

MEETINGS

Integrating Remote Sensing Data Into Geographic Information Systems

Bridging the Gap Between Remote Sensing and GIS; Redlands, California, 17–18 November 2010

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Fifty remote sensing scientists and geographic information systems (GIS) experts attended a joint NASA–Environmental Science Research Institute (ESRI) workshop at the headquarters of ESRI. The purpose of the workshop was to bring together a diverse community of experts to explore benefits and barriers to the integration of remote sensing data into GIS.

Remote sensing represents an ever-expanding source of scientific data about our planet. Some individual NASA missions alone provide more than 1 terabyte of data per day. Remote sensing data can help solve problems in diverse applications, including disaster response, environmental planning, global change, insurance, and private investment. These data attain their greatest value when combined with other data from a variety of sources, yet this seemingly simple step is often very challenging.

GIS has traditionally provided effective solutions to the integration, visualization,

and analysis of georeferenced data, and in some application areas, remote sensing and GIS work together quite effectively. In the sciences, there has been much less communication between the remote sensing and GIS communities, creating inconsistencies in data models, formats, standards, tools, services, and terminology. For example, the ESRI ArcGIS software is unable to directly read data in the Hierarchical Data Format (HDF) or Hierarchical Data Format–Earth Observing System (HDF-EOS) data formats. This workshop was inspired by the need to resolve these technological gaps.

The workshop identified several related areas needing improvements, the main theme being the lack of knowledge about available remote sensing data sets and lack of tools to manage and use remote sensing data in GIS. Better data standards and easier discovery and access are needed. A key to this is better catalogs that include use cases or “recipes” on how the data may be used in real-world applications. An important part of this is the

need for better, more consistent metadata (information about the data). This last point was identified by all the breakout groups as a critical need not being met by the data providers, typically due to lack of funding or interest. Finally, GIS needs to support complex (e.g., multidimensional) scientific data formats to allow these data to be used in new applications.

The group identified two paths forward that will keep the momentum going and maintain communication between the GIS and remote sensing communities: (1) establishment of an Earth and Remote Sensing Science User Group to develop suggestions for future GIS software enhancements and (2) development of demonstration projects that illustrate the benefits of bridging the gap between remote sensing and GIS.

A steering committee for the Earth and Remote Sensing Science User Group is now being established; the first meeting of the user group is planned for the July 2011 ESRI User Conference in San Diego, Calif. Demonstration projects are still being considered.

A wiki (<http://oodt.jpl.nasa.gov/wiki/display/ESRI/Home>) captures the results of the workshop and its final report. Part of the writing of this report was performed under contract to NASA.

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Recovery of Global Surface Weather Observations for Historical Reanalyses and International Users

Third International Atmospheric Circulation Reconstructions Over the Earth Initiative Workshop: Reanalysis and Applications; Baltimore, Maryland, 3–5 November 2010

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The third Atmospheric Circulation Reconstructions over the Earth (ACRE) workshop advanced the goals of the international ACRE initiative (<http://www.met-acre.org/>) to undertake and facilitate the recovery of instrumental terrestrial and marine global surface weather observations underpinning global weather reconstructions and reanalyses spanning the past 200–250 years (<http://reanalyses.org>). The workshop improved integration of the 35–40 ACRE-linked international scientific projects, institutions, and organizations working toward these ends.

The meeting highlighted the broad array and international usage of ACRE-facilitated data sets and reanalysis: the International Surface Pressure Databank (ISPD; <http://dss.ucar.edu/datasets/ds132.0/>),

the International Comprehensive Ocean–Atmosphere Data Set (ICOADS; <http://icoads.noaa.gov/>), and the 20th Century Reanalysis (20CR; http://www.esrl.noaa.gov/psd/data/20thC_Rean/). The need for more data recovery for all regions of the globe during the nineteenth and early twentieth centuries was emphasized. Many regional efforts for such recovery are under way. The Arctic and maritime regions were highlighted as particular areas needing attention. As a result of the meeting, connections with existing projects were made and new efforts were started to address these needs.

The workshop agenda included studies using 20CR to investigate variations in El Niño–Southern Oscillation, storminess, drought, seasonal rainfall, tornado outbreaks, hurricanes, and many other applications. Considerable science in the areas of weather and climate extremes,

climate analysis, and climate trends was also presented. Climate science can now be directed to the use of ISPD, ICOADS, and 20CR in more advanced studies of weather and climate variations and trends over the past 150 years than was previously possible.

Presentations were also made on citizen science, massive-scale data handling, and Web-based high-resolution visualizations of the data and 20CR products. Attendees were encouraged to aid and embrace the successful development of these technologies to make the ACRE-related products as relevant, user friendly, tailored, and shaped as possible.

A notable outcome of the meeting was to shape ongoing utilization of the ACRE products (http://www.met-acre.org/Home/ACRE_G2.png?attredirects=0) for climate researchers, the diverse climate applications community, educators, and students. Specific changes to the ACRE structure made at the meeting include new interfaces for data access and visualization and a newly focused working group on user needs. Additionally, an ACRE working group on the link between documentary climate data and reanalysis was initiated.

An important outcome prompted by the third ACRE workshop is the recent statement on “research and systematic observation” made at the United Nations Framework Convention on Climate Change (UNFCCC) Sixteenth Conference of Parties meeting in Cancun, Mexico, by the Subsidiary Body for Scientific and Technological Advice (SBSTA): “The SBSTA further noted the importance of historical observations as the basis for analysis and reanalysis and encouraged parties and relevant organizations to increase their data rescue and digitization of historical observations and to establish and

strengthen international coordination initiatives for these activities.”

This workshop was organized in conjunction with the “Evaluation of Reanalyses—Developing an Integrated Earth System Analysis (IESA) Capability” meeting. Workshop presentations are available at <http://www.joss.ucar.edu/events/2010/acre/agenda.html>, and a full report can be found at <http://www.met-acre.org/meetings-and-workshops-1/3rdACREWorkshop.doc?attredirects=0>.

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Floodplain Lakes: Evolution and Response

PAGES International Floodplain Lakes Workshop; Fayetteville, Arkansas, 16–19 September 2010

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Human alteration of the major rivers and floodplains of the world is a global concern because they sustain aquatic ecosystems and supply food and energy to society. When in flood stage, the influence of a river extends across the floodplain and can revitalize productive wetlands. The condition of many rivers has declined worldwide, but the degree of degradation is hard to assess due to natural variability of flow and uncertainty of baseline status. Evidence of changes over decades to millennia in river and wetland conditions, however, can be quantified from physical, chemical, and biological information archived in the accumulated sediments of floodplain lakes.

A diverse group of floodplain lake researchers (paleolimnologists, fluvial geomorphologists, geochemists, and wildlife scientists) met to advance understanding of processes that influence the biological and geochemical signals of hydrologic and land use changes in lake sediments and that affect development of useful core chronologies in these deposits. The meeting was sponsored by Past Global Changes (PAGES), an international organization that coordinates and promotes past global change research

(<http://www.pages-igbp.org/>) to inform the management of present-day environmental issues. Thirty scientists, including Ph.D. students and postdoctoral researchers from the United States, Australia, Russia, Canada, Brazil, and China, participated in the 4-day workshop.

Research in sedimentary systems as dynamic as floodplain lakes requires interdisciplinary collaboration. Thus, considerable meeting time was devoted to developing the necessary linkages across the disciplines of geomorphology, hydrology, paleolimnology, climate modeling, and engineering. Despite the challenges that dynamic sedimentary environments present, the workshop discussions concluded that chronological resolution and accuracy were generally sufficient to inform management decisions.

Presentations spanned three main themes: (1) chemical and biological indicators and dating of lake sediment, (2) regional integration of studies within continents, and (3) assessment of human impact. Case studies were presented from the Murray-Darling, Yangtze, Mississippi, Missouri, Amazon, Manú, Sacramento, White, Peace-Athabasca, and Cauca river systems. A stark example of river change came from the Missouri River, where evidence is consistent with climate-driven

state shifts between meandering and braided system states.

A goal of PAGES is to provide regional syntheses of individual studies to elucidate broader patterns of change, and the benefit of this approach was exemplified by a synthesis of wetland change at the Murray-Darling basin, Australia. Because several projects focus on sites that are important internationally under the 1971 Ramsar Convention on Wetlands and show evidence of accelerated catchment sediment yields, response of floodplain wetlands to regulation of flow, and alteration to water quality, one outcome of the workshop was a focus on facilitating accessibility of paleoecological data for agencies charged with assessing the natural ecological character of listed wetlands and setting limits on acceptable degradation of wetlands.

Participants agreed that reconstruction of paleohydroecological variability holds considerable promise for identifying risks to river-floodplain systems and for developing best management practices under changing climates. This workshop represented an initial step toward these goals, which will be advanced further in future biennial meetings.

For the meeting program, see http://comp.uark.edu/~shausman/PAGESworkshop/draft_program.pdf.

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