



## **New solutions for climate network visualization**

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An increasing amount of climate and climate impact research methods deals with geo-referenced networks, including energy, trade, supply-chain, disease dissemination and climatic tele-connection networks. At the same time, the size and complexity of these networks increases, resulting in networks of more than hundred thousand or even millions of edges, which are often temporally evolving, have additional data at nodes and edges, and can consist of multiple layers even in real 3D. This gives challenges to both the static representation and the interactive exploration of these networks, first of all avoiding edge clutter (“edge spaghetti”) and allowing interactivity even for unfiltered networks.

Within this presentation, we illustrate potential solutions to these challenges. Therefore, we give a glimpse on a questionnaire performed with climate and complex system scientists with respect to their network visualization requirements, and on a review of available state-of-the-art visualization techniques and tools for this purpose (see as well Nocke et al., 2015). In the main part, we present alternative visualization solutions for several use cases (global, regional, and multi-layered climate networks) including alternative geographic projections, edge bundling, and 3-D network support (based on CGV and GTX tools), and implementation details to reach interactive frame rates.

### References:

Nocke, T., S. Buschmann, J. F. Donges, N. Marwan, H.-J. Schulz, and C. Tominski: Review: Visual analytics of climate networks, *Nonlinear Processes in Geophysics*, 22, 545-570, doi:10.5194/npg-22-545-2015, 2015