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Fine-Resolution climate projections enhance regional climate change impact studies

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NEWS

World Stress Map Published

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The World Stress Map (WSM), published in April 2007 by the Commission for the Geological Map of the World and the Heidelberg Academy of Sciences and Humanities, displays the tectonic regime and the orientation of the contemporary maximum horizontal compressional stress at more than 12,000 locations within the Earth's crust. The Mercator projection is a scale of 1:46,000,000.

The WSM provides insight into large-scale patterns of stress orientations (i.e., first-order stress patterns due to plate boundary forces and second-order stress patterns due to topography), large lateral density variations, and deglaciation effects. Furthermore, the WSM contains a number of regions with high data resolution that enable users to investigate variations in stress orientations on local scales and to discuss factors controlling third-order stress patterns such as active faults, local inclusions, detachment horizons, and density contrasts. Forces resulting from these geological subsurface structures control the stress field orientations especially when magnitudes of the horizontal stresses are close to each other.

The WSM is a result of more than two decades of international collaboration. It and the CD-ROM—which includes the digital version of the map, the full database, a bibliography, and a software tool for user-defined stress maps—are available at http://www.ccgm.org. Further information is available at http://www.world-stress-map.org.

—OLIVER HEIDBACH, BIRGIT MÜLLER, KARL FUCHS, and FRIEDEMANN WENZEL, Geophysical Institute of Karlsruhe Universität, Germany, and Heidelberg Academy of Sciences and Humanities, Germany; JOHN REINECKER, Institute of Geosciences, University of Tübingen, Germany; MARK TINGAY, School of Earth and Environmental Sciences, University of Adelaide, Australia; BLANKA SPERNER, Geological Institute, University of Freiberg, Germany; and JEAN-PAUL CADET and PHILIPP ROSSI, Commission for the Geological Map of the World, Paris.

Fine-Resolution Climate Projections Enhance Regional Climate Change Impact Studies

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A new data set enhances the abilities of researchers and decision-makers to assess possible future climates, explore societal impacts, and approach policy responses from a risk-based perspective. The data set, which consists of a library of 112 fine-resolution climate projections, based on 16 climate models and three greenhouse gas emissions scenarios, is now publicly available. Monthly climate projections from 1950 to 2099 were downscaled to a spatial resolution of 1/8° (about 140 square kilometers per grid cell) covering the conterminous United States and portions of Canada and Mexico.

For the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, climate modeling groups produced hundreds of simulations of past and future climates. The colocation of these simulations in a single archive (at the Program for Climate Model Diagnosis and Intercomparison at Lawrence Livermore National Laboratory (LLNL), established to facilitate assessment of general circulation models, or GCMs) and the conversion of all results to a common data format have made probabilistic, multimodel projections and impact assessments practical. A remaining issue is that the spatial scale of climate model output is typically too coarse for regional impact studies. Multiple downscaling approaches exist for deriving regional climate from coarse-resolution model output; these approaches are typically applied on an ad hoc basis to a particular region.

To facilitate regional climate change impact studies, the U.S. Bureau of Reclamation's Research and Development Office, LLNL, the University of California Institute for Research on Climate Change and Its Societal Impacts, and Santa Clara University (through support from the U.S. Department of Energy's National Energy Technology Laboratory) developed a public-access archive of downscaled projections.

A statistical technique was used to generate gridded fields of precipitation and surface air temperature over the conterminous United States and portions of Canada and Mexico. The method involves (1) a quantile-mapping approach that corrects for GCM biases, based on observations of 1950–1999; and (2) interpolation of monthly bias-corrected GCM anomalies onto a fine-scale grid of historical climate data, producing a monthly time series at each 1/8-degree grid cell. The method has been used extensively for hydrologic impact studies (including many with ensembles of GCMs) and in a variety of climate change impact studies on systems as diverse as wine grape cultivation, habitat migration, and air quality.

The downscaled data are freely available for download at the Green Data Oasis, a large data store at LLNL for sharing scientific data (http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/). Users can specify particular models, emissions scenarios, time periods, geographical areas, and raw data or summary statistics. All data are archived in a standard netCDF format, a self-describing machine-independent format for sharing gridded scientific data.

The full text of this article can be found in the electronic supplement to this *EOS* issue (http://www.agu.org/eos_elec/).

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