LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

A Grid Infrastructure for Environmental Computing

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Presentation at the International Symposium on Grids and Clouds (ISGC) 2015, Taipei/Taiwan

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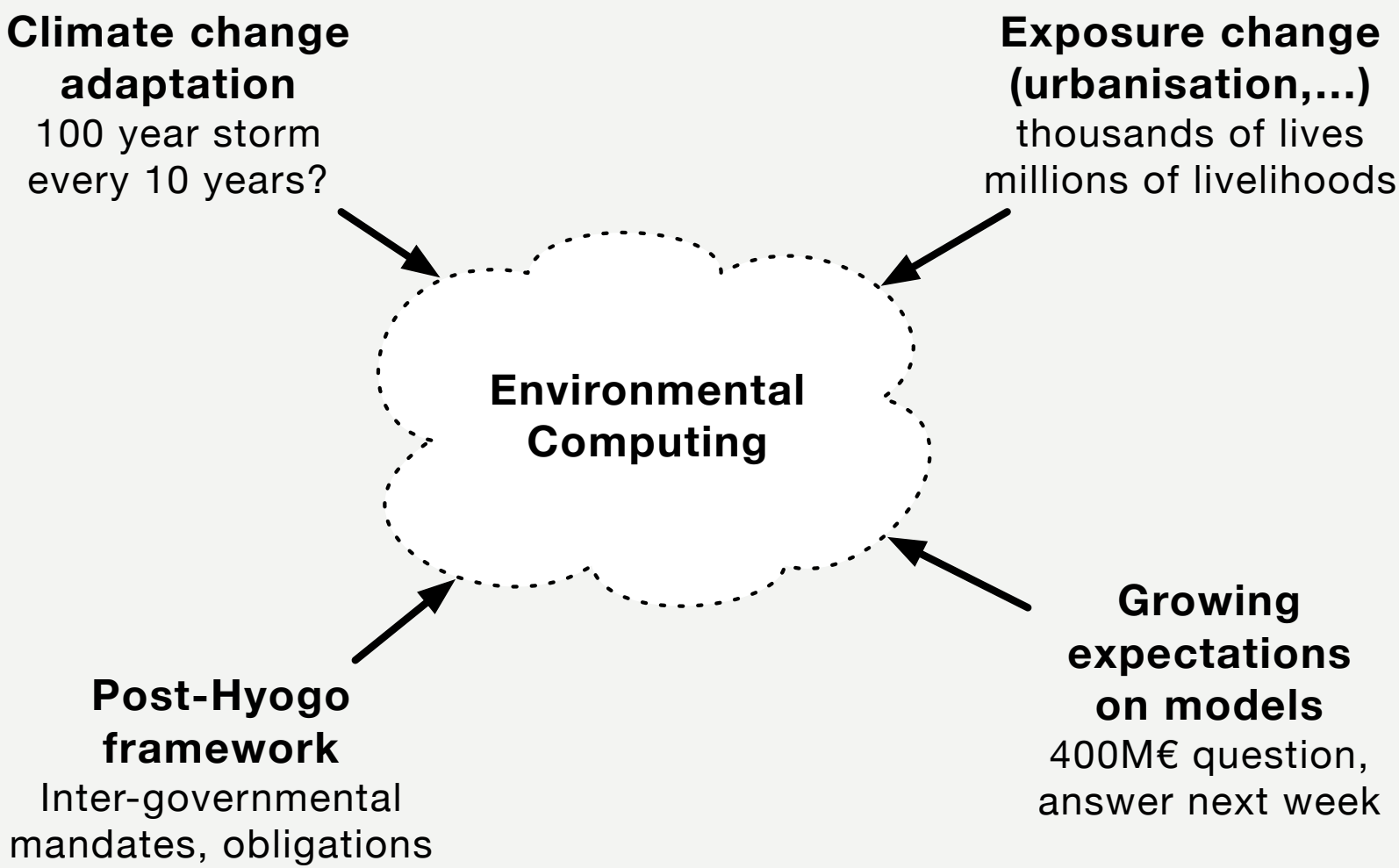
Environmental computing infrastructure: anything that helps us cope with this…



Good news – and bad

- Signs of market pull for infrastructure
  - After a decade characterised by “technology push”
- Opportunity to address major issues
  - Fine particulates: 2.1 million deaths annually (3 x times malaria)
  - 10 worst natural disasters in 2014: over 2600 deaths, 46b$ damages
- Pressure
  - Answers need to come faster
  - With more confidence
  - Often there is no “safe option”
  - Questions are more holistic

Breaking down the title

- Environmental computing
  - Applied environmental modelling
    - New use cases, problem statements
  - Environmental multi-modelling
    - Link several models together to produce more complete scenarios
    - Capture inherently multi-model phenomena, such as flooding
- Grid infrastructure
  - IaaS + … + consulting

What is environmental computing?

- Enhance, combine, complement – don't replace
  - Meteorology, seismology etc. important components
    - Scaled up – especially "new" specialties
    - Speeded up – urgent computing
  - Developing applied environmental modelling solutions
    - Efficiency
    - Trust
    - Making the results relevant
  - Similar to medical informatics
    - Integration didn't replace specific disciplines
    - Made them more accessible and visible – and trusted
    - Common body of knowledge

Current environmental computing service providers (government facing)

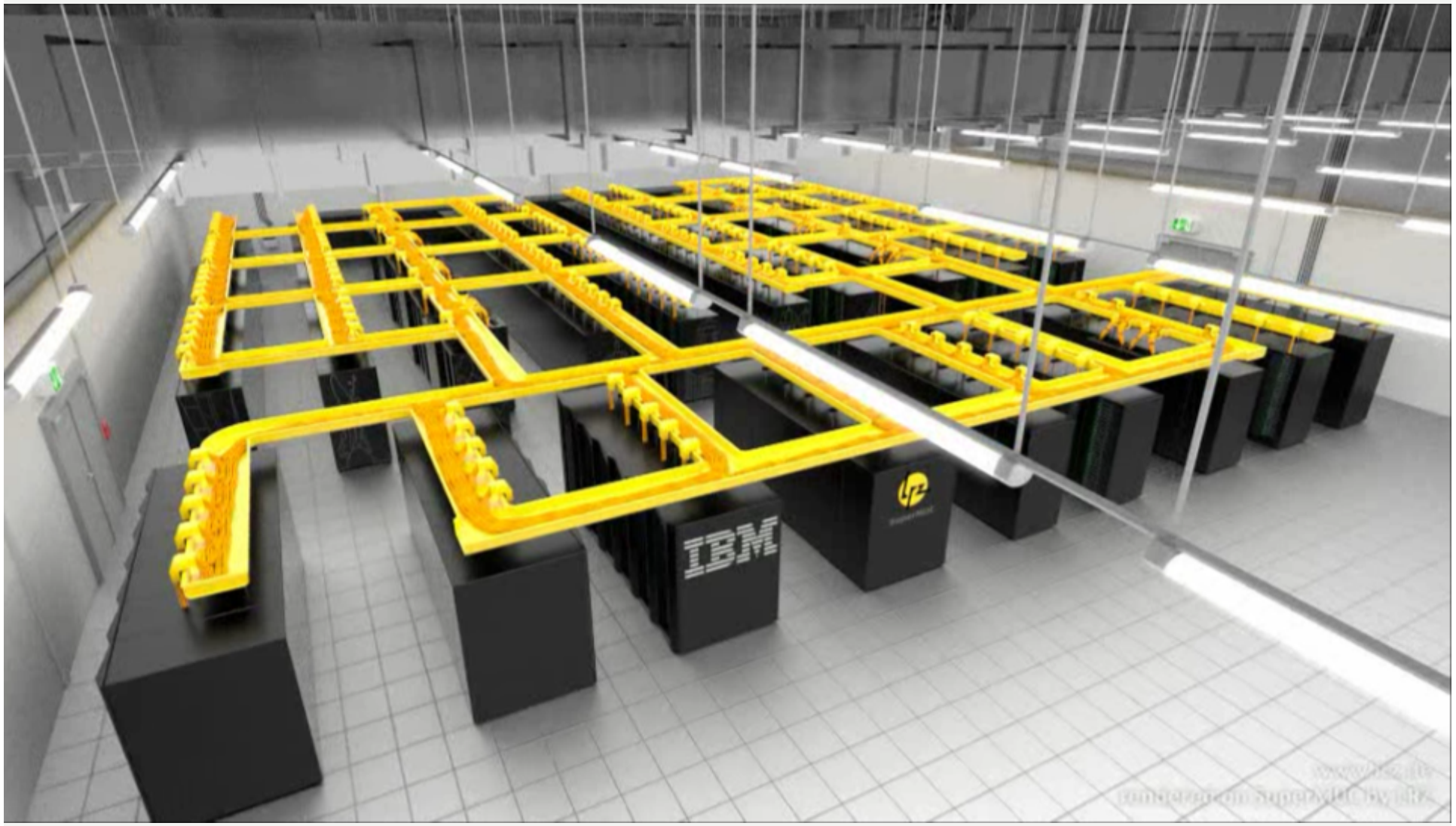
- UNISDR
  - UN-wide mandate: coordinate disaster risk reduction activities
  - Ongoing collaboration with LMU/LRZ, joint “side event” 15th March at Sendai WCDRR
  - Computational challenge: Global Assessment Report on Risk reduction
    - Global grids ranging from 30km to 1km “edge”
    - “We could have happily spent one more year producing this”
    - Ambition: 100m x 100m grid -> computing requirements thousands to millions times the current ones
- Others
  - WHO, UNEP,…
  - EC-ECHO,…
  - National civil protection
- Approach: coordinate role, modelling in collaborating institutes

Technical challenge – case UNISDR

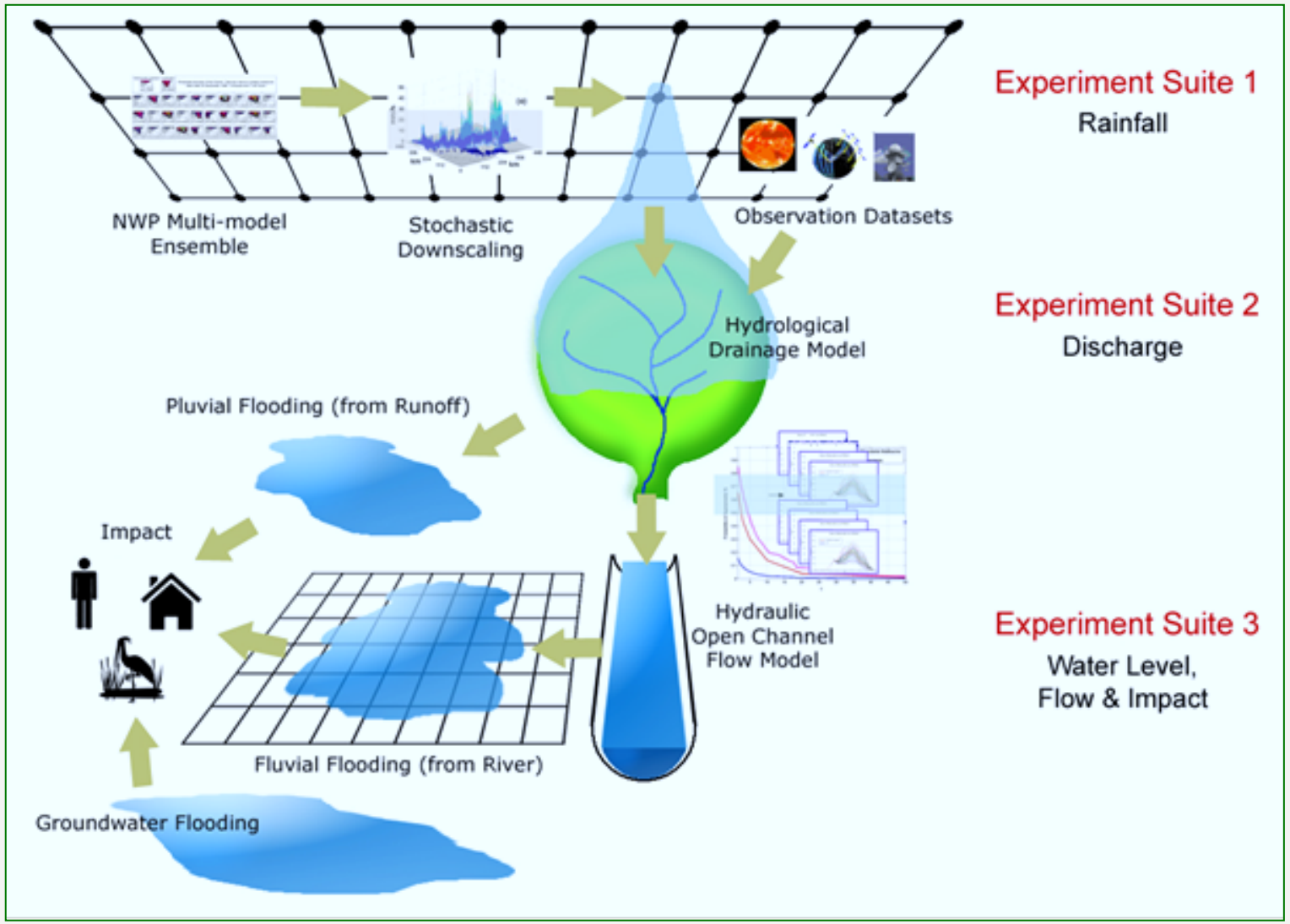
- 2 Servers, 24 cores
- 5 week “job” to provide fundamental input to policy documents
- Reaching this stage ~6 months (from single core model)

- Manual “sanity checks” essential
- Country-by-country checks trigger re-execution (impact days)

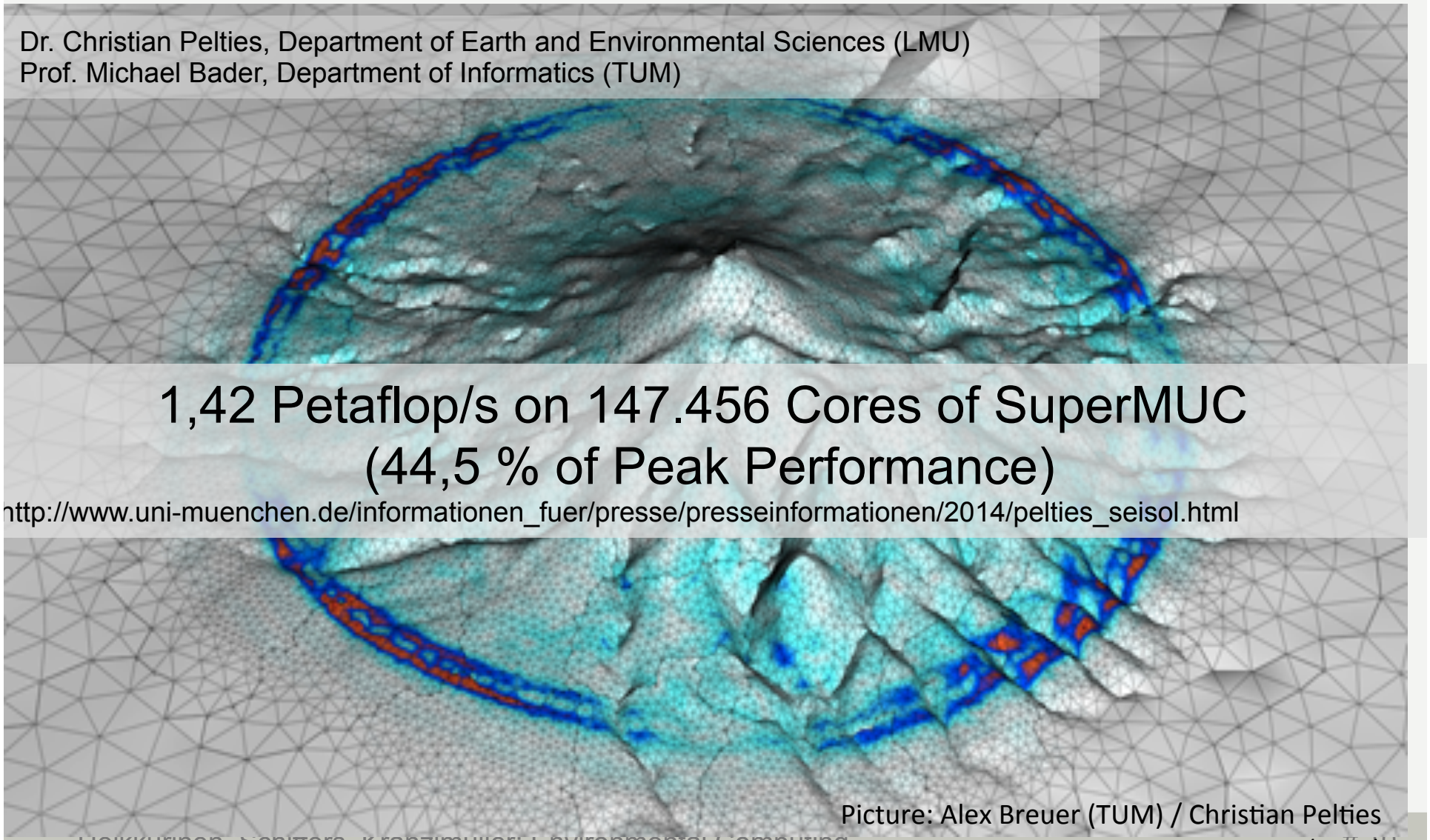
Another 6 months?



Success stories: DRIHM (motivated the first steps)



Success stories: seisol



Dr. Christian Pelties, Department of Earth and Environmental Sciences (LMU)
Prof. Michael Bader, Department of Informatics (TUM)

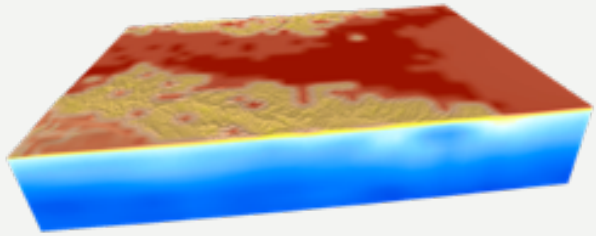
1,42 Petaflop/s on 147.456 Cores of SuperMUC
(44,5 % of Peak Performance)

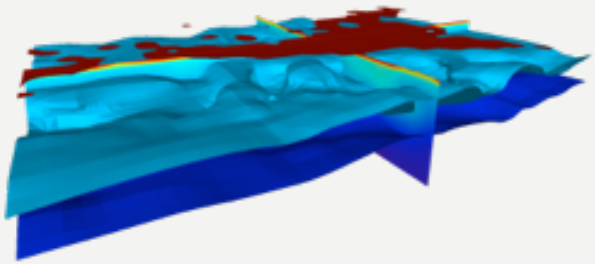
http://www.uni-muenchen.de/informationen_fuer/presse/presseinformationen/2014/pelties_seisol.html

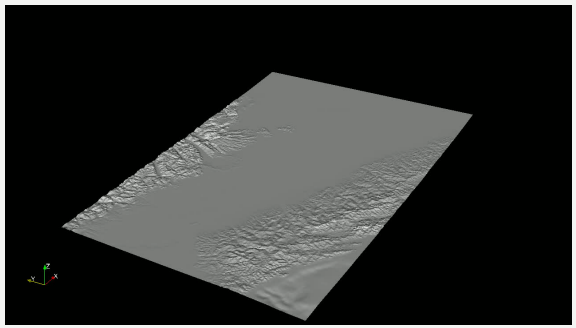
Picture: Alex Breuer (TUM) / Christian Pelties (LMU)

Success stories: VERCE

Leverage on the 5 sided projection installation to enable decision makers to have a swift and yet deep insight into simulated predictions







Credits:
VERCE.eu

North Italian earthquake

Date: 20 May 2012

Magnitude: 5.9

Code: Specfem3D Cartesian

Why these matter

- Part of the shared body of knowledge that we need to build
  - Technical solutions (products, libraries)
  - Approaches used to reach them (reuse in other projects)
  - “Lessons learned”
- Motivation for the model developers
  - “We have a path to SuperMUC” *and* to major policy documents
- New users for components
  - Individual component vs. component suite

Bringing the infrastructure to current environmental computing service providers

- Requirement gathering crucial
  - May require proof of concept implementations
- Change the wheels while the bus is running
  - High demand for modelling results on the user side
  - Offer man- and computing power, not advice
- Support network needs to be “Grid-like”
  - A lot of the current environmental computing activities are federated
  - Actual computing infrastructure less important?

The big picture – redrawn

	Phenomena (Observations, Models)	Solution Enabling (Services, Tools, Providers, Cooperations)	Opportunities & Benefits (Science, Economy, Ecology, Society)
Technical Perspective	Seismology Global Warming Hydro-Meteorology		Disaster Management Climate Change Responses Local/Regional Forecasting Hazard Research Decision Support
Organizational Perspective	Citizen Scientists Governmental Authorities Scientific Communities Enterprises		Project Funding Schemes Centers of Excellence Transdisciplinary Education Market Opportunities Research Agendas

Information and next steps

- More information
  - Envcomp.eu website- launched, more content soon
  - WCDRR side event: http://www.envcomp.eu/?page_id=84
- Events
  - eScience 2015: environmental computing focus day
    - http://escience2015.mnm-team.org/
  - ISGC 2016 workshop on disaster mitigation (TBC)
- Get in touch!
  - Mailing lists being planned – contact heikku@nm.ifi.lmu.de
  - Success stories, interesting problems, use cases etc. also most welcome!
  - Envcomp.eu forum (in beta)