MU

MASARYK UNIVERZITY
INSTITUTE OF BIOSTATISTICS AND ANALYSES

MASARYK UNIVERZITY
FACULTY OF INFORMATICS

Visual Analytics in Environmental Research:
a Survey on Challenges, Methods and Available Tools

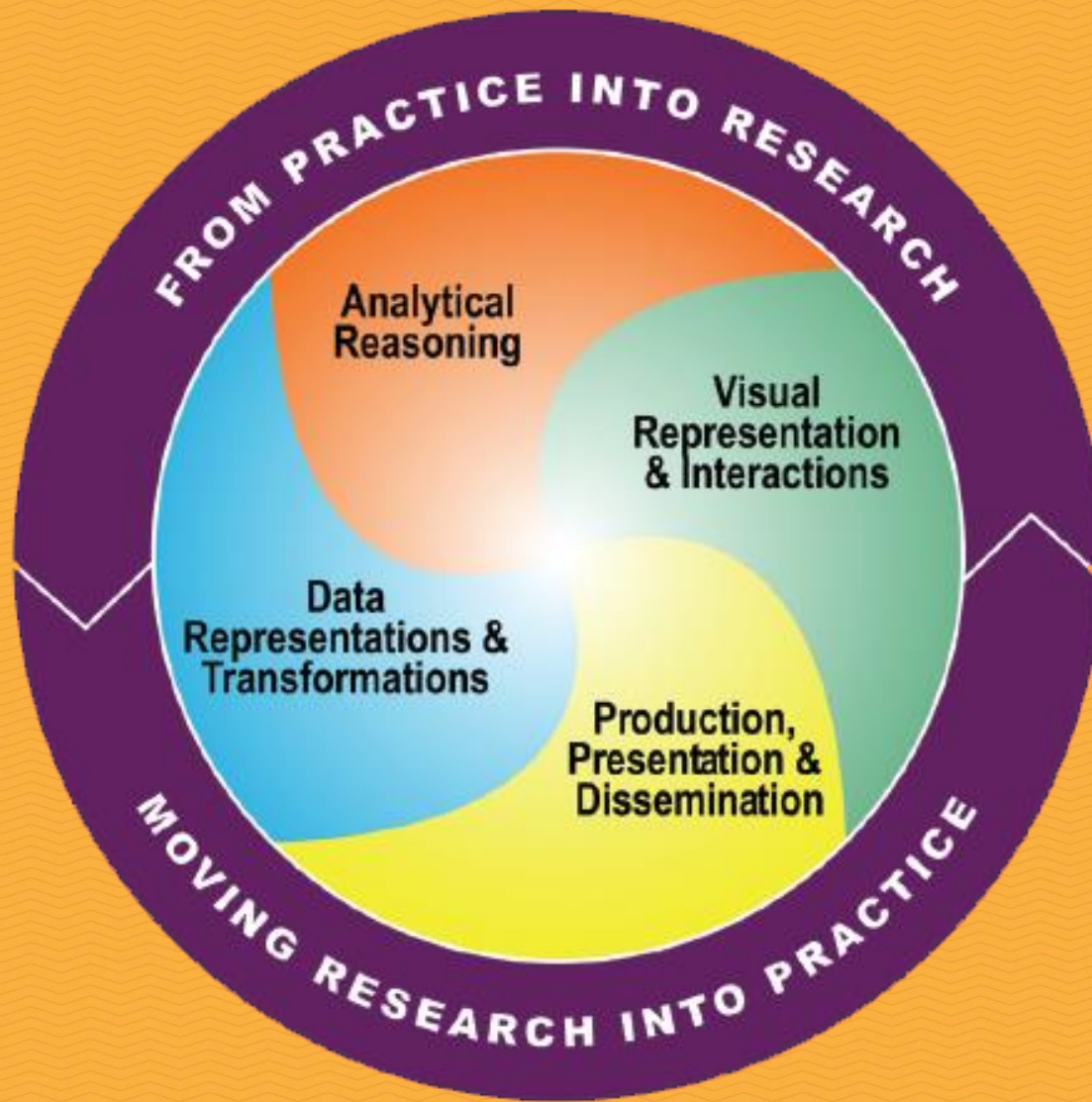Martin Komenda, Daniel Schwarz

ISESS 2013

Outline

- Visual analytics approach

- Human cognitive abilities and limitations

- Current challenges

- Visual analytics scenario overview

What is Visual Analytics?

Visual Analytics is the science of analytical reasoning supported by interactive visual interfaces.

- Support the cognitive processes
- Deliver the knowledge
- Discover the relations and patterns

What is Visual Analytics?

Thomas, J., Cook, K.: Illuminating the Path: Research and Development Agenda for Visual Analytics

Application of Visual Analytics

- Moving from research to a widespread use

- Looking at the data from different perspectives

- Combining with computational processing

- Optimization of delivering knowledge

Human Cognitive Abilities

Inscrease of computing components performance

Human cognitive capability remain constant

How to reduce human cognitive weaknesses?

Visual Analytics Systems

- Combination of mathematical, statistical informatical and linguistic analysis

Transforming data into
  - clear,
  - concise,
  - human comprehensible
    visual representations.

Visual Analytics Scenario Overview

http://www.sas.com/

Scenario I.

Methods & Techniques

- time scales statistical values computing, pattern visual identification, detected pattern exploration
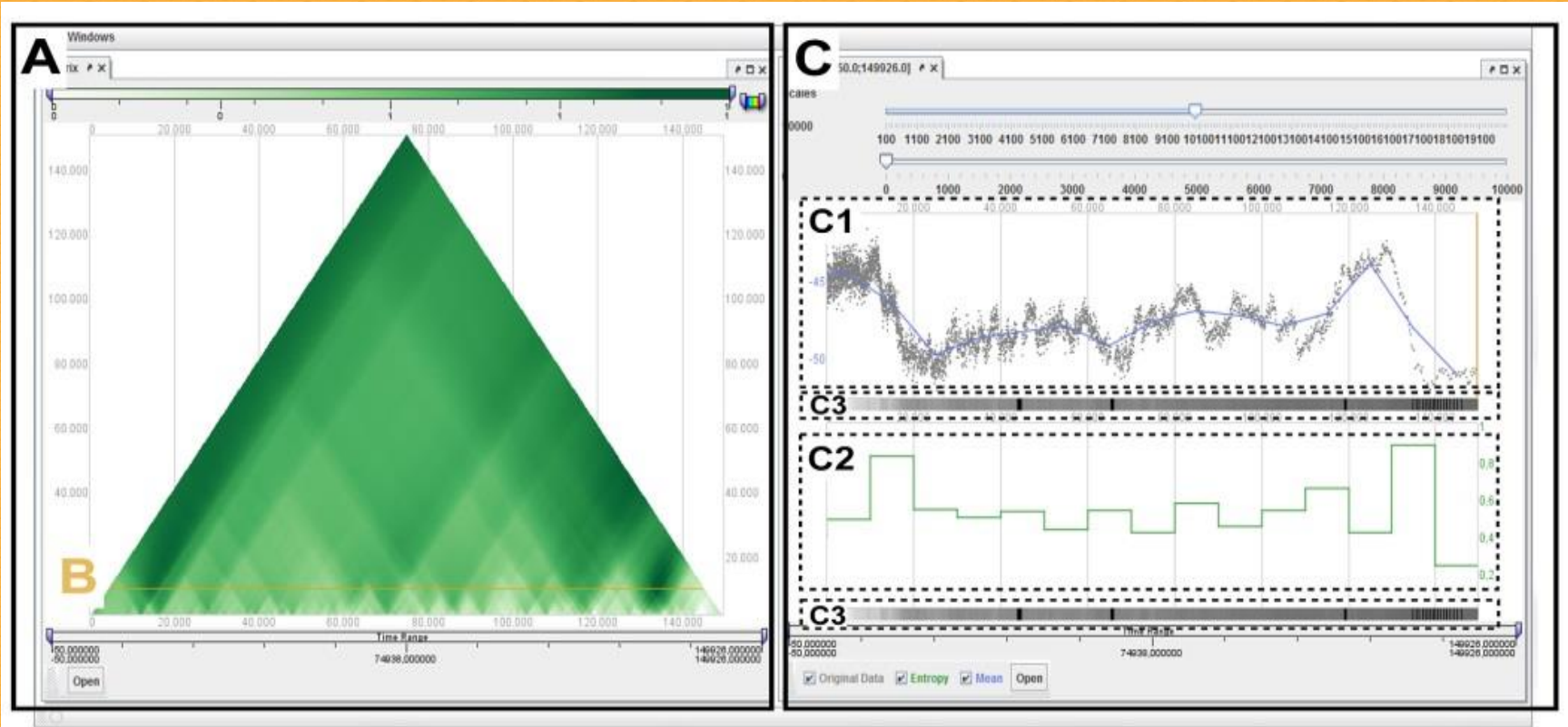
Purpose

- detection of patterns in numerical time series

Data sets

- Earth's climate system and ocean data

Scenario I.

Sips, M., Kothur, P., Unger, A., Hege, H.-C., Dransch, D.: A Visual Analytics Approach to Multiscale Exploration of Environmental Time Series. Vis. Comput. Graph. Ieee Trans. 18, 2899-2907 (2012).

Scenario II.

Methods & Techniques

- model setup verification, critical parameters estimation, parallel processing analysis, simulation results validation
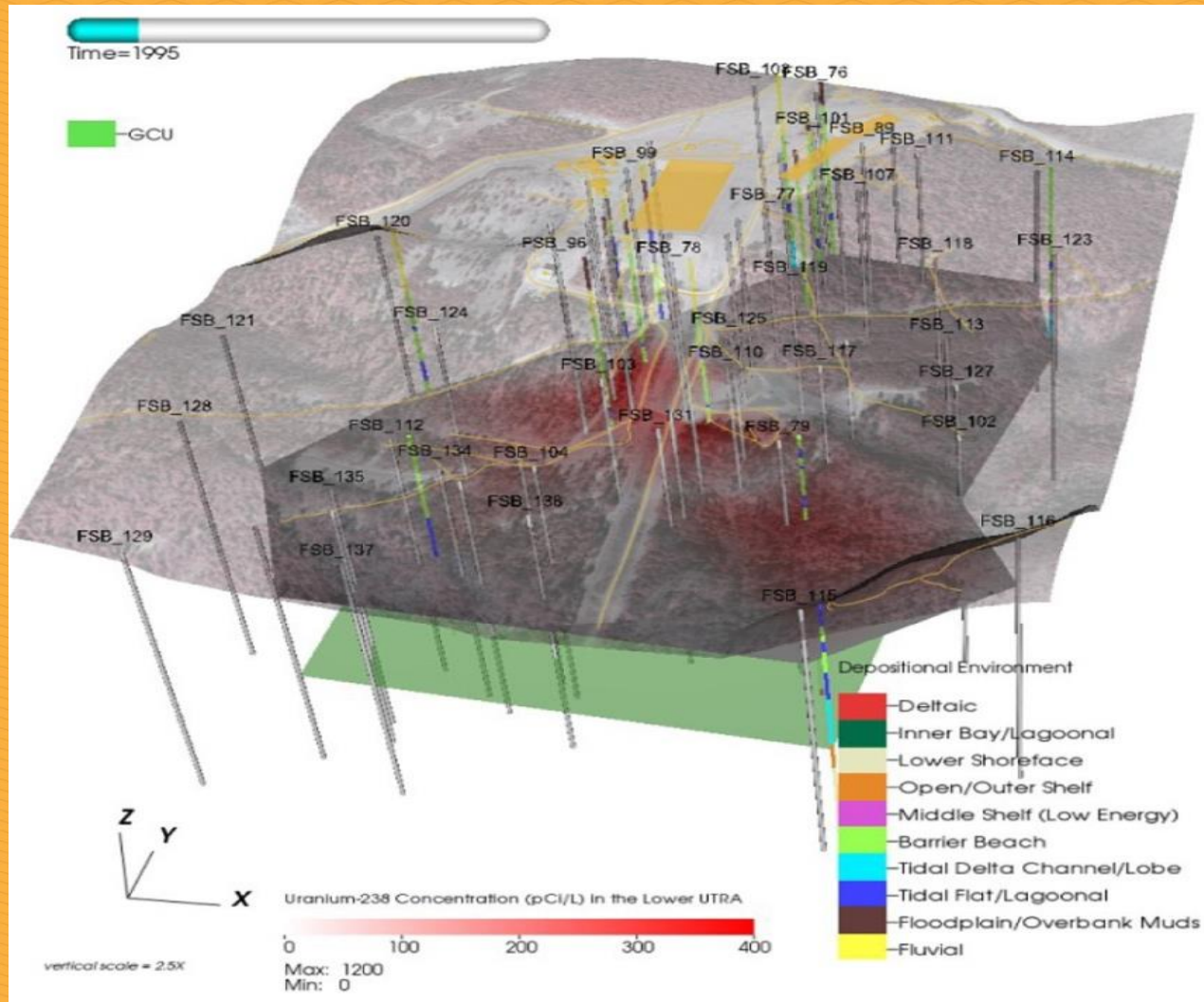
Purpose

- decision-making process support in planning of treatment options for contaminated sites

Data sets

- nuclear contaminant data

Scenario II.

Meyer, J., Bethel, E.W., Horsman, J.L., Hubbard, S.S., Krishnan, H., Romosan, A., Keating, E.H., Monroe, L., Strelitz, R., Moore, P., Taylor, G., Torkian, B., Johnson, T.C., Gorton, I.: Visual Data Analysis as an Integral Part of Environmental Management. Ieee Trans. Vis. Comput. Graph. 18, 2088–2094 (2012).

Scenario III.

Methods & Techniques

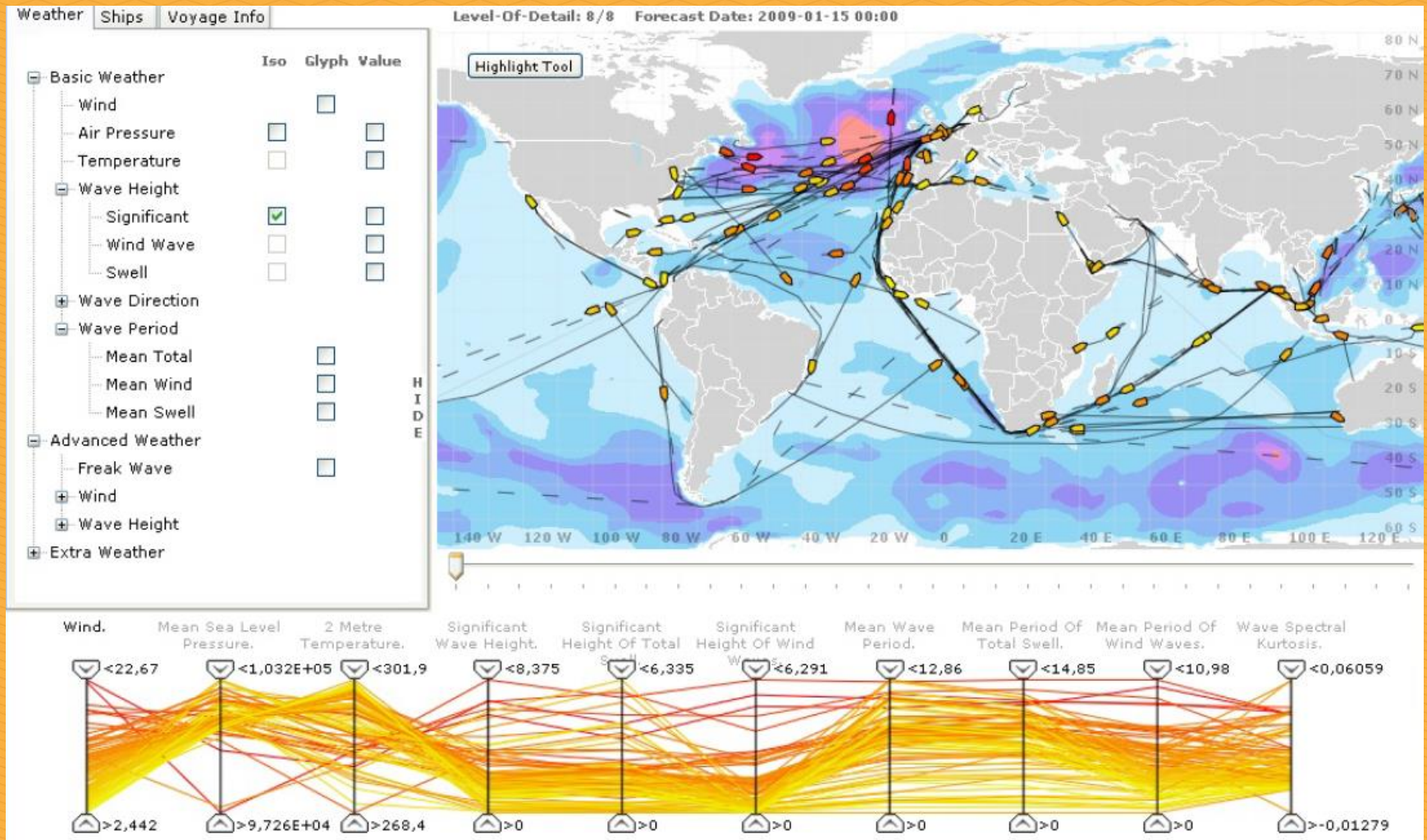- gridded binary format processing, parallel coordinates plots, voyage time graphs, geospatial data interaction

Purpose

- weather parameters visualization along ship routes

Data sets

- ship voyages data

Scenario III.

Lundblad, P., Eurenius, O., Heldring, T.: Interactive visualization of weather and ship data. Information Visualisation, 13th International Conference. pp. 379–386 (2009).

Conclusions

- Goals and benefits of Visual Analytics

- Human cognition limitations

- Visual Analytics methods

Thank you for your attention

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