What lies beneath: Petroleum targets unearthed by UH professor

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Kristopher Innanen, an assistant professor of physics at UH, is the 2006 recipient of the J. Clarence Karcher Award from the Society of Exploration Geophysicists. Only the second from UH to receive this top honor, Innanen was given the Karcher award for enhancing ways to detect petroleum targets. Credit: Thomas Shea

Enhancing ways to detect petroleum targets has earned one University of Houston scientist high international honors. Kristopher Innanen, an assistant professor of physics at UH, received the J. Clarence Karcher Award from the Society of Exploration Geophysicists (SEG) during the SEG International Exposition and 76th Annual Meeting in New Orleans last month.

Only the second from UH to receive this top honor, Innanen was given the Karcher award to recognize his significant contributions as a young geophysicist of outstanding abilities under the age of 35.

"He has developed algorithms to locate petroleum targets and create high-resolution pictures of the Earth's subsurface without any prior knowledge about what lies above the target," said Cullen Distinguished Professor of Physics Arthur Weglein. "It has been my good fortune to have the opportunity to work with many outstanding colleagues and students over the years, and Kris Innanen has both led and made tremendous individual contributions to the history of high-impact fundamental seismic research."

Specifically, Innanen was recognized for his work on the development and implementation of algorithms that process reflection seismic data. The goal of this research is to pinpoint the location of potential hydrocarbon targets beneath the Earth's surface, particularly when there is little accurate prior knowledge about the subsurface and when the medium is structurally complex.

"We are making progress and are very encouraged with these prototype algorithms, whose potential is to act in complex regions and regions that are difficult to characterize," Innanen said. "Since these algorithms are all very non-linear – in that they essentially involve the measured data being repeatedly multiplied by themselves – it has become useful in our group to think of the processing as 'data talking to data.' Whether we're working on extending and implementing multiple removal algorithms or developing algorithms for locating and resolving subsurface structure, at the end of the day, the fascination lies in understanding the inter-data conversations and separating out the ones for the job at hand."

Previous work by Weglein and his students and collaborators involved developing algorithms that make it possible to eliminate multiples – a form of coherent noise – from seismic data and to locate and determine subsurface structure in the absence of a velocity model. The algorithms for removing multiples are considered the most comprehensive and effective now in use throughout the industry.

"Kris Innanen has contributed to this technical campaign since his graduate student days and postdoctoral fellowship at the University of British Columbia, as well as for the past year as a new faculty member of the UH physics department and M-OSRP," Weglein said. "He has advanced the concept, algorithmic development and depth-imaging capability for processing primaries to accommodate a larger contrast between the actual earth and a chosen reference medium. This is a significant accomplishment and important milestone toward field data application."

Innanen's contribution progressed and extended the application domain of the earlier velocity independent depth-imaging algorithm developed by Shaw and his collaborators. Innanen also pioneered the concept and construction of inverse scattering algorithms for an absorptive, anelastic earth, leading efforts to implement computationally intensive multiple removal algorithms. The multiple removal methods are in broad industry use, while the processing objectives for an anelastic earth are still in the research stage. Derived from the inverse scattering series, the algorithms being developed by Innanen and his M-OSRP colleagues, Weglein said, are unique because currently no direct method exists to find hydrocarbon targets when the structure above the target is complex and unknown.

Source: University of Houston