

**Possible UNU Contributions to
GEO/AWCI**

Srikantha Herath

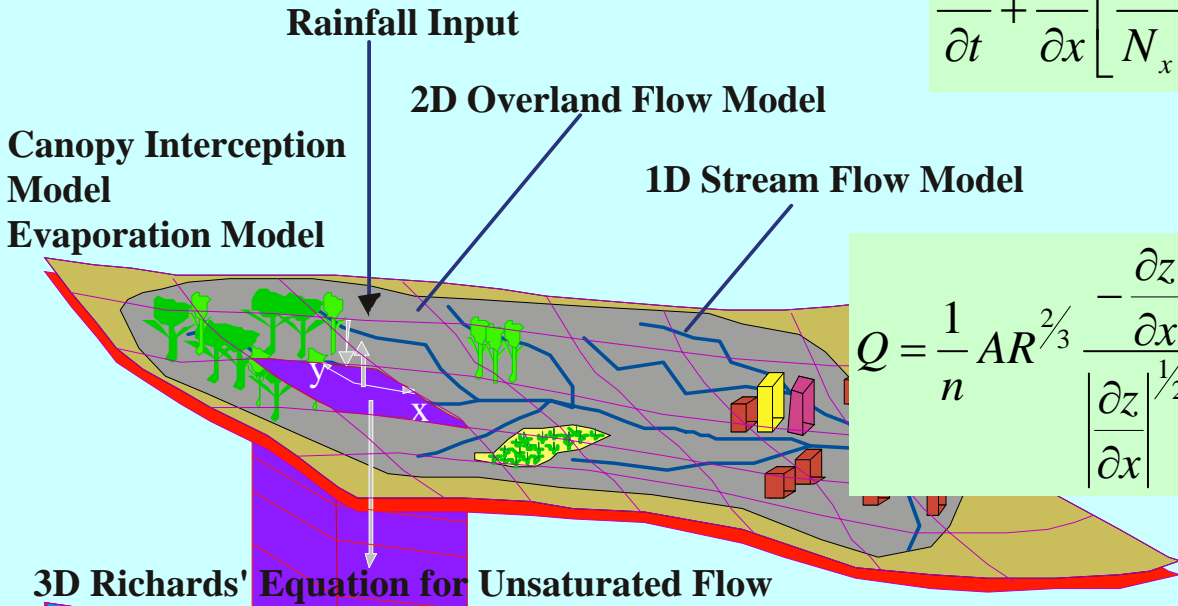
**Environment and Sustainable Development
Program**

UNITED NATIONS UNIVERSITY

Tools for capacity building and applied research

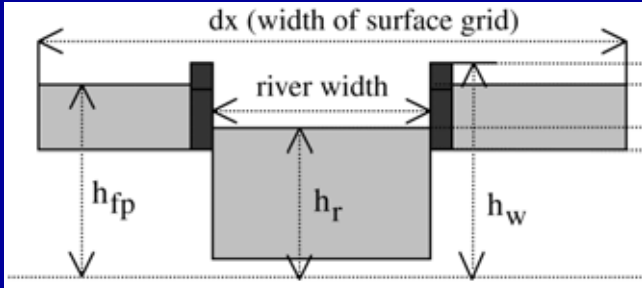
- ❑ Flood inundation modelling**
- ❑ Flood loss estimation**
- ❑ Rainfall downscaling and forecasting**
- ❑ Currently setting up a training program targeting senior engineers and researchers**

Inundation modelling



$$\frac{\partial h}{\partial t} + \frac{\partial}{\partial x} \left[\frac{1}{N_x} S_{fx}^{1/2} h^{2/3} h \right] + \frac{\partial}{\partial y} \left[\frac{1}{N_y} S_{fy}^{1/2} h^{2/3} h \right] = q$$

$$Q = \frac{1}{n} AR^{2/3} \frac{-\frac{\partial z}{\partial x}}{\left| \frac{\partial z}{\partial x} \right|^{1/2}}$$



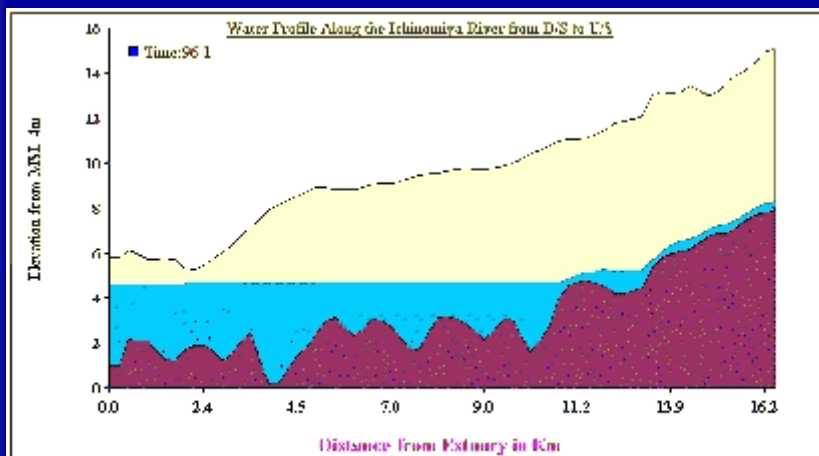
$$C \frac{\partial \Psi}{\partial t} = \frac{\partial}{\partial z} \left(k_{zz} \frac{\partial \Psi}{\partial z} + 1 \right) + k_{xx} \frac{\partial^2 \Psi}{\partial x^2} + k_{yy} \frac{\partial^2 \Psi}{\partial y^2} + S$$

$$S_i \frac{\partial h_i}{\partial t} = K_{xx_i} \frac{\partial^2 h_i}{\partial x^2} + K_{yy_i} \frac{\partial^2 h_i}{\partial y^2} + R_i$$

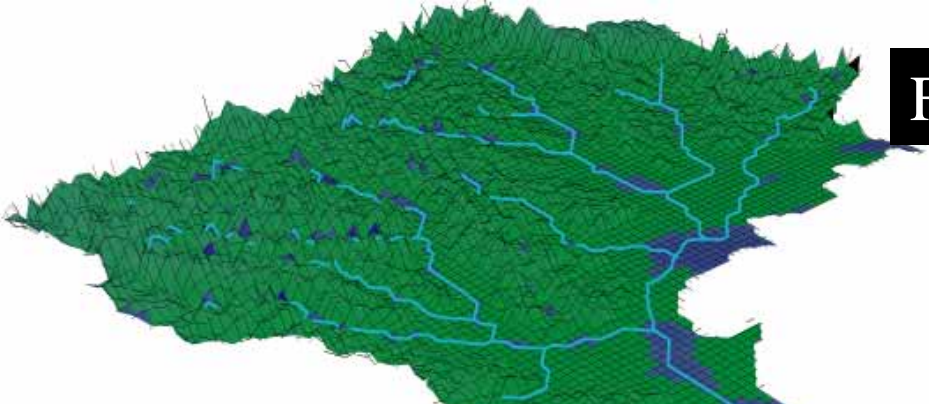
Rain to flood inundation modeling

□ Features

- River overflow and flood plain interaction
- Diffusive or Dynamic wave approximation for river network
- Include/exclude unsaturated zone and ground water
- Applied in Japan, Thailand and a number of Asian countries.
- Grids from 5 m to 250m. (no limitation)

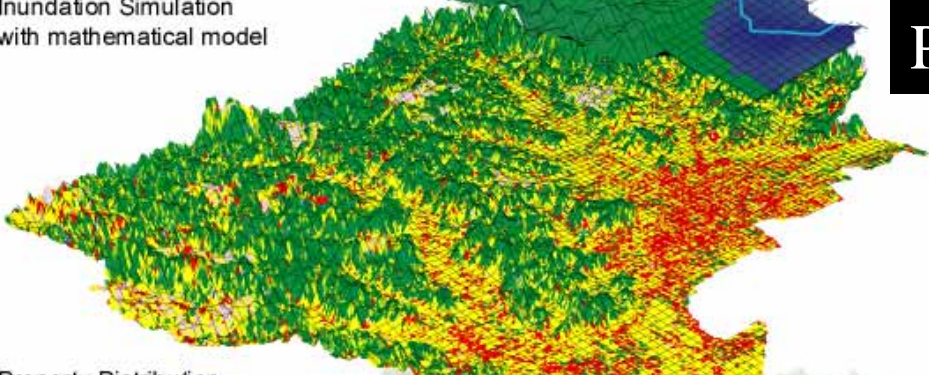


Flood Inundation



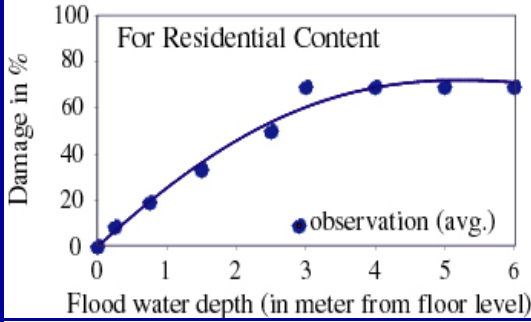
Inundation Simulation with mathematical model

Property Distribution



Property Distribution with GIS

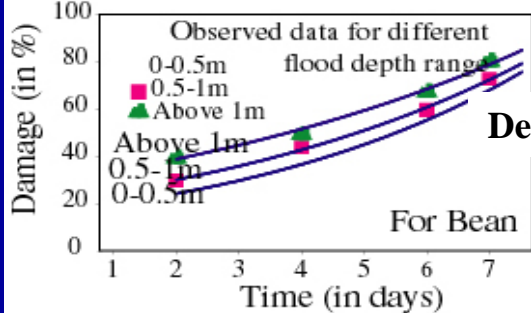
Damage %



Residential building content

Depth

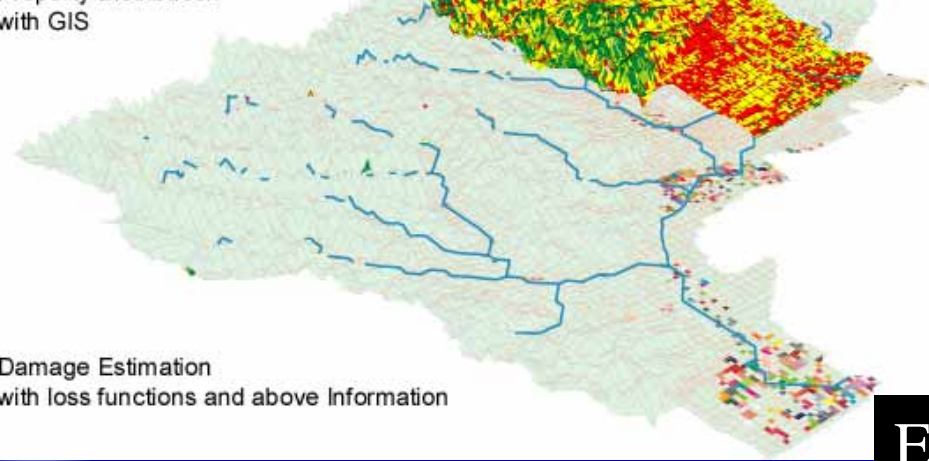
Damage %



Beans

Depth

Time

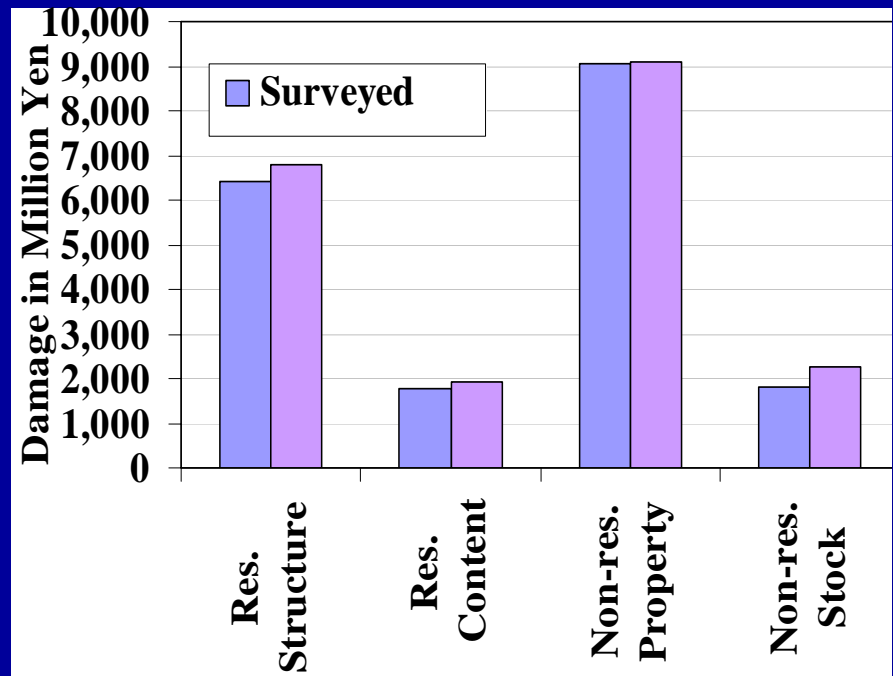


Damage Estimation with loss functions and above information

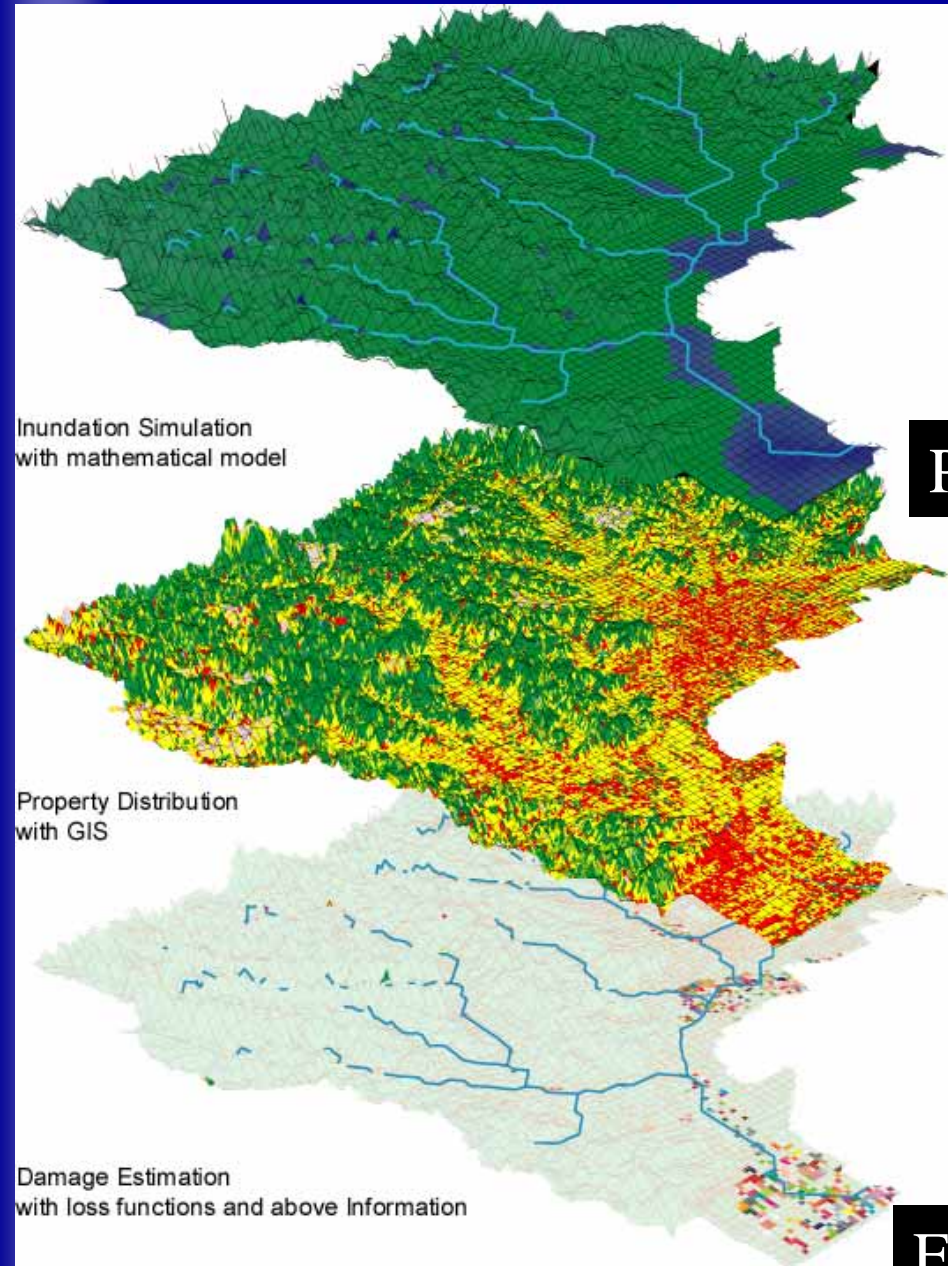
Economic damage Distribution

- ❑ **Differences among estimates.**
 - **Direct, from flood height, from forecasting**
- ❑ **A significant effort is required to improve the elevation data resolutions from current levels - order of 10 cm.**

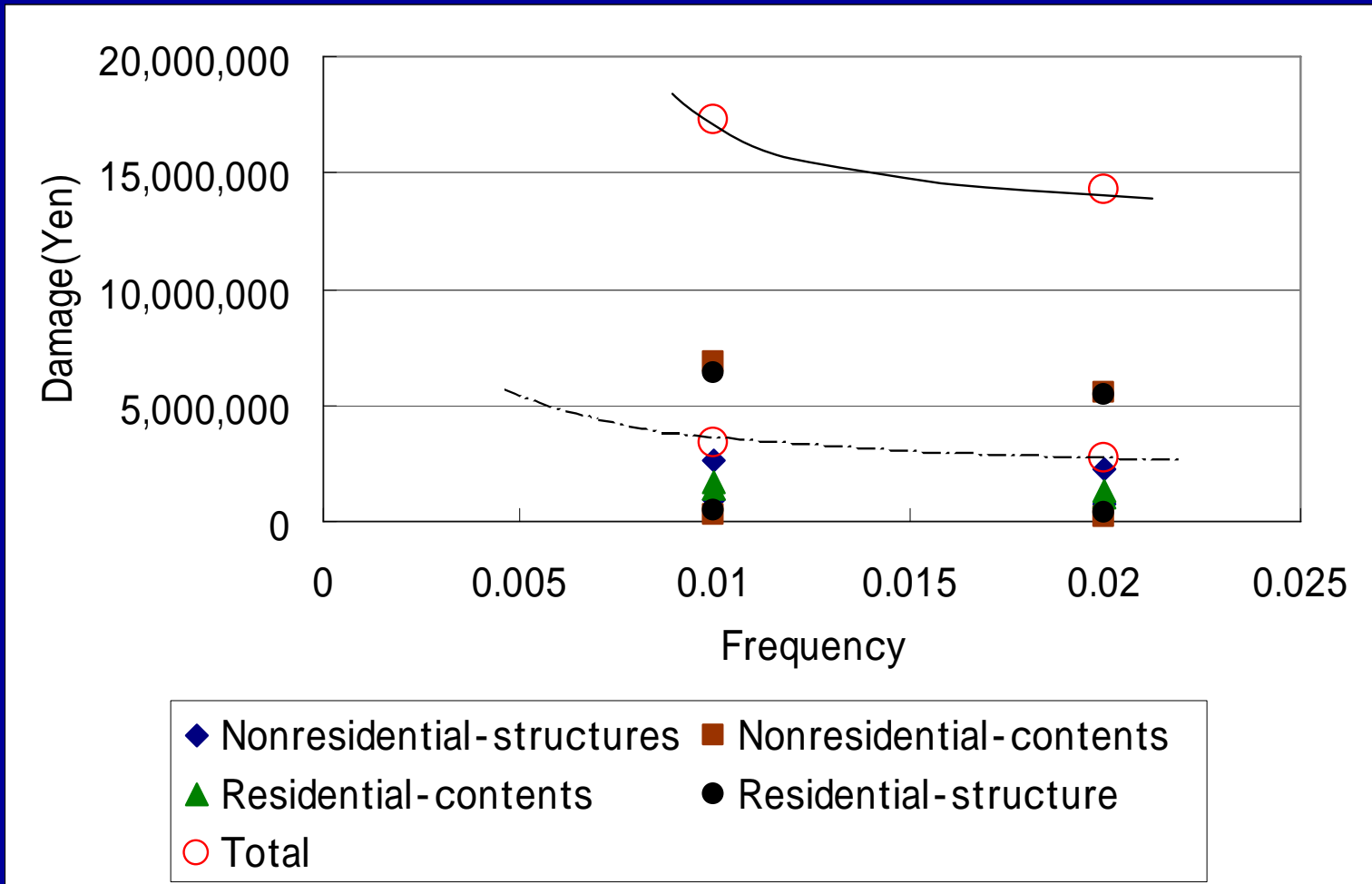
Property Distribution



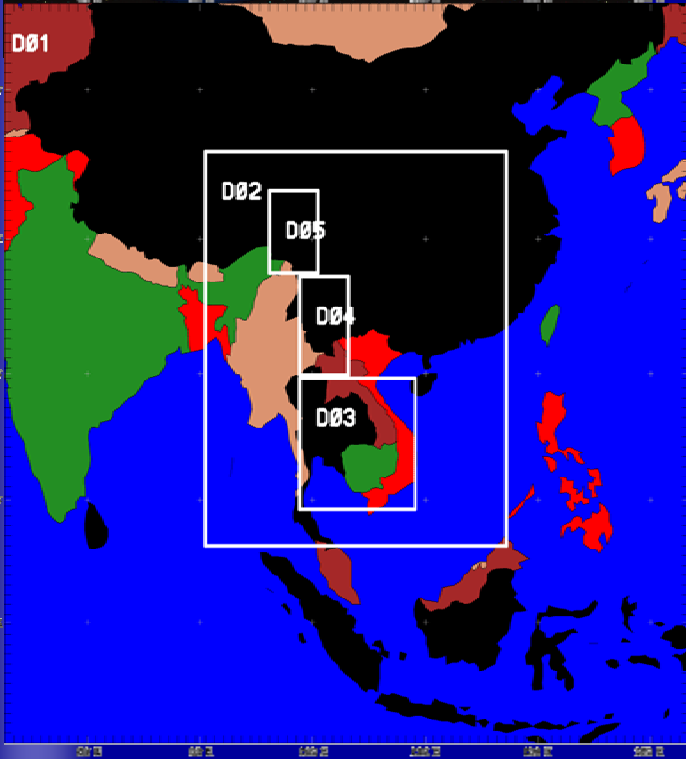
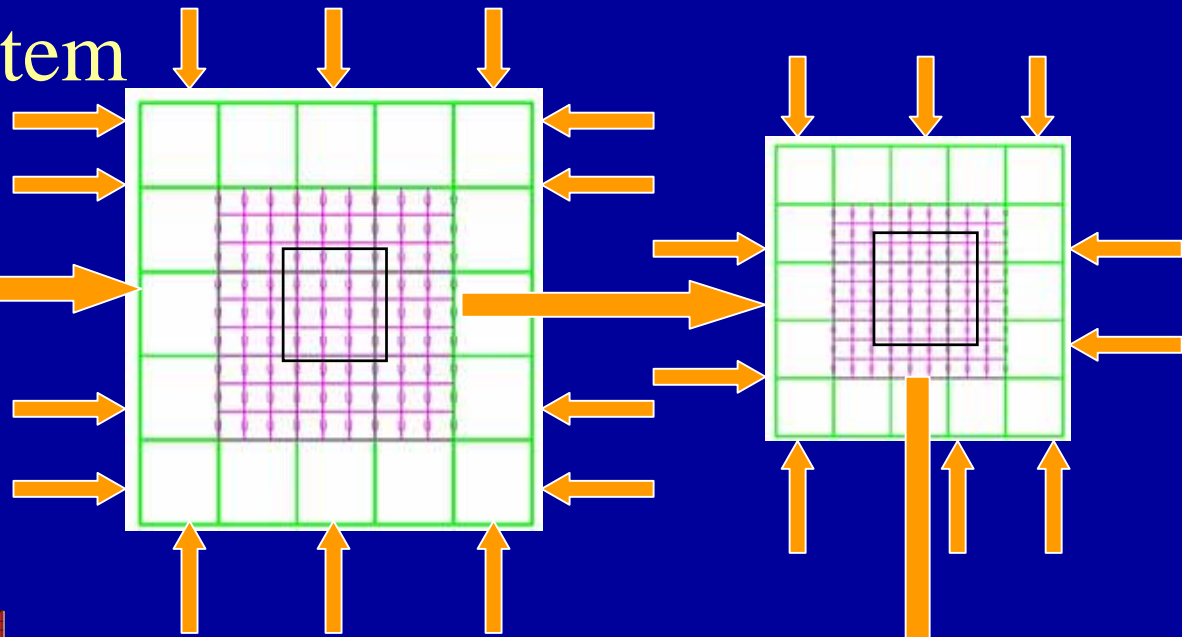
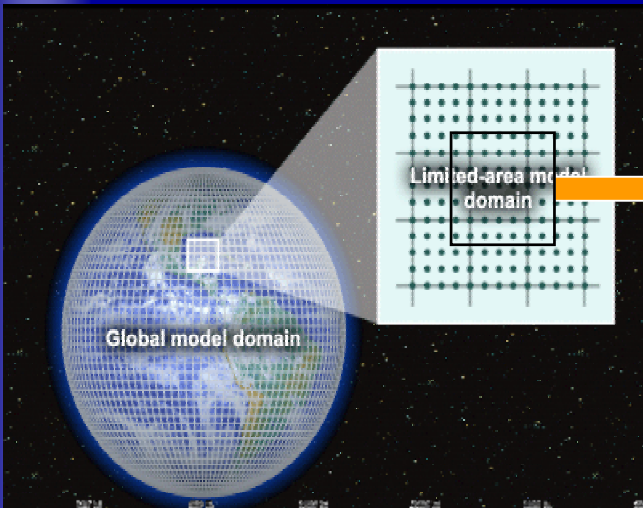
Economic damage Distribution



Frequency – Loss relation



Realtime RF system

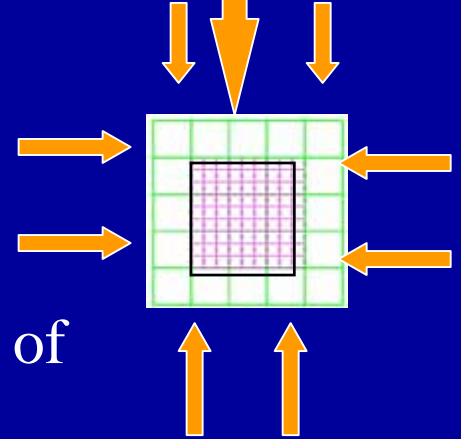


We use the global forecast (GFS data sets)

Weather Research and Forecasting (WRF) Model of NCAR, USA used for downscaling

Automated systems

Use for scenario modelling



Hardware

Cluster Workstations

Pre-post processing
computer

High-powered workstation

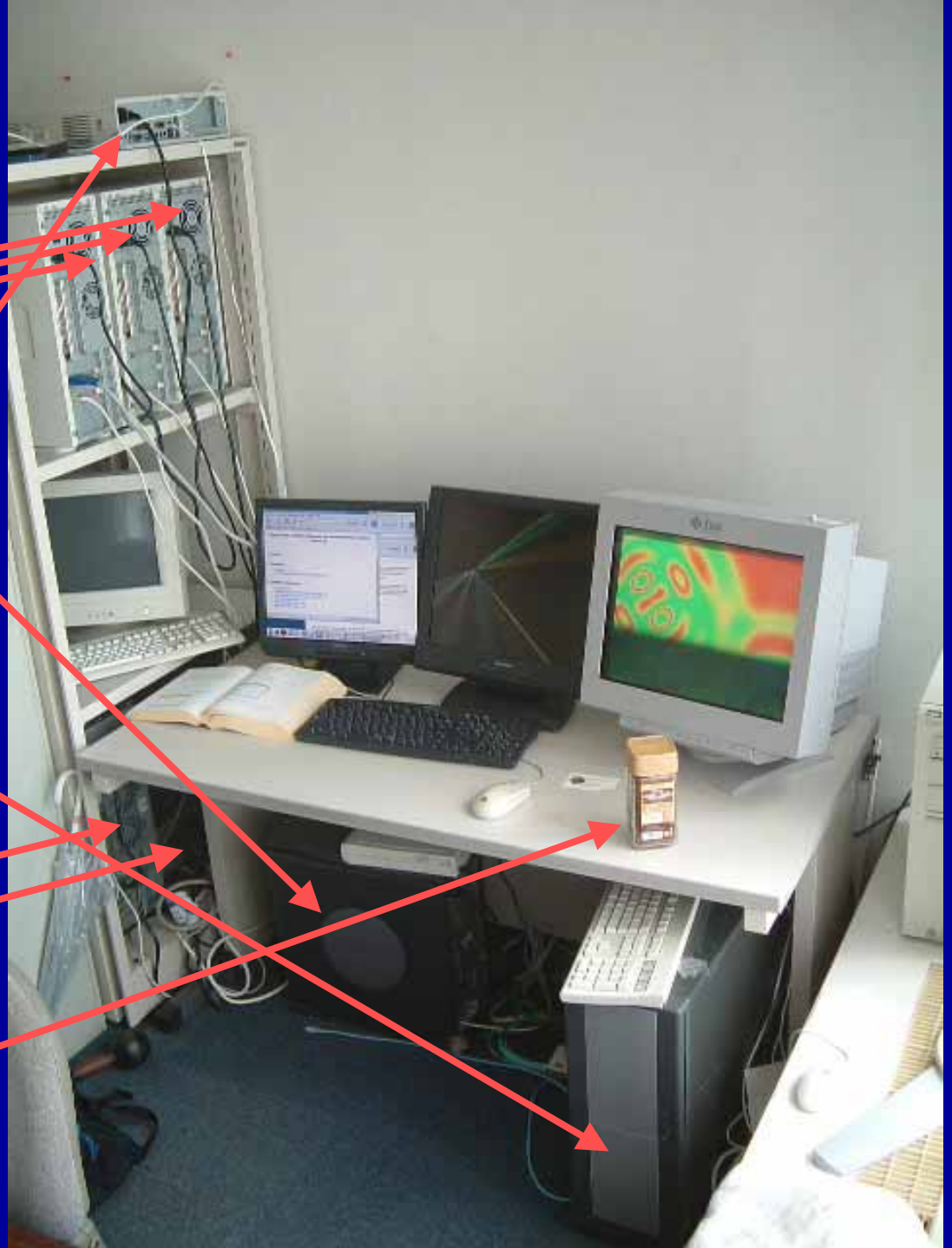
DNS server

Additional
workstation

Server

Gateway/Router

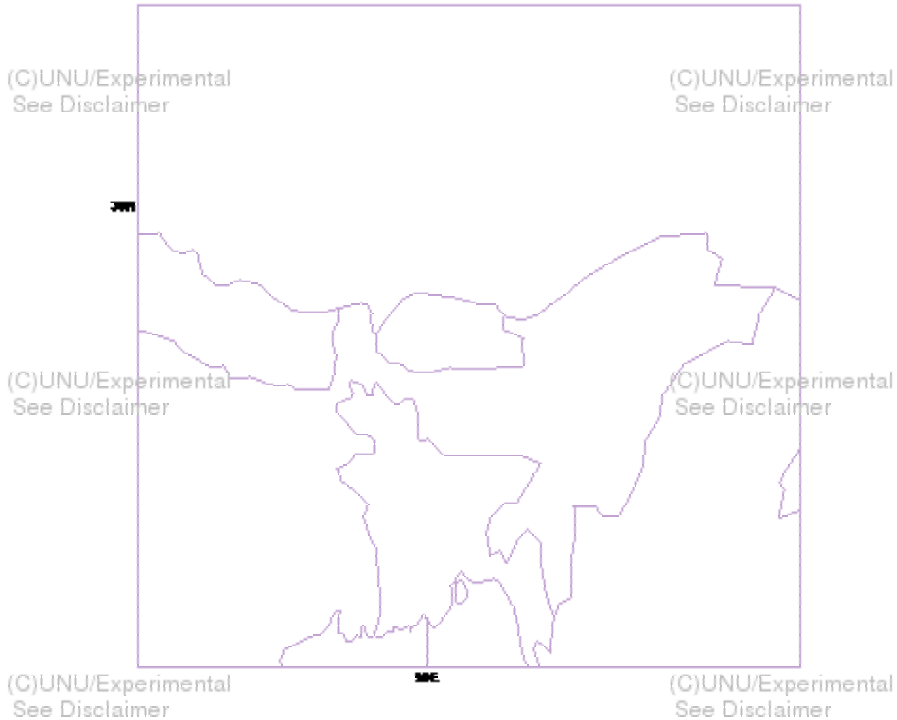
Coffee



Application - Bhutan

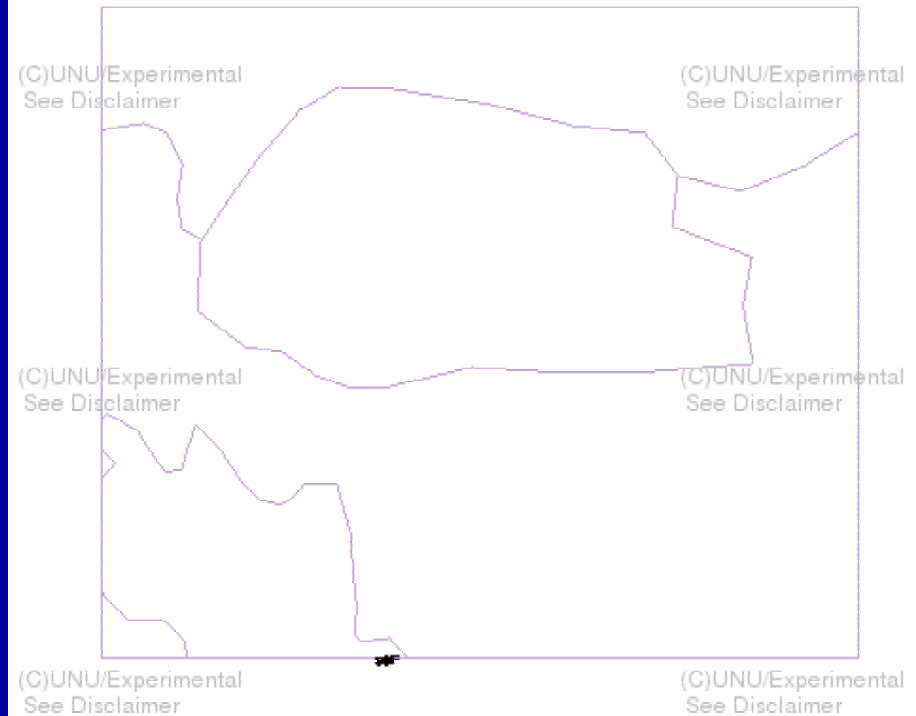
Total Precip (color, mm)

2007-01-10 00:00:00 = 2007-01-10 00:00:00 + 0 h



Total Precip (color, mm)

2007-01-10 00:00:00 = 2007-01-10 00:00:00 + 0 h



Thank You