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About

Dr Martin Widmann is a climate scientist. His current main research area is regional climate change, in particular the development and validation of statistical downscaling methods. He also studies past climates; the main activity in this field is the development of data assimilation methods to combine climate simulations with empirical knowledge from proxy data.

Biography

- Dipl. Phys., University of Freiburg, 1992
- Ph.D., Institute for Atmospheric Science, ETH Zuerich, 1996
- Postdoc, Department of Atmospheric Sciences, University of Washington, Seattle, 1996-1999
- Scientist, Institute for Coastal Research, GKSS Research Centre, Geesthacht, 1999-2006
- Guest lecturer at University of Lueneburg, 2000-2003
- Lecturer, GEES, University of Birmingham, 2006 - 2011
- Senior Lecturer, GEES, University of Birmingham, 2011-present

Postgraduate supervision

PhD students (main supervisor)

- 2012 – present: **Anastasios Matsikaris**, 'Palaeo data assimilation with a GCM using an ensemble-based method'.
- **Jonathan Eden**, 2007-2011. Estimation of regional precipitation from GCM simulations using model output statistics. School funded
- **Kerstin Prömmel**, 2004-2008. Regional climate simulations over the Alps. GKSS Research Centre, Geesthacht, Germany, with Julie Jones. Funded by EU Framework
- **Nikolaus Groll**, 2003-2006. Sensitivity of teleconnections and interscale relationships to orbital forcing, GKSS Research Centre, Geesthacht, Germany, with Julie Jones. Funded by German climate research program DEKLIM, as well as by the Helmholtz Society, Germany

Research

Research groups

- Climate & Atmosphere
- Geosystems

Research interests

- climate modelling
- past and future climate change
- data assimilation in palaeoclimatology
- statistical downscaling for precipitation

Current / recent research

Transient GCM simulations of the mid-Holocene climate and comparison with palaeoclimate proxy data

Together with Sebastian Wagner (GKSS Research Centre, Geesthacht, Germany) and Julie Jones (University of Sheffield) I am investigating the climate response to orbital and solar forcing using transient simulations for the mid-Holocene (7.0-4.5 ka BP) with a coupled atmosphere-ocean general circulation model (project MIDHOL). In collaboration with colleagues from the universities of Bremen and Cologne we have also performed consistency tests between the statistically downscaled simulations and climate proxy data from North and South America. MIDHOL has been funded by the German climate research programme DEKLIM.

Southern Hemisphere atmospheric circulation

I work with Julie Jones (University of Sheffield) on reconstructions of the state of the Southern Hemisphere Annular Mode (the major mode of extratropical atmospheric circulation in the Southern Hemisphere, also known as the Antarctic Oscillation) from instrumental pressure measurements for the twentieth century, and from tree-ring

width chronologies back to the 18th century. This work has been supported by the German climate research programme DEKLIM and the Helmholtz Society.

Correction of precipitation simulated by General Circulation Models using Model Output Statistics

Simulating precipitation realistically is still a major challenge in climate modelling, because the spatial scales involved are often smaller than the gridcell size used in General Circulation Models (GCMs). I work with Jonathan Eden (University of Birmingham) on developing a method for statistically estimating regional precipitation using GCM-simulated precipitation as a predictor. This is an example for a Model Output Statistics correction method, which is conceptually different from the perfect-prog downscaling usually used in climate change studies. As part of this project we run the ECHAM5 GCM on the BEAR Linux cluster at the University of Birmingham. Once the correction method is developed, it will be applied to GCM simulations for the 21st century.

Data assimilation for palaeoclimatic applications

I have developed a pattern nudging method that allows the specification of large-scale circulation anomalies in general circulation models. This work is conducted in collaboration with Hans von Storch (GKSS Research Centre, Geesthacht), Reiner Schnur (Max Planck Institute for Meteorology, Hamburg) and Ingo Kirchner (Free University Berlin) and aims at providing a tool for assimilating large-scale circulation estimates derived from proxy data in simulations with general circulation models. This work has been supported by the German climate research programme DEKLIM and the Helmholtz Society.

Stability of teleconnections and of scale relationships

Together with Nikolaus Groll (GKSS Research Centre, Geesthacht) I have compared temperature teleconnections in the Eemian (the last interglacial about 125 ka ago) and in the preindustrial climate using simulations with General Circulation Models. We have also analysed relationships between large-scale atmospheric circulation and regional temperatures in these simulations. This work shows how orbital forcing changes the mean climate and thus in turn teleconnections and relationships between large-scale and regional climate. It has been supported by the German climate research programme DEKLIM.

Regional climate modelling for the European Alps

In collaboration with Kerstin Prömmel, Beate Mueller (GKSS Research Centre, Geesthacht) and Julie Jones (University of Sheffield) I am involved in the analysis of a regional model simulation over the Alps. We are exploring whether the high-resolution simulation adds value compared to the ERA40 reanalysis. We also are investigating mesoscale climate variability patterns in the region. This work has been funded through the EU Framework 5 project ALP-IMP.

Other activities

Administrative Responsibilities

Program leader **MSc Applied Meteorology and Climatology (/postgraduate/courses/taught/gees/applied-met-climatology.aspx)**

Publications

Key Publications since 2001

Matsikaris, A., **M. Widmann**, and J. Jungclaus, 2014: On-line and off-line data assimilation of palaeoclimate proxy data into GCMs using ensemble member selection. Submitted.

Maraun, D. and **M. Widmann**: Do regional climate models represent regional climate. Submitted

Maraun, D., **M. Widmann**, R. Benestad, S. Kotlarski, E. Hertig, J. Wibig, J.M. Gutierrez, R. Huth,
R.E. Chandler and R. Wilcke (2014), VALUE - A Framework to Validate Downscaling Approaches for Climate Studies. Submitted.

Eden, J.M., **M. Widmann**, D. Maraun, M. Vrac, 2014: Comparison of GCM- and RCM-simulated precipitation following stochastic postprocessing. J. Geophys. Res, 27(1), in press.

Wong, G., D. Maraun, M. Vrac, **M. Widmann**, J.M. Eden and T. Kent, 2014: Stochastic model output statistics for correcting and downscaling precipitation including extremes. J. Climate, 28 (18).

Eden, J.M., **M. Widmann**, 2014: Downscaling of GCM-simulated precipitation using Model Output Statistics. J. Climate, 27(1), 312-324.

Eden, J.M., **M. Widmann**, and G.R. Evans, 2014: Pacific SST influence on spring precipitation in Addis Ababa, Ethiopia. Internat. J. Climatology, 34(4), 1223-1235, DOI: 10.1002/joc.3759.

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Prömmel, K., B. Geyer, J.M. Jones, and **M. Widmann**, 2010: Evaluation of the skill and added value of a reanalysis-driven regional simulation for Alpine temperature. Int. J. Climatol., 30, 760-773

Widmann, M., 2009: Delayed Holocene warming. *Nature Geoscience*, 2, 380-381.

Jones, J.M., R.L. Fogt, **M. Widmann**, G. Marshall, P. Jones and M. Visbeck, 2009: Historical Southern Hemisphere Annular Mode Variability. Part I: Century Length Seasonal Reconstructions of the Southern Hemisphere Annular Mode. *J. Clim*., 22, 5319-5345

Wanner, H., Beer, J., Bütikofer, J. Crowley, T., Cubasch, U., Flückiger, J., Goosse, H., Grosjean, M., Joos, F., Kaplan, J.O., Küttel, M., Müller, S., Pentice, C. Solomina, O., Stocker, T., Tarasov, P., Wagner, M., and **Widmann, M.**, 2008: Mid to late Holocene climate change - an overview, *Quaternary Science Reviews,* 27(19-20), 1791-1828.

Wagner, S., **M. Widmann**, J. Jones, T. Haberzettl, A. Lücke, C. Mayr, C. Ohlendorf, F. Schäbitz and B. Zolitschka, 2007: Transient simulations, empirical reconstructions and forcing mechanisms for the Mid-Holocene hydrological climate in Southern Patagonia. *Climate Dynamics*, 29(4), 333-355.

Widmann, M., N. Groll and J.M. Jones, 2007. Simulated teleconnections during the Eemian, the last glacial inception and the preindustrial period. In Sirocko, F., T. Litt and M. Claussen (eds.): *The climate of past interglacials*, Elsevier, ISSN 1571-0866, 622pp..

Le Treut, H., R. Sommerville, U. Cubasch, Y. Ding, C. Mauritzen, A. Mokssit, T. Peterson, M.Prather and contributing authors (including **M. Widmann**), 2007: Historical Overview of Climate Change Science. In: *Climate Change 2007 – The Physical Science Basis. IPCC AR4 WG* 1, Cambridge University Press.

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Groll, N., **M. Widmann**, J. M.Jones, F. Kaspar, and S. Lorenz, 2005: Simulated relationships between regional temperatures and large-scale circulation during the early Eemian interglacial (125 kyr BP) and the pre-industrial period. *J. Clim*, 18(19), 4035-4048 .

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