South Atlantic Margin Processes and Links with onshore Evolution

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Status of the surface wave analysis for WALPASS dataset

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Introduction:

The Walvis Ridge is the connecting link between the Tristan da Cunha hotspot and the Etendeka continental flood basalt province. This is an ideal location to get a better understanding for the plume-lithosphere interaction and the breakup of the continents. It is imperative to have a clear image of this region to put forward any kind of geodynamical model in the midst of the controversial topics like plume theory and various deep-Earth processes. Within the frame of the WALPASS project twelve broadband ocean-bottom seismometer (BBOBS) had been deployed off the north-west coast of Namibia. as well as 28 land stations in northwestern Namibia. The seismological net covers an area of approximately 400 x 800 km. Data from eleven months (BBOBS) and up to two years (land stations) are available.

We are presenting some preliminary work done on the BBOBS data set. Due to problems with internal power of the instruments, the internal clock drift could be measured at only two stations. We test ambient noise correlation to estimate the clock drift for the remaining 10 seafloor instruments. First results of surface wave inversion for land station are also presented.

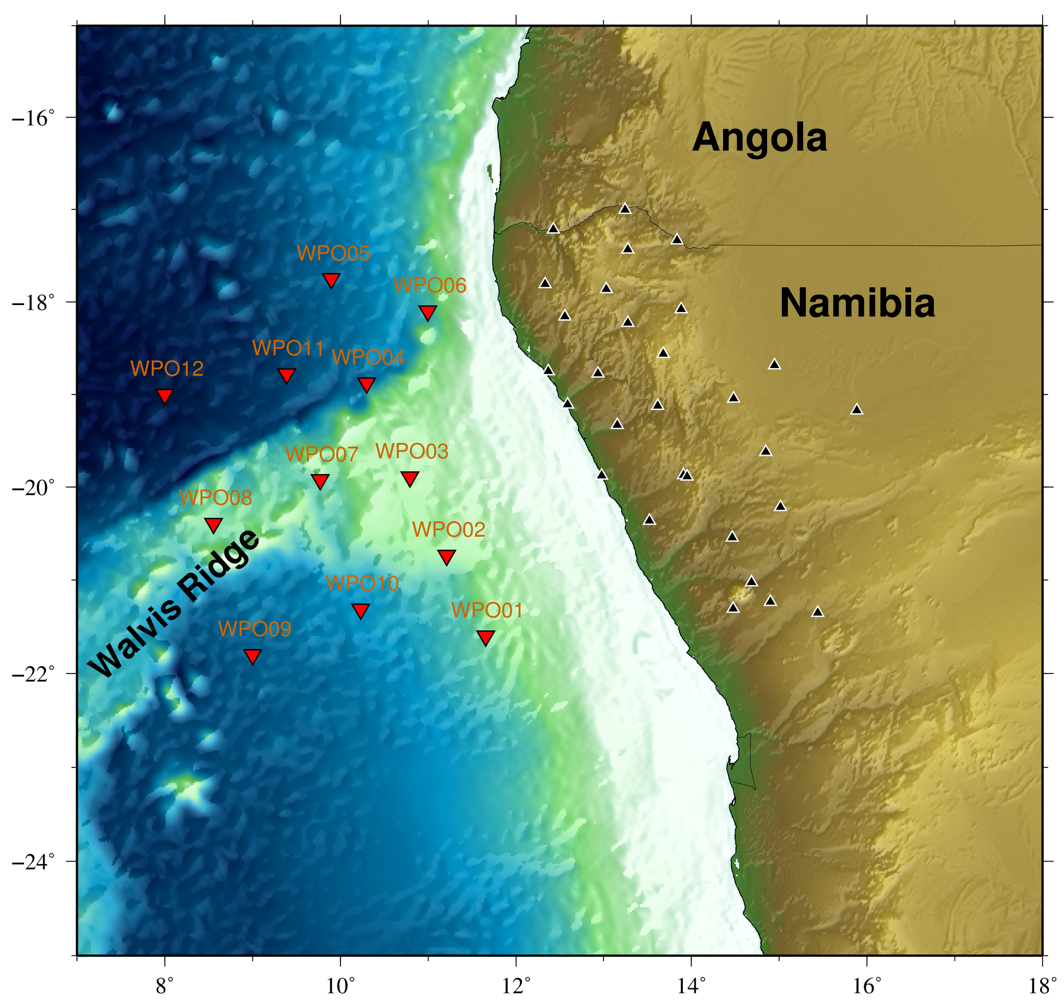


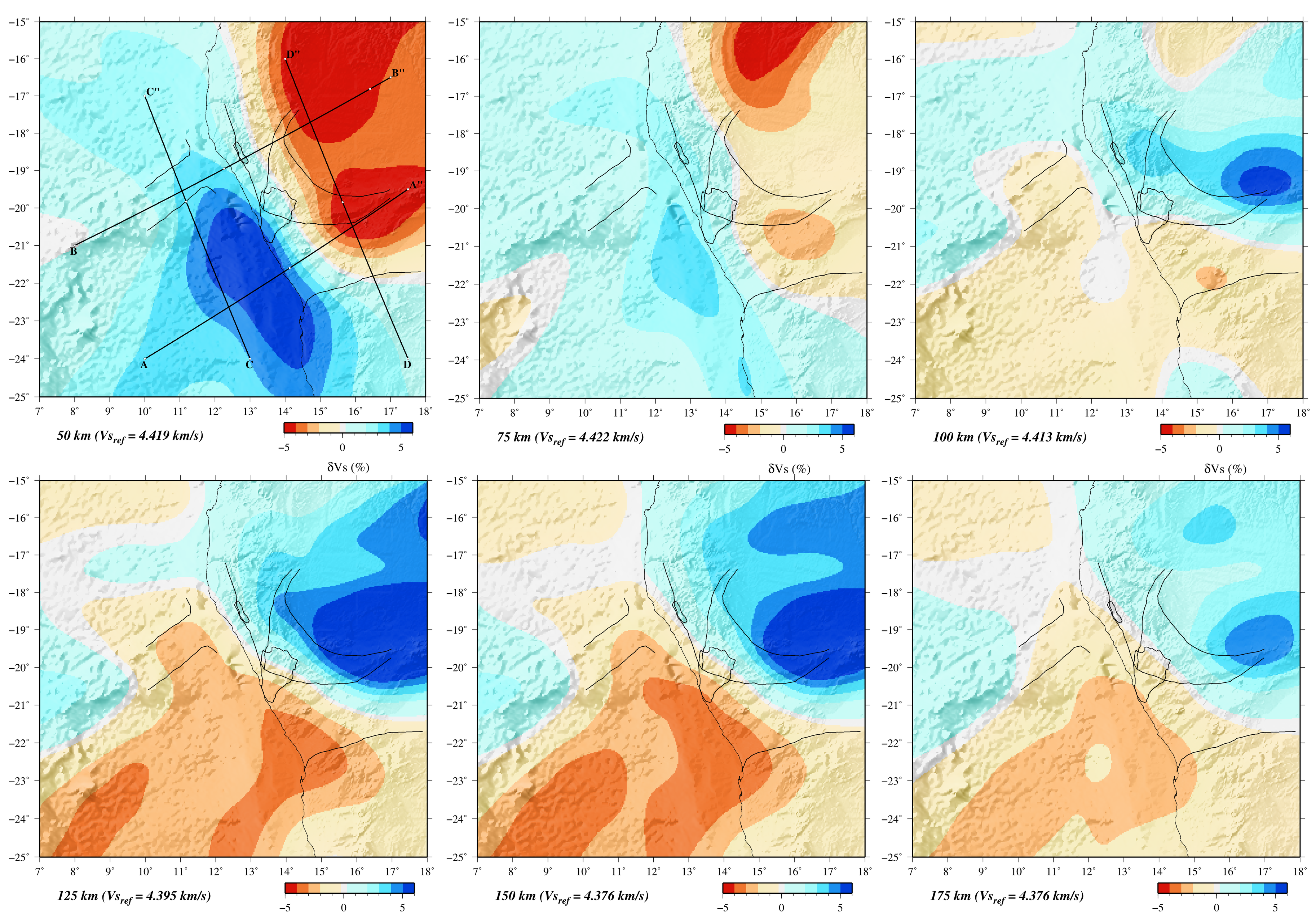
Figure 1: Map showing the station distribution where the OBS stations are shown in orange and land stations in black.

Surface Wave Analysis :

The techniques used in the present work for constructing 3D Sv velocity model are spread in two distinct steps. In the first stage we have used automated nonlinear waveform inversion technique in terms of secondary observables for modeling each multi-mode Rayleigh waveform to determine the path-average mantle Sv-wave speed structure (Cara and Lévêque, 1987). Secondary observables which are built from the seismogram using cross-correlation technique help reducing nonlinearity on the model parameters. In second stage we combine all one-dimensional path averaged velocity models in a tomographic inversion to retrieve the three-dimensional SV wave speed structure.

Lateral smoothing is controlled by Gaussian a priori covariance function :
scale length (Lcorr = 100Km)
standard deviation (σ = 0.01 Km/sec)

Depth Section



References:

Cara, M., and Lévêque (1987), Waveform inversion using secondary´veobservables, Geophy. Res. Lett., **14**, 1046–1049.

Debayle, E. (1999), Sv-wave azimuthal anisotropy in the Australian uppermantle: Preliminary results from automated Rayleigh waveform inver-sion, Geophys. J. Int., **137**, 747–754.

Time Drift Analysis :

Seismic network on land are connected with the external clock via GPS or radio signal. This is for time-to-time syncronization of the internal clock. In the case of OBS deployment the GPS is not an option, so the syncronization is done before deployment and after retrival. In our case the second syncronization failed due to technical problem. The difference in time during this process is commenly known as skew time. *Sens-Schönfelder* (2008) demonstrated the clock-drift for the land stations using ambient noise cross-correlation.

For cross-correlation we used 24-hour data spilt into 1500s of window length which overlaps 50%. Amplitude normalization used here are defined in *Bensen et al.* (2007). Afterwards the cross-correlation we stacked the consecutive 20 days trace with the difference of 5 days (1-20, 6-25 and so on). In order to determine the clock drift we have cross-correlated the first trace of the correlated result with all the remaining traces (after the stacking and filtering).

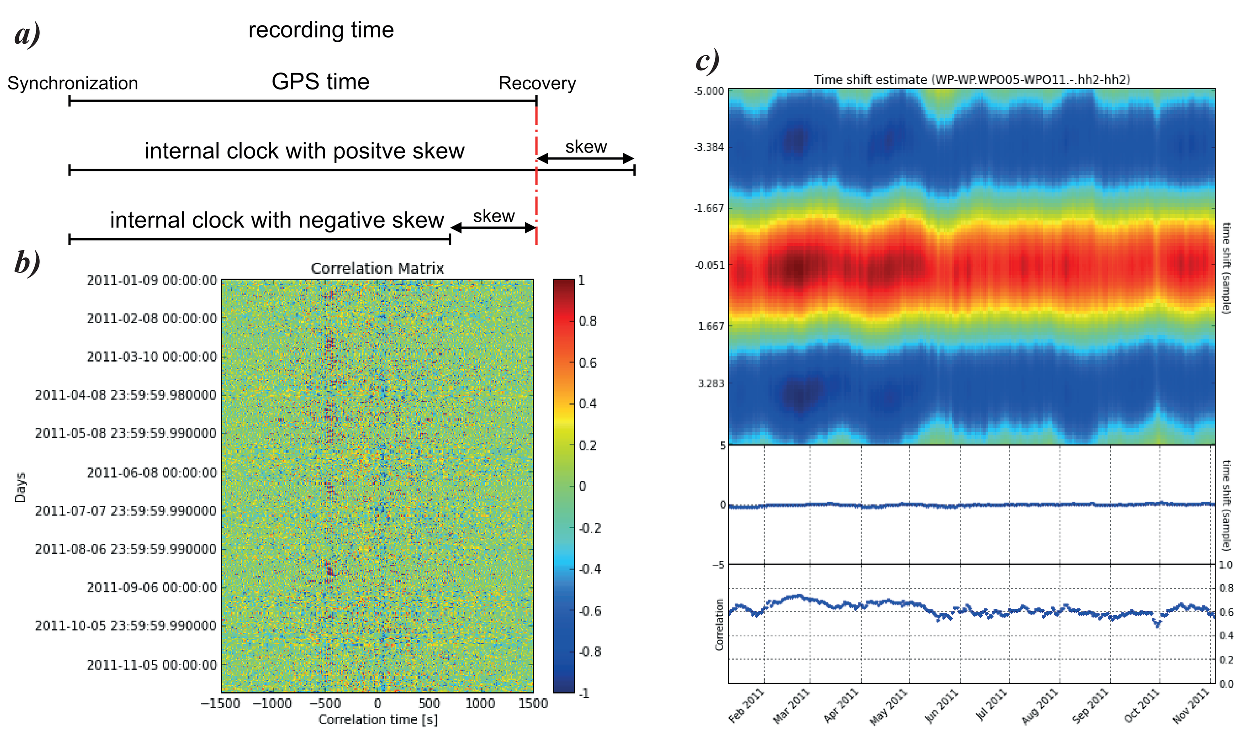


Figure 2: a) Cartoon showing the measured skew value at the time of recovery and its meaning. b) Cross-correlation result of 24-hour long data set. c) CrossStacked section

Station	Drift over period (sec.)	Drift per day (sec.)
WPO01	-0.02122627	-0.00006432
WPO03	-0.011057	-0.00003351
WPO04	-0.12062435	-0.00036553
WPO 05	-0.03811104	-0.00011549
WPO06	-0.08170663	-0.0002476
WPO07	-0.0887494	-0.00026894
WPO08	0.02251376	0.00006822
WPO09	0.07165287	0.00021713
WPO10	-0.1017886	-0.00030845
WPO 11	-0.11509547	-0.00034877
WPO12	0.0895996	0.00027151

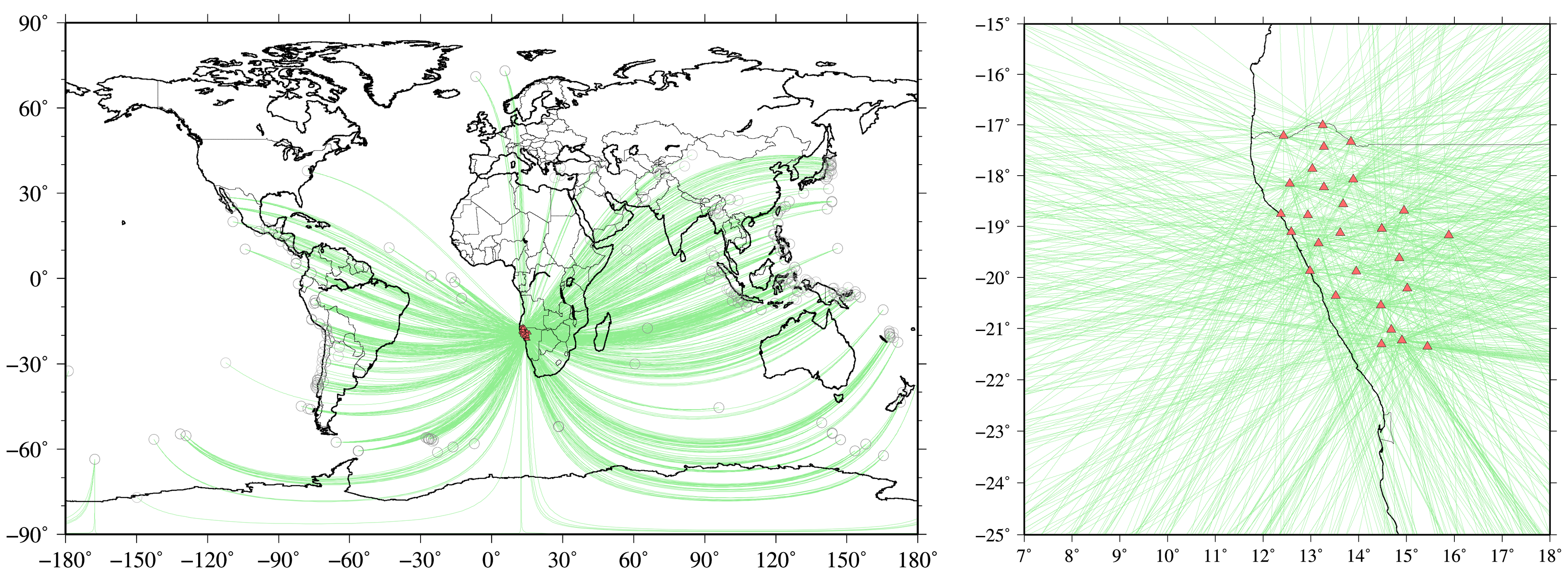
Table 1: The table show the estimation of the clock drift. In conclusion the time drift over the whole period of station working ranges from -0.1s to 0.08s. These values were after applying the correction of the known skew values of WPO05 and WPO11.

References:

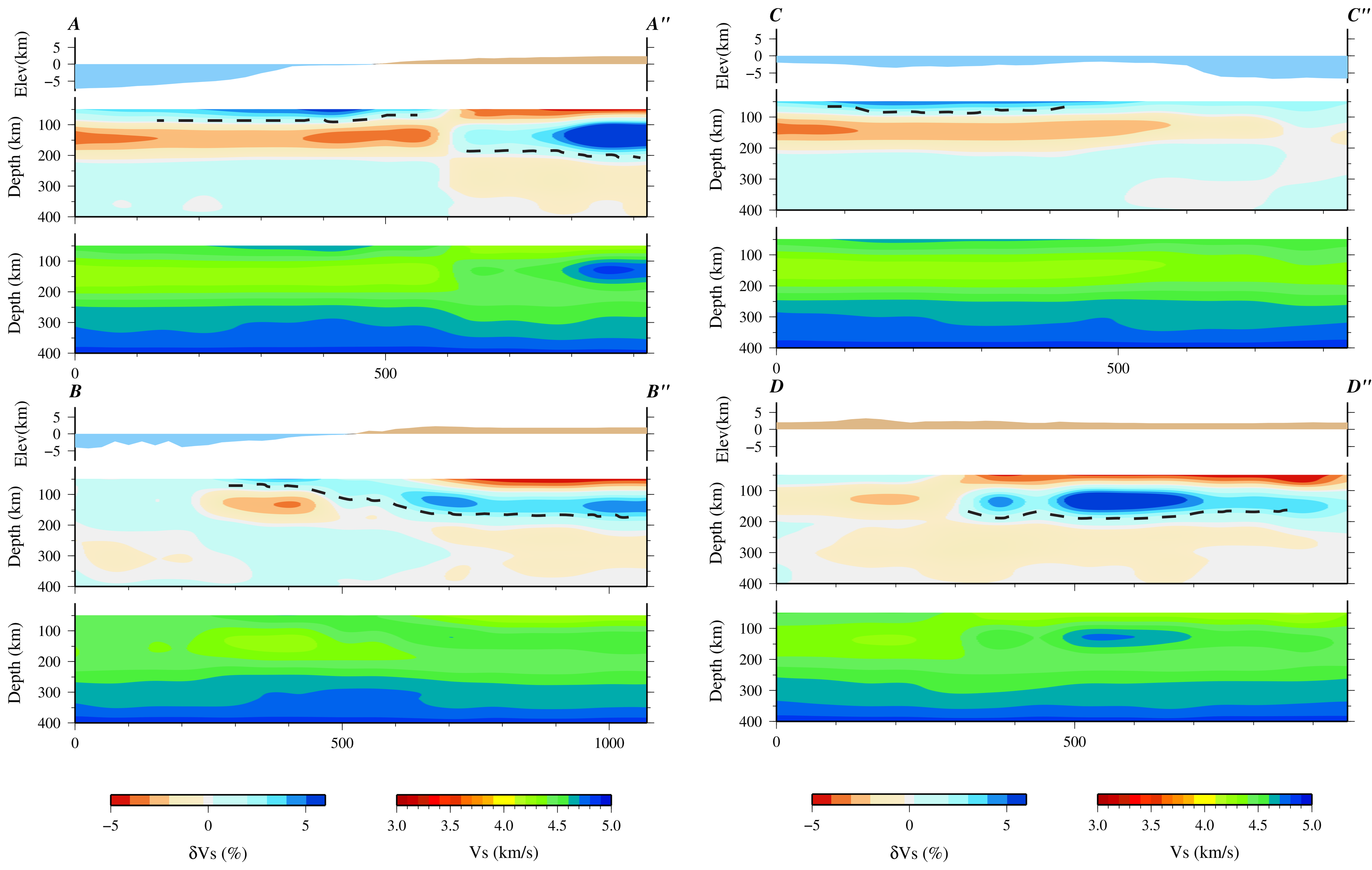
Bensen, G. D., et al., (2007) Processing seismic ambient noise data to obtain reliable broad-band surface wave dispersion measurements, *Geophysical Journal International*, **169**, 1239-1260.

Sens-Schönfelder, C. (2008) Synchronizing seismic networks with ambient noise, *Geophysical Journal International*, **174**, 966-970.

Map of data coverage



Profile Section: Perturbation & Absolute velocity



Preliminary result :

* South of Walvis ridge shows high velocity (oceanic lithosphere 50-75km) feature along the shore line
* From North to Damara belt marks the boundary of continental lithosphere (below 75km).
* LAB are shown with dotted lines in the profile.