

# USGS Mendenhall Research Opportunity

Proposals due February 21, 2012 More information at <http://geology.usgs.gov/postdoc>

## Integrating hydrologic and geophysical data for groundwater characterization: method development and application to airborne electromagnetic surveys

Groundwater serves as a major freshwater storage component in the hydrologic cycle and, as such, is often critical to ecosystems and the ability of humans to exist in many parts of the terrestrial environment. It is groundwater that provides dependable water sources, consistent temperatures, and nurturing geochemistry over much of the planet. Continually expanding demands for fresh water resources to meet the needs of growing human populations, combined with the contamination of existing aquifers and the need to preserve natural ecologic systems, have placed a growing burden on groundwater reserves.

Sustainable management of groundwater resources requires characterization of hydrologic systems over large areas and with sufficient resolution to capture their dynamic behavior under variable natural and anthropogenic forcing. While traditional hydrologic measurements provide detailed, local information about a system, they are often available only at a few sparsely located wells. Geophysical data, on the other hand, can provide dense sampling over a large study area, but are less directly related to the underlying hydrologic properties of interest. This Research Opportunity seeks to improve characterization of subsurface hydrologic systems using remotely sensed airborne electromagnetic data [e.g., *Siemon et al.*, 2009] in conjunction with additional hydrologic and geophysical measurements, such as ground-based geophysics, well logs, and hydrogeologic observations.

Recent efforts in the field of hydrogeophysics aim to integrate disparate types of data, which typically provide information at various scales, to inform hydrogeologic models [*Ferré et al.*, 2009]. By combining sparse data that define site-specific relationships between geophysical and hydrogeologic properties with densely spaced geophysical datasets that provide good spatial coverage, it has been shown that better inferences can be made about large-scale hydrogeologic variability than with either method alone [e.g. *Dafflon et al.*, 2010; *Hinnell et al.*, 2010].

Applicants to this Research Opportunity are invited to propose innovative methods for integrating geophysical and hydrogeologic datasets to inform hydrogeologic models. The applicant is encouraged to incorporate one or more airborne electromagnetic datasets recently acquired by the USGS in eastern Nebraska, western Nebraska, San Luis Valley of Colorado, Paradox valley of Colorado, and/or Fort Yukon Alaska in their proposal. Potential topics of interest might include: integration of multi-disciplinary data to hypothesize and test alternative hydrogeologic models, examine and possibly extend sensitivity analysis methods for groundwater models informed by geophysical data, quantify the uncertainty for joint interpretation of hydrogeophysical datasets, develop relationships between hydrologic and geophysical properties, develop algorithms for integrated hydrogeophysical analysis, identify/address gaps in existing datasets, or other related topics. The successful candidate will develop a fully integrated research plan that leverages multi-disciplinary data to better inform groundwater models.

**Proposed Duty Station:** Denver, CO. Mendenhall Postdoctoral positions are typically for 2 years.

**Areas of Ph.D.:** Hydrology, geophysics (candidates holding a Ph.D. in other disciplines but with knowledge and skills relevant to the Research Opportunity may be considered).

**Qualifications:** Applicants must meet one of the following qualifications: Research Geophysicist, Research Hydrologist (This type of research is performed by those who have backgrounds for the occupations stated above. However, other titles may be applicable depending on the applicant's background, education, and research proposal. The final classification of the position will be made by the Human Resources specialist.)

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### References

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