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TITLE: Crust and upper-mantle imaging with noise

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Seismology (S)

CURRENT SESSION: S19. Ambient Noise Imaging in Seismology and Helioseismology

AUTHORS (FIRST NAME, LAST NAME): Elmer Niels Ruigrok[1], Xander Campman[2], Cornelis P A Wapenaar[1]

INSTITUTIONS (ALL): 1. Geotechnology, Delft University of Technology, Delft, Netherlands.
2. Shell International Exploration and Production B.V., Rijswijk, Netherlands.

Title of Team:

ABSTRACT BODY: The last few years there has been a growing number of body-wave observations in noise records. Vinnik (1973) postulated the theory that P-waves would even be the dominant waveform, at distances of about 40 degrees epicentral distance from an oceanic source. At arrays far from offshore storms, surface waves induced by nearby storms would not mask the body-wave signal and hence primarily P-waves would be recorded (Toksöz and Lacoss, 1968). We measured at such an array, in Egypt, and indeed found a large proportion of P-waves.

Also the last few years, a new methodology is under development to image the lithosphere below an array of receivers, without active sources or local earthquakes. Instead, transmitted waves are used which are caused by distant sources. These sources may either be transient or more stationary. With this new methodology, called seismic interferometry, reflection responses are extracted from the coda of transmissions.

Combining the two developments, it is clear that there is a large potential for obtaining reflection responses from low-frequency noise. A practical advantage of using noise instead of earthquake responses is that an array only needs to be deployed for a few days or weeks instead of months, to gather enough illumination.

We used a few days of continuous data, recorded with an array in the Abu Gharadig basin, Egypt. We split up the record in 4 distinct frequency bands and in many small time-windows. Using array techniques and taking advantage of all three-component recordings, we could unravel the dominant waveforms arriving in each time window, at each frequency band.

The recorded waveforms, and hence the noise sources, varied greatly per frequency band, and -in a lesser extent- per time-window. Primarily P-waves were detected at the vertical component for two of the four frequency bands. For these frequency bands, we only selected the time windows with a favorable illumination. By subsequently applying seismic interferometry, we retrieved P-wave reflection responses and delineated reflectors in the crust, the Moho and possibly the Lehmann discontinuity.

Toksöz, M. N. & Lacoss, R. T., 1968. Microseism: Mode structure and sources, Science, 159, 872-873.

Vinnik, L.P., 1973. Sources of microseismic P-waves, Pure and Applied Geophysics, 103(1), 282-289.

INDEX TERMS: [7203] SEISMOLOGY / Body waves, [7218] SEISMOLOGY / Lithosphere, [7205] SEISMOLOGY / Continental crust.

(No Table Selected)

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Additional Details

Previously Presented Material: The material has never been presented or published before.