Hydro - Geophysics

3 month training/research opportunity with possibility of continuation as MSc/PhD/Postdoc

3D and 4D GPR Characterization of Fluid Flow

The vadose zone – where air, water, soil, and rock interact to support life – is a highly dynamic environment with complex flow and transport processes that remain poorly understood. As an alternative to invasive measurements at only a few points we have developed a method for submeter resolution imaging of the shallow subsurface. For improved understanding of groundwater recharge, contaminant migration, and carbonate diagenesis we use a **uniquely precise and efficient 3D and 4D GPR system**, the latest Landmark™ interpretation and visualization tools, FDTD radar wave modeling, dielectric and hydraulic characterization of porous media, and numerical flow modeling. Cooperating partners are the Comparative Sedimentology Lab (University of Miami), the Environmental Geophysics Research Group (University of South Florida), the Env. Physics Group (University of Connecticut), the Office of Ground Water (Branch of Geophysics at the USGS) and the Env. Science and Engineering Section (EPFL, Switzerland).

Your Learning and Research Opportunity:
This 3 month research project gives hands-on experience of the full cycle of 3D/4D imaging from survey design to final interpretation and publication. You will conduct:

- **Field Work:** Possible field experiments include borehole infiltration, drain field monitoring, irrigation experiment, or rainfall drainage. For one of these projects design the experiment and acquire 3D and 4D GPR surveys. Our new GPR system enables acquisition of several repeated 3D GPR surveys within one day.
- **3D/4D GPR Data Analysis**: Process data to extract vertical timeshifts and amplitude differences of reflectors due to changes in water content. Warp 3D cubes to make repeat surveys structurally identical and produce difference cubes highlighting where water flow occurs. Integrate with 3D geological interpretation to determine preferential flow paths. Due to the similarity of GPR and seismic data we can use state-of-the-art Landmark™ processing, interpretation and visualization tools to accomplish this task.
- **Dissemination and follow-up:** Write a journal article about your experiment and results. If time permits, do more in-depth analysis such as numeric flow modeling, joint inversion, or FDTD radar wave modeling and present results at a conference.

Required Qualifications
- Bachelor Degree or higher in Natural Sciences.
- Fluently speak and write English. Participants are expected to present and publish their research.
- Practical experience in at least one of these areas: Field Hydrology / Hydrological Modeling / Seismic- or Radar Data Processing and Interpretation / Sedimentology / Rock- or Soil Physics.

Please email your application including resume, grades and a statement of reasons of your interest in the project.

Email: mgrasmueck@rsmas.miami.edu more info: www.3DGPR.info