As advisors, students, and mentors, we all have a responsibility to cultivate professional relationships and define adequate training. Advisors should recognize and accept personal and programmatic limitations and facilitate additional training for the interdisciplinarily inclined student. Students should seek help early in project development, identifying mentors, and training opportunities. Established scholars should respond to contact from a student across campus—its importance to that student may be immeasurable. The first task of an interdisciplinary training team is to identify opportunities for students to obtain pertinent skills. While self-instruction enhances creativity and independence, it can also be time-consuming and ineffective compared with group or professional instruction; thus both modes are necessary.

Although there remain many challenges to interdisciplinary work (e.g., disciplinary "languages"), we can do more to support students as they confront these challenges. A broader task is to structure or restructure interdisciplinary graduate programs to provide mentors upon matriculation and support formal training in the skills and techniques that are fundamental to new scientists. In turn, students can act, with skills and confidence, to disentangle the growing complexity of global environmental change.

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References

Cook, C., F. Heath, and R. L. Thompson (2000), A meta-analysis of response rates in Web- or Internet-based surveys, *Educ. Psychol. Meas., 60*(6), 821–836, doi:10.1177/00131640021970934.

Rhoten, D. (2004), Interdisciplinary research: Trend or transition, *Items Issues, 5,* 6–11.

Schmidt, G., and E. Moyer (2008), A new kind of scientist, *Nat. Rep. Clim. Change, 2,* 102–03, doi:10.1038/climate.2008.76.

U.S. National Academy of Sciences (2005), *Facilitating Interdisciplinary Research,* Natl. Acad. Press, Washington, D. C.

Weingart, P. (2000), Interdisciplinarity: The paradoxical discourse, in *Practising Interdisciplinarity*, edited by P. Weingart and N. Stehr, pp. 25–41, Univ. of Toronto Press, Toronto, Ont., Canada.

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MEETINGS

Applying Geodesy to Hydrologic Cycle Monitoring

IGCP 565 Workshop 3: Separating Hydrological and Tectonic Signals in Geodetic Observations; Reno, Nevada, 11–13 October 2010

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The third International Geoscience Programme (IGCP) 565 workshop took place in Nevada. There were 57 participants from 11 countries representing universities, national laboratories, and government agencies. A series of plenary presentations was followed by breakout sessions addressing topics that included the advances needed to improve modeling algorithms for applications of geodesy to hydrology, working with the Group on Earth Observations (GEO) Water Cycle Community of Practice, and developing a hydrogeodetic data portal.

The presentations and discussions underlined the added value in applying geodesy to support hydrologic cycle monitoring and modeling, especially terrestrial water storage. However, before the full benefits of the emerging field of hydrogeodesy become exploitable, there is a need to reduce model uncertainty through validation with point to basin observations; to increase consistency in processing and modeling displacement, gravity variations, and hydrologic processes; and to develop new technologies that merge scale mismatches. Improving accuracy and stability of the geodetic reference frames will extend the applicability of geodesy to hydrologic problems. In tectonically active areas, joint interpretation of tectonic and hydrologic signals is required. Ground truth networks are needed at a higher density and with quality control protocols that ensure accuracy.

A limitation for the hydrologic application of satellite gravity measurements, such as the Gravity Recovery and Climate Experiment (GRACE), is the low spatial resolution. GRACE can indirectly yield terrestrial water storage change at submonthly time scales and at 100,000-square-kilometer space scales. In many geographical areas, Global Navigation Satellite System (GNSS) observations of surface displacements have a much higher spatial resolution. Combined assimilation of GRACE with Global Positioning System (GPS) and in situ gravity observations in hydrological models has been proposed as a way to overcome this limitation, but land water storage changes derived from GRACE and GPS agree well only in limited areas. Reasons for the disagreement identified at the workshop include inconsistencies in data processing and spatial filtering and, most important, biases of the land water storage through tectonic and other processes not accounted for. Therefore, the development of a modeling framework for the joint estimation of tectonic and hydrologic signals was recommended.

A primary recommendation of the workshop is a pilot project in California that would demonstrate the utility of hydrogeodesy by merging geodetic information with hydrologic modeling via assimilation, leading to technology transfer to African nations through a similar project in the Nile Basin. The California Central Valley, where more than half of U.S. fruits and vegetables are grown, is a region rich in groundwater and surface water observations. A dense GPS network provides high-resolution information on surface displacements, which can be combined with GRACE to derive land water storage variations with high spatial resolution. A key question is whether the same approach will also apply in regions of Africa.

Workshop participants recommended that the African pilot project should address region-specific issues that bring stakeholders and water managers into the activity, and it should involve the World Bank; United States Agency for International Development (USAID); United Nations Habitat; United Nations Educational, Scientific and Cultural Organization (UNESCO) International Hydrological Programme; WaterNet; NASA; and other groups already working in the Nile Basin. The required science contribution includes tool development and capacity building for a science and decision-making interface for water management in Africa and will need international participation from African countries within the Nile Basin and data sharing through a common decision support framework.

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Improved Coastal Altimetry Could Contribute to the Monitoring of Regional Sea Level Trends

Fourth Coastal Altimetry Workshop; Porto, Portugal, 14–15 October 2010

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Satellite altimetry is now a mature Earth observation technique with great impact in many areas of study, including ocean circulation, marine geoid, bathymetry, and assimilation into models, as well as sea level trends and their impacts on the understanding of global climate change. Until recently, the centimeter-level accuracy achieved by this technique had been limited to open ocean about 50 kilometers off the coast.

Aiming to develop products for coastal zones with an accuracy similar to that achieved in the open ocean, several research projects in the past few years, such as Prototype Innovant de Système de Traitement pour les Applications Côtières et l'Hydrologie (PISTACH), Development of Radar Altimetry Data Processing in the Coastal Zone (COASTALT), Centre de Topographie des Océans et de l'Hydrosphère (CTOH), and more recently the European Space Agency Climate Change Initiative (ESA CCI), have been supported by various agencies. In parallel, a set of Coastal Altimetry Workshops was initiated (Silver Spring, Md., 2008; Pisa, Italy, 2008; Frascati, Italy, 2009). The Fourth Coastal Altimetry Workshop followed on this successful series of workshops and was hosted by the University of Porto, with support mainly from ESA and 10 other institutions and space agencies.

The workshop was designed to discuss a wide range of topics, from the latest developments in data processing to emerging applications and new technologies. An unprecedented number of scientists (126), from 17 countries on four continents, participated in the event. The workshop agenda, a detailed report, and the presentations can be found at http://www.coastalt.eu.

Participants agreed on the need for continuation of research projects and initiatives aimed at reprocessing and sustaining the production of coastal altimeter products, especially those already available and preferably refined with recently developed algorithms. There is also a need for exploitation of better coastal bathymetry, which is not yet accessible in the scientific domain; improved description of existing coastal altimeter products in terms of their capabilities, advantages, and disadvantages; and publication of "champion user cases" demonstrating the added value of altimetry in coastal studies. Workshop participants also agreed that access to all required data for validating coastal altimetry (tide gauge, coastal geoid) is important. They pointed out that deriving coastal currents from altimetry is still a challenge. Merging data from several sources (drifters, tide gauges, acoustic Doppler current profilers, etc.) is useful and necessary. Furthermore, it was noted that coastal forecast systems are already exploiting coastal altimetry for operational applications. Tides will be included in the next generation of the models assimilating altimetry.

Overall, the community recognized that much progress has been made, particularly on wet tropospheric correction and on retracking, and that the generation of coastal altimetry products is bound to have a great impact in synergy with other data sets to better monitor coastal zones. One of the next challenges is to demonstrate that coastal altimetry can contribute to the monitoring of regional sea level trends.

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