Geophysical Research Abstracts
Vol. 14, EGU2012-6366, 2012
EGU General Assembly 2012

Prestack depth migration of bistatic georadar data

R. J. Ferguson (1), M.J. Yedlin (2), and L Nielsen (3)
(1) University of Calgary (rjfergus@ucalgary.ca), (2) University of British Columbia , (3) University of Copenhagen

Prestack Depth Migration (PSDM) of bi-static georadar data is computationally expensive because each georadar trace is migrated separately from the others, and then the set of migrated traces is stacked into a single image. For example, given a dataset of 1000 georadar traces, 1000 migrations are computed and then stacked. The computational effort of PSDM scales linearly with the number of traces. Zero Offset Migration (ZOM) is comparatively inexpensive. This is because no matter how many traces are collected, only a single migration is computed, and no stacking procedure is required. The computational cost of ZOM scales logarithmically with the number of traces. Further, for bi-static data with a non-zero offset, ZOM and PSDM return theoretically the same result in the deeper part of the image, and they differ only in the very shallowest part of the image. As a result, the extra cost of PSDM and it's marginal expected benefit relative to ZOM ensure that PSDM is seldom applied to georadar data.

We find through numerical experiment and field trials (with 1m antennae spacing), however, that PSDM is actually much better than ZOM for not only the shallow part of the image but for the deeper part as well. We find that this difference is so significant that in many cases it will justify the extra cost of PSDM. In particular, we find that that the difference in image quality is due to a significant reduction in migration artifact strength and pervasiveness. We expect that, though our PSDM and ZOM algorithms are identical internally, the "stacking" process that distinguishes PSDM from ZOM gives rise to the image improvement.

For our data examples, we have adapted a PSDM algorithm that is normally applied to seismic imaging for oil and gas exploration. It is a phase-shift based algorithm that accommodates lateral velocity variation, anisotropy, as well as irregular acquisition spacing. We find that this algorithm is efficient and easy to use.