Dynamic Data-Driven Application System Methods in Economics and Financial Systems Modelling

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ICCS2013, Barcelona
EMMA- EMergency situations and disasters modelling, simulation and MAnagement

Overarching Objective:

- provide an effective decision support and management system for emergency situations management and disaster management for natural events (floods, tsunamis, earthquakes, hurricanes, volcano eruptions) for EU and men made disasters.
Aims

• accessing and processing both real-time data from a cloud of sensors and/or from a network of repositories, as well as simulation data coming from a network of supercomputing centers and data providers.

• development and testing of new paradigms and environments which execute simulations/modelling combined with real feed data and visualization and Virtual Reality feedback

• Validate the above on variety of case studies
1. Provide a common platform base on Dynamic Data Driven Application Systems (DDDAS) paradigm unifying the approach for all models for disaster and emergency situations modelling in the project.
2. Designing and developing, novel scalable algorithms, software infrastructures and methods for DDDAS paradigm allowing more efficient:

- real time interaction with real time feeds and historic data (large volumes and both structured and unstructured),
- visualization and Virtual Reality feedback,
- real-time analytics and interactive decision support for emergency situations management and disaster management.
3. Deal with large volumes of data and data types which are:

- structured and unstructured,
- both real-time and historic including 3D from finance,
- geospatial,
- social networks,
- transportation, logistics,
- telecommunications, etc
4. Need to work with an extremely large complex data sets and/or streams. Software implementation of the system developed will be tested on a set of case studies drawn from:

- emergency situations
- disaster management for natural events (floods, tsunamis, earthquakes, hurricanes, volcano eruptions)
- men made disasters (finance, etc.)
Detailed Objectives

The diagram illustrates the distribution of detailed objectives across different countries and categories. The countries represented are the Philippines, the United States, China, India, Indonesia, Mexico, Brazil, Nepal, Japan, and Guatemala. The objectives are categorized into Climatological, Geophysical, Hydrological, and Meteorological. The table below provides the specific numbers for each category and country:

<table>
<thead>
<tr>
<th>Category</th>
<th>Philippines</th>
<th>United States</th>
<th>China P Rep</th>
<th>India</th>
<th>Indonesia</th>
<th>Mexico</th>
<th>Brazil</th>
<th>Guatemala</th>
<th>Japan</th>
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<td>7</td>
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</tbody>
</table>
Detailed Objectives

Number of persons reported affected by natural disasters in 2011

Source: EM-DAT International Disaster Database
Disaster Impacts

UNISDR

Disaster Impacts / 2000-2012

$1.7 trillion damage (USD)

2.9 billion affected

1.2 million killed

Disasters caused the most economic damage - 2004 was also the year of Hurricane Katrina.

Earthquakes killed the most people - it was also the year of the Indian Ocean earthquake and tsunami.

Drought affected most people - it was also the year of major flooding in south and central part of China.

Data source: EM-DAT: The International Disaster Database. Data version 13 March 2013, vol. 07

Reducing Risks, Saving Lives
Disaster Impacts by category

![Bar chart showing disaster impacts by category, including damages, victims, and occurrence for Climatological, Geophysical, Hydrological, and Meteorological events.

- Climatological (2001-2010 vs 2011)
- Geophysical (2001-2010 vs 2011)
- Hydrological (2001-2010 vs 2011)
- Meteorological (2001-2010 vs 2011)
Current Case Studies

- Meteorological Phenomena (Hurricanes, Tornados, Typhoons)
- Hydro-Meteorological Phenomena (Floods)
- Seismologic Phenomena (Earthquakes, Volcanos)
- Atmospheric Phenomena (Air Pollution, Climate Change)
Case studies - Financial modeling side:

- Massive data analysis. Noisy data analysis (historic and streaming)
- Variety of advanced economics modelling is urgently needed!
- Banking – sophisticated stress tests!
- Risk Computing and Analysis, Solvency Calculation
- Portfolio Management, derivatives Pricing
- Algorithmic Trading
- Security and Fraud Management
- Customer Satisfaction-Relations (social networking analysis, etc)
Questions?