A Web-Based Visual User Interface
to a flood forecasting system

Professor Mikael Jern
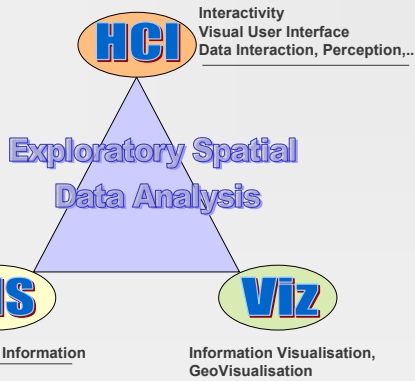Linköping University, Sweden

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Outline – Focus on Real-time Demonstrations

Demonstrate state-of-the-art visualisation tools that can be used in geo-information fields – Disaster managements

❑ **Exploratory Data Analysis and Visual User Interface**

❑ **Short Conceptual Demonstration of tools**

❑ **MUSIC – Visual Flood forecasting**

❑ **Demonstration of FloodViewer**

❑ **Dynamic Documents - Demonstration**

❑ **Conclusion and Future**

http://servus.itn.liu.se/projects/music

HCI

Interactivity
Visual User Interface
Data Interaction, Perception,..

Exploratory Spatial
Data Analysis

GIS

Viz

Geographical Information

Information Visualisation,
GeoVisualisation

Search for relationships, patterns and trends
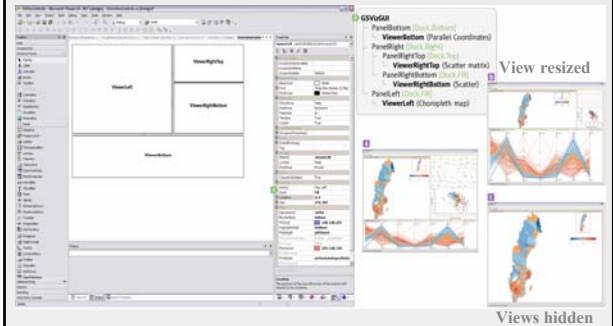**to gain understanding and knowledge of the data**
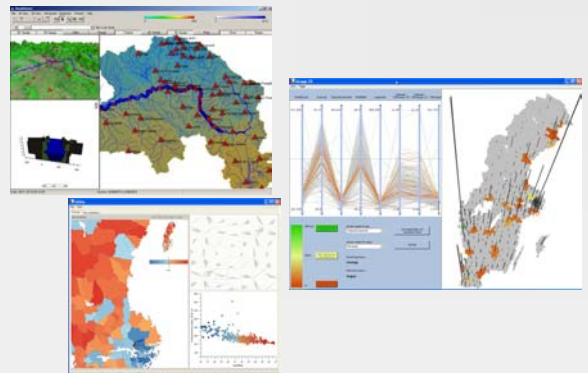
Exploratory Spatial Data Analysis - Highlights

- **Data is Multi-Dimensional, Temporal and Spatial**
- **Dynamically Linked and Coordinated Views**
  - Humans can detect certain patterns better and faster than data mining tools
  - Instead of 3D visualisation – view same data with different methods
- **Dynamic Queries – Filter multiD data**
- **Visual User Interface – High performance interaction**
- **Perceptual issues vitally important - 2D as superior to 3D**
  - to rapidly and *automatically* detect patterns and changes in size, colour, shape, movement, or texture
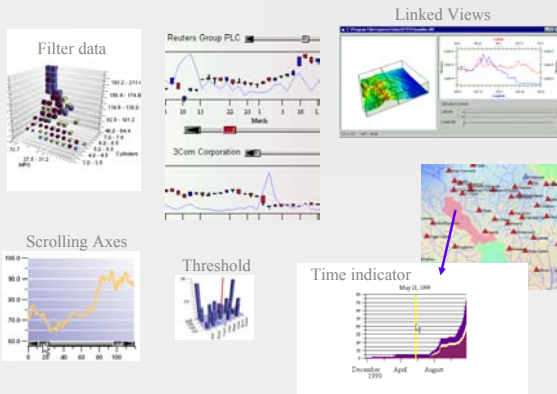

Dynamically Linked and Coordinated Views
Microsoft's Visual Studio .NET

View resized

Views hidden

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Some Visual User Interface - Methods

Filter data

Linked Views

Reuters Group PLC

3Com Corporation

Scrolling Axes

Threshold

Time indicator

Dynamic Queries

- Interactive control by a user of visual query parameters that generates a dynamic visual display of database search results.
- Continuously update search results as users adjust GUI sliders to emulate queries.
- Bypasses the need for learning syntax of database query languages.
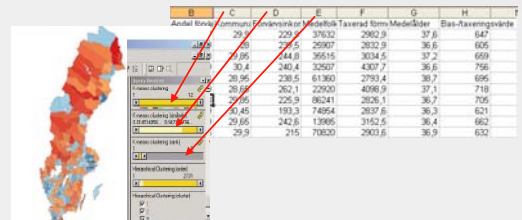
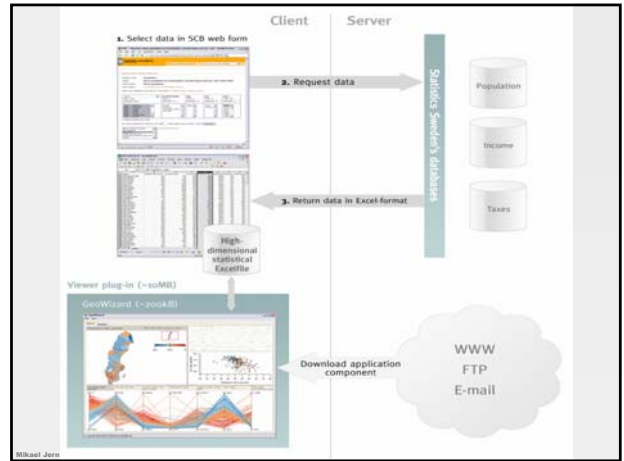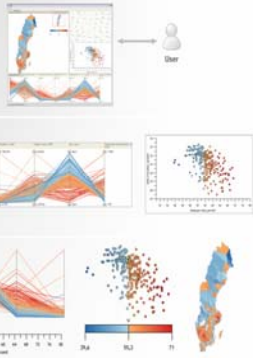**Layered Component Architecture**

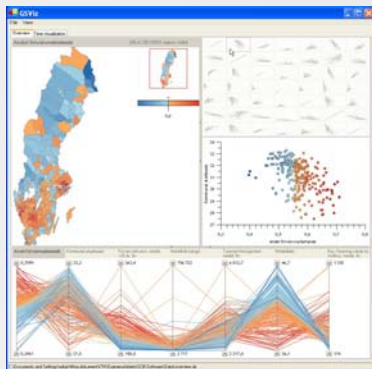*Tailor-made applications*

Application component

Functional component

Atomic component

Conceptual Quick Demonstration

Conceptual Quick Demonstration

Conceptual Quick Demonstration
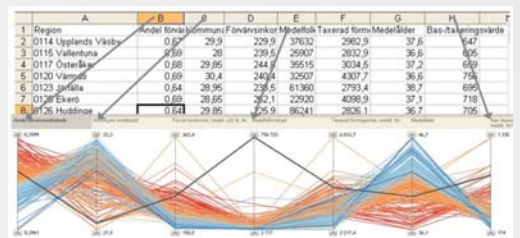
MUSIC – Flood forecasting

Multi

Sensor Precipitation
        Measurements

Integration

Calibration and flood
                forecasting

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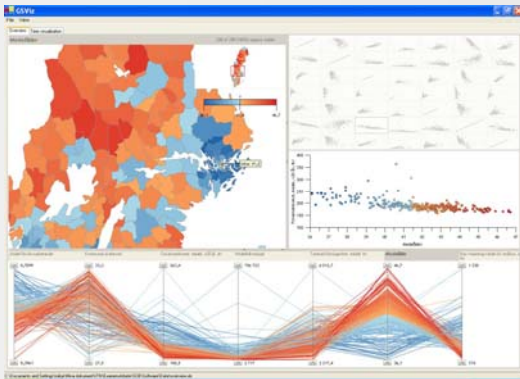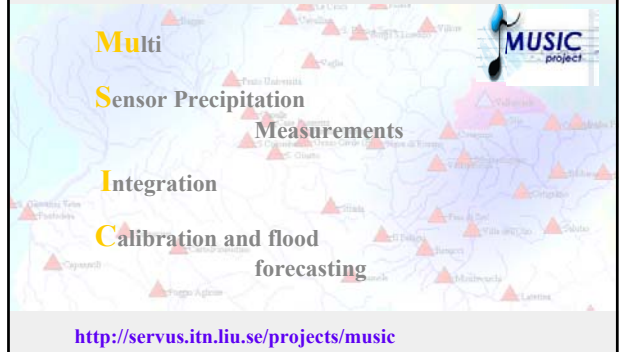
MUSIC – EC funded project

PROJECT PARTNERS:

		Project Partners	Link to Website
1	UNIBO	University of Bologna (I)	
2	UNEW	University of Newcastle upon Tyne (UK)	
3	CNR-ISAO	Consiglio Nazionale delle Ricerche (I)	
4	GEMA	Gematronik GmbH elektronische Anlagen (D)	
5	ET&P	ET&P Srl-Environmental Technologies and Products (I)	
6	LIU	Linköping University	
7	ARPA-SMR	Agenzia Regionale Prevenzione e Ambiente dell'Emilia Romagna (I)	
8	FMA	Fondazione per la Meteorologia Applicata (I)	
9	IMGW	Institute of Meteorology and Water Management (PL)	

MUSIC - Objectives

- ❑ Improve the overall precipitation forecasting reliability
- ❑ Develop a precipitation data fusion system (weather radar, satellite and rain-gauge)
- ❑ Integrate and test the improved facilities in well proven flood forecasting models with known characteristics
- ❑ Provide a measure of the uncertainty of the precipitation estimates and the flood forecasts
- ❑ **Design new methods of visualization and dissemination of precipitation and flood warning data**

Case study: Arno River in Toscana, Italy

Data Fusion

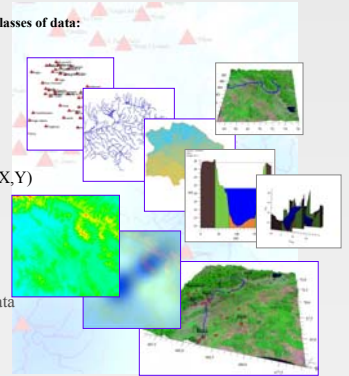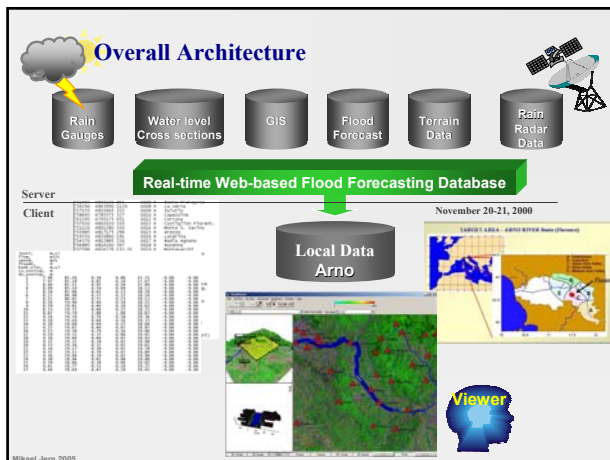Input Data represented by two main classes of data:

❑ **Vector Data**
  o Rain Gauges
  o River Network
  o River Main Segment
  o Sub-basins
  o Waterlevel
  o Cross Sections 500 (X,Y)

❑ **Raster Data**
  o Digital Terrain Map
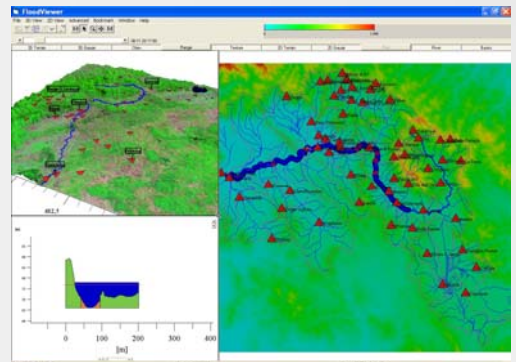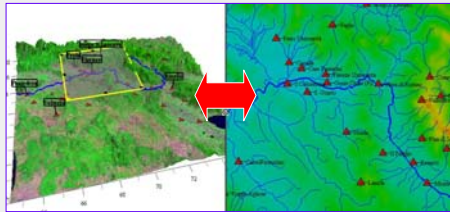 o Overlap Satellite
  o Radar and Kriged data

Overall Architecture

Rain Gauges | Water level Cross sections | GIS | Flood Forecast | Terrain Data | Rain Radar Data

Real-time Web-based Flood Forecasting Database

Server
Client

November 20-21, 2000

Local Data Arno

Viewer

D E M O

Linked Views

Focus and Context

Water level
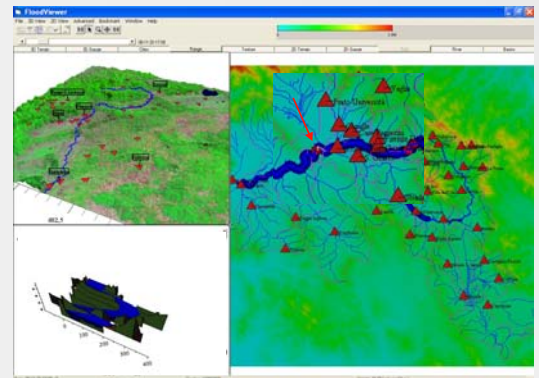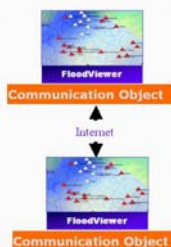
Three System Scenarios

Light-weight Application	Encapsulated object	Collaborate Application
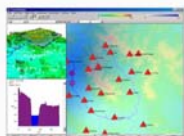
Dynamic Interactive Office WORD Document

Hyperlink controls Component Attributes "Guided Tour"

Application Component

Local Data is embedded in the document

Exploratory Visualisation – Key ideas….

- ❏ Interaction with large multiD data sets
- ❏ Dynamically linked views and Dynamic Queries
- ❏ Fit with perceptual skills - visual perception, spatial memory
- ❏ Meaningful interaction to support learning and thinking and reasoning
- ❏ Customisable Visual User Interface
- ❏ Small footprint – Delivered through the Web
- ❏ No Runtime Cost – Easy-to-install
- ❏ Can be Embedded in Electronic Documents
- ❏ **Not a failed experiment**
- ❏ **But not a future revolution either…yet**

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Thank you !!!