, WFS)

Community Engagement and Support



Main Challenges and Opportunities

- Data sharing
 - Opening up access to scientific datasets observed from instrumentations and products of research
- Resiliency
 - Reliability of the service in the event of catastrophic disasters (man-made or natural)
- Visualization
 - Creative approach in analyzing scientific datasets
- Scalability
 - How fast can resources be upgraded/expanded

Summary

- Demand for larger e-Science infrastructures continue to increase as researchers are empowered with knowledge of innovative tools to carry out more intensive studies at a larger scale and faster pace
- e-Science unites the efforts of the research community and the national government

Thank you very much for your attention.