Proceedings of the Third USGS Modeling Conference, June 7–11, 2010, Broomfield, Colorado: Understanding and Predicting for a Changing World

Scientific Investigations Report 2011–5147

U.S. Department of the Interior
U.S. Geological Survey

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Edited by Shailaja R. Brady

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Preface

The Third USGS Modeling Conference was held June 7–11, 2010, in Broomfield, Colorado. The conference focused on the development and application of analytical and theoretical models and data availability that support managing the Nation's resources and help protect lives and property. Participants at the conference included scientists and managers from Department of the Interior (DOI) Bureaus; national and international Federal, State, and local agencies; academic institutions; and nongovernmental organizations. The conference was organized according to DOI priorities and the strategic directions of the USGS Science Strategy; the following themes were emphasized: (1) Understanding Ecosystems and Restoring America's Treasured Landscapes; (2) Climate Change and Impact; (3) New Energy Frontier and Minerals for America; (4) A National Hazards, Risk, and Resilience Assessment Program; (5) Role of Environment and Wildlife in Human Health; (6) A Water Census of the United States; and (7) New Methods of Investigation and Discovery. The conference theme—"Understanding and Predicting for a Changing World"—focused on the following goals: advance development and application of models; provide tools that address management issues; present state-of-the-art models ranging from individual phenomena to integrated systems; and foster a working community among scientists and managers. This publication includes abstracts for the 148 of 125 oral presentations and 23 posters presented at the conference.

The organizing committee for the conference included the following individuals:

Laurie Balistrieri
Shailaja R. Brady (Co-Chair)
Thomas Doyle
Linda C. Gundersen
Leanne Hanson
Thomas Philippi (National Park Service)
Rudy Schuster
Mark Wildhaber (Co-Chair)
Jenifer Bracewell
Brian Cade
Kevin Gallagher
Dave Govoni
Shuguang Liu
Steve Regan
June Thormodsgard
Nathan Wood

The Role of Groundwater in Geologic Processes (oral presentation)

By S.E. Ingebritsen[1]

[1]U.S. Geological Survey, Menlo Park, Calif.

Historically, interest in groundwater and other subsurface fluids was confined to a few specific disciplines in the earth sciences, notably groundwater hydrology, soil physics, engineering geology, petroleum geology, and petroleum engineering. These disciplines tended to be "applied" in nature, with practitioners concentrating on the immediate and practical problems of water supply, water quality, mine dewatering, deformation under structural loads, and the location and recovery of fluid hydrocarbons. This situation has changed over the past few decades. Hydrogeologists and geologists are now actively modeling the role of groundwater and other subsurface fluids in such fundamental geologic processes as crustal heat transfer, ore deposition, hydrocarbon migration, earthquakes, tectonic deformation, diagenesis, and metamorphism. This talk will emphasize (1) the role of fluid properties in governing fluid flow and heat transfer at the midocean ridge and (2) the coupling between fluid pressure, seismicity, and crustal permeability.

Invasive Species and Climate Change (oral presentation)

By Catherine S. Jarnevich,[1] Bethany Bradley,[2] Tracy R. Holcombe,[1] Thomas Stohlgren,[1] and Jeffrey T. Morisette[1]

[1]U.S. Geological Survey, Fort Collins, Colo.

[2]Department of Biology, Amherst College, Amherst, Mass.

Species environmental matching models to predict species potential distributions are now commonplace, and are often based solely on climate data. Given that we are interested in the potential distribution and effects of harmful species, it is important how species-environment relationships might be affected by climate change scenarios when they are included in the models. We provide an overview of how different aspects of global change may impact species invasions, either improving or decreasing the suitability of their habitat in the future. We discuss the climate change data needs to generate useful suitable habitat models for management, and the caveats related to the applications of these models with climate change. We then provide specific examples of species environmental matching models at various spatial scales that include climate change projections. Our models show both potential contraction and expansion of invasive species ranges, highlighting the need for different management strategies. An iterative monitoring and modeling approach is required to validate and improve the models over time.

Climate Change Impacts on Freshwater Recreational Fishing in the United States (poster)

By Russell Jones,[1] Constance Travers,[1] Charles Rodgers,[1] Brian Lazar,[1] Eric English,[1] Kenneth Strzepek,[2] and Jeremy Martinich[3]

[1]Stratus Consulting Inc, Boulder, Colo.

[2]Civil, Environmental, and Architectural Engineering, University of Colorado, Boulder, Colo.

[3]Climate Change Division, U.S. Environmental Protection Agency, Washington, D.C.

We analyzed the potential impacts of climate change on stream suitability for freshwater fish assemblages in the United States. We quantified the projected changes in stream-water temperatures, stream flow, and areal extent of suitable habitat resulting from a range of projected changes in temperature and precipitation. Based on the projected shifts, we estimated potential economic impacts associated with changes in freshwater recreational fishing. Using a geographic information system, we developed a spatially explicit modeling framework of grid cells organized into 2,099 8-digit hydrologic unit code (HUC) polygons for the conterminous United States. Projected temperature and precipitation changes associated with climate change were obtained for 2030, 2050, and 2100, and three future emissions scenarios representing low, moderate, and high emissions. We then generated a grid of projected water temperatures using regional air and water temperature regressions. Habitat suitability was derived from the value of the lowest monthly average water temperature within a HUC compared to a model-calibrated maximum water temperature tolerance of cold-water and warm-water fish guilds. Although projections vary somewhat by emissions scenario and year, in general, the spatial distribution of cold-water fisheries is predicted to contract, being replaced by warm and cool water and rough fisheries. As expected, these projected changes are more pronounced with increasing time and emissions. To estimate the potential economic impacts of predicted habitat changes on recreational fishing, we used a national-scale economic model of recreational fishing, updated with current data. Using projected losses in fishing days, multiplied by per-day values derived from the current economics literature, we estimate that the total present value of estimated national economic losses to freshwater recreational fishing from 2009 to 2100 will range from $81 million to $6.4 billion, depending on the discount rate assumed, and the emissions scenario.

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