

# **EnvirVis 2017**

## **Workshop on Visualisation in Environmental Sciences**

**Barcelona, Spain  
June 12 – 13, 2017**

### **Workshop Chairs**

Karsten Rink, Helmholtz Centre for Environmental Research - UFZ, Germany  
Ariane Middel, School of Geographical Sciences and Urban Planning, Phoenix, AZ, USA  
Dirk Zeckzer, Leipzig University, Leipzig, Germany  
Roxana Bujack, Los Alamos National Laboratory, USA

### **Proceedings Production Editor**

Dieter Fellner (TU Darmstadt & Fraunhofer IGD, Germany)

Sponsored by EUROGRAPHICS Association

This work is subject to copyright.

All rights reserved, whether the whole or part of the material is concerned, specifically those of translation, reprinting, re-use of illustrations, broadcasting, reproduction by photocopying machines or similar means, and storage in data banks.

Copyright ©2017 by the Eurographics Association  
Postfach 2926, 38629 Goslar, Germany

Published by the Eurographics Association  
–Postfach 2926, 38629 Goslar, Germany–  
in cooperation with  
Institute of Computer Graphics & Knowledge Visualization at Graz University of Technology  
and  
Fraunhofer IGD (Fraunhofer Institute for Computer Graphics Research), Darmstadt

ISBN 978-3-03868-040-6

The electronic version of the proceedings is available from the Eurographics Digital Library at  
<http://diglib.eg.org>

## Table of Contents

Table of Contents .....	iii
Preface .....	iv
International Programme Committee .....	v
Author Index .....	vi
Keynote .....	vii
<b>Session 1</b>	
Setting up Virtual Geographic Environments in Unity .....	1
<i>Karsten Rink, Lars Bilke, and Olaf Kolditz</i>	
An Interactive Web-based Doppler Wind Lidar Visualisation System .....	7
<i>Nicholas Tan Jerome, Suren Chilingaryan, Andreas Kopmann, and Andreas Wieser</i>	
Visual Characterisation of Temporal Occupancy for Movement Ecology .....	13
<i>Aidan Slingsby and Emiel van Loon</i>	
<b>Session 2</b>	
Visual Study of the Benguela Upwelling System using Pathline Predicates .....	19
<i>Pascal Nardini, Michael Böttinger, Gerik Scheuermann, and Martin Schmidt</i>	
Visual Eddy Analysis of the Agulhas Current .....	25
<i>Felix Raith, Niklas Röber, Helmuth Haak, and Gerik Scheuermann</i>	
Multivariate Visualization of Oceanography Data Using Decals .....	31
<i>Allan Rocha, Julio Daniel Silva, Usman Alim, and Mario Costa Sousa</i>	
STOAViz: Visualizing Saturated Thickness of Ogallala Aquifer .....	37
<i>Tommy Dang, Long Hoang Nguyen, Abdullah Karim, and Venki Uddameri</i>	
<b>Session 3</b>	
Extracting, Visualizing and Tracking Mesoscale Ocean Eddies in Two-dimensional Image Sequences Using Contours and Moments .....	43
<i>Divya Banesh, Joseph A. Schoonover, James P. Ahrens, and Bernd Hamann</i>	
Video Compression for Ocean Simulation Image Databases .....	49
<i>Anne S. Berres, Terece L. Turton, Mark Petersen, David H. Rogers, and James P. Ahrens</i>	
Intuitive Colormaps for Environmental Visualization .....	55
<i>Francesca Samsel, Terece L. Turton, Philip Wolfram, and Roxana Bujack</i>	

## **Preface**

In recent years, research in environmental sciences has become more and more important as we are facing increasing problems concerning climate change, water scarcity, pollution of the environment and changes in biodiversity. Visualization of complex monitoring or remote sensing data, as well as results based on statistical analyses or simulation of natural phenomena such as groundwater processes or migration of animal species under changing natural conditions is a crucial step for a better understanding of the data. It is essential for discovering correlations and communicating research results to the public. The size of the data and the heterogeneity of the information are additional challenges for the simulation and subsequent understanding of research results. Besides applying established visualization techniques to geoscientific data, advances are also made with the help of high-performance computing, virtual reality environments as well as specialized hardware.

The EnvirVis workshop invites contributions with a broad application area in environmental research from both visualization and environmental sciences. Our goal is to raise awareness to the importance of visualisation in geosciences and to establish a forum for interdisciplinary discussions.

Karsten Rink, Ariane Middel, Dirk Zeckzer, and Roxana Bujack

## **International Programme Committee**

Nazli Yonca Aydin, ETH Zürich, Switzerland  
Emmanuelle Beauxis-Aussalet, Centrum Wiskunde & Informatica, Netherlands  
Anne Berres, Los Alamos National Laboratory, USA  
Wes Bethel, Lawrence Berkeley Laboratory, USA  
Georges-Pierre Bonneau, INRIA Grenoble, France  
Urška Demsar, University of St. Andrews, UK  
Doris Dransch, GFZ, Germany  
Jocelyne Erhel, INRIA Rennes, France  
Sebastian Grottel, TU Dresden, Germany  
Stefan Gumhold, TU Dresden, Germany  
Hans Hagen, University of Kaiserslautern, Germany  
Federico Iuricich, University of Maryland, USA  
Michal Koutek, KNMI, Netherlands  
Niklas Röber, DKRZ, Germany  
Francesca Samsel, University of Texas, Austin, USA  
Marc Walther, TU Dresden, Germany  
Alexander Wiebel, University of Applied Sciences Worms, Germany  
Thomas Wischgoll, Wright State University, USA  
Philip Wolfram, Los Alamos National Laboratory, USA

## Author Index

Ahrens, James P. ....	43, 49	Petersen, Mark .....	49
Alim, Usman .....	31	Raith, Felix .....	25
Banesh, Divya .....	43	Rink, Karsten .....	1
Berres, Anne S. ....	49	Röber, Niklas .....	25
Bilke, Lars .....	1	Rocha, Allan .....	31
Böttinger, Michael .....	19	Rogers, David H. ....	49
Bujack, Roxana .....	55	Samsel, Francesca .....	55
Chilingaryan, Suren .....	7	Scheuermann, Gerik .....	19, 25
Dang, Tommy .....	37	Schmidt, Martin .....	19
Haak, Helmuth .....	25	Schoonover, Joseph A. ....	43
Hamann, Bernd .....	43	Silva, Julio Daniel .....	31
Jerome, Nicholas Tan .....	7	Slingsby, Aidan .....	13
Karim, Abdullah .....	37	Sousa, Mario Costa .....	31
Kolditz, Olaf .....	1	Turton, Terece L. ....	49, 55
Kopmann, Andreas .....	7	Uddameri, Venki .....	37
Loon, Emiel van .....	13	Wieser, Andreas .....	7
Nardini, Pascal .....	19	Wolfram, Philip .....	55
Nguyen, Long Hoang .....	37		

## **Keynote**

### **Decoding the Mysteries of Color Perception**

**Bernice Rogowitz**

#### **Abstract**

Environmental data and model outputs are often mapped into color to create visual representations. The choice of color scales, for example, can easily lead to misrepresentations of the features in the data. This is because color is not a single dimension, but three, and each of these three dimensions differs in how it communicates information about magnitude, spatial resolution and temporal variation. Color can also be used to highlight, segment, and direct attention, which can inform (or mis-inform!) the interpretation of the data. This talk demystifies color perception and provides concrete guidance for its use in environmental sciences.