Dôme-C, Antarctica

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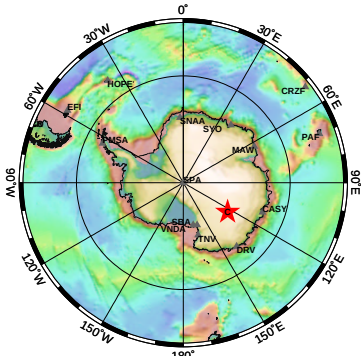
The experiment

We carry out a seismological project at Dôme-C, Antarctica which is related to the Concordia program, a scientific cooperative program involving Italy and France. The core of the Concordia program is the setting of a permanent base on the site of Dôme C for observations in various scientific domains.

The seismological project includes two parts :

- the installation of a broad-band observatory station, close to the base so that it can benefit from power supply and other facilities,
- at a later stage, the deployment of an array of seismometers over a few tens of kilometers.

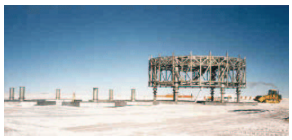
For both parts of the project, we need to study the ground noise in a large bandwidth. We present here the results of the first measurements made during the 1998-1999 campaign.



Dôme-C is situated about 1000 km away from the closest coast, on a very flat plateau, at an elevation of 3250m

Read more about the project in poster G010 (symposium G11)

the site

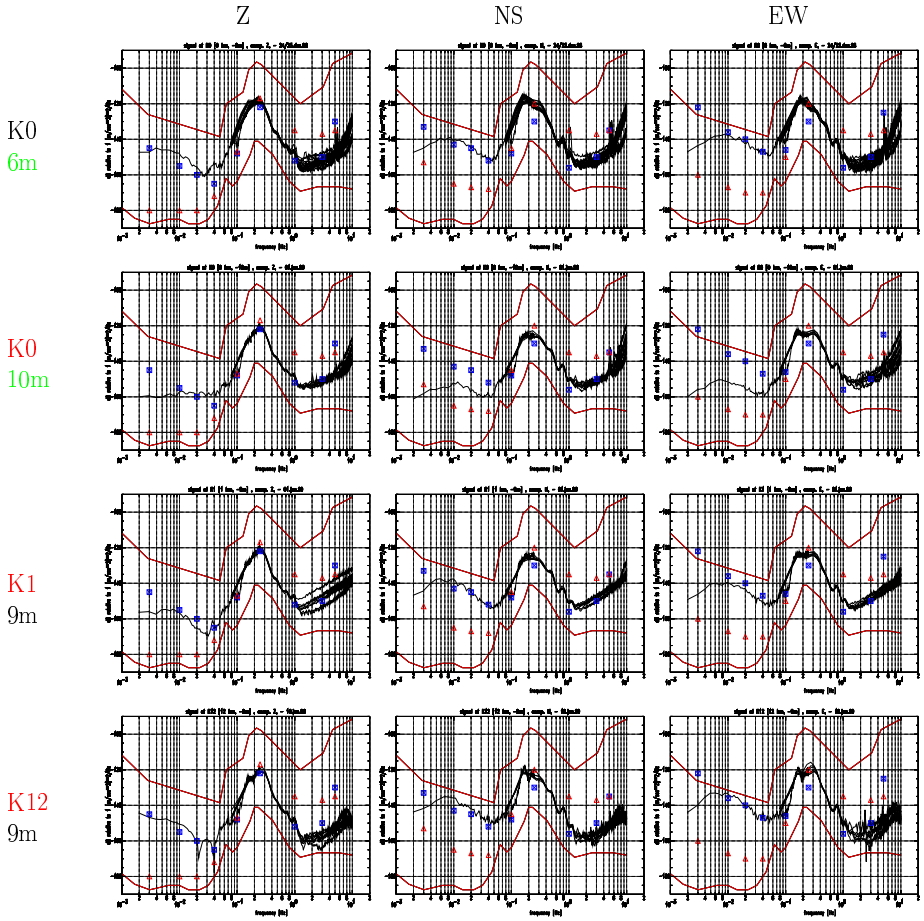


the base (under construction)

data loggers and sensor

(photos J. Burdin/H. Dufumier)

Power density spectra of seismic noise (in acceleration)



blue squares : noise values at SPA (South pole) ; orange triangles : noise values at HRV (Harvard, USA) ; orange lines : Peterson's New Noise Models

We installed STS-2 broadband seismometers on different sites to study the gain we can expect by moving away from the base (a source of anthropic noise, mainly at short periods). We present here results obtained close to the base (K0), at 1 km away (K1) and 12 km away from the base (K12).

We also tested vaults dug at different depths to reach a more compacted and stable snow, and to get a better thermal stability which is important for the signal quality at long period. We present here results obtained at 6 m and 10 m depth at K0. At K1 and K12, the unique depth was 9 m.

The density spectra are computed in 2 parts : the LP range (500s-4s) is obtained from a single record of 10-15 hours, then divided into 2000s windows for which Fourier spectra are calculated and averaged ; the SP range (12.5s-10Hz) is obtained a similar way from 1 hour records and 50s windows, but several density spectra are now displayed on the same plot, thus giving a rough idea of the time variability of the noise.

Conclusions : our measurements show an overall consistency with the noise measured at SPA (South pole). The main differences show up at K0-10m for horizontal components where we obtain lower values at LP, around the microseismic peak where we obtain higher values on horizontal components, and at short periods at K12 where better values are obtained for Z. The comparison with HRV shows we cannot expect as good a LP signal at Dôme-C as in a good continental site. This may be due to the 3500m-thick ice layer. In contrast, the K12 spectra demonstrate that we may expect a very low noise level at short period, similar to the best continental stations.
Comparison of measurements at 6m depth and 10m depth illustrates the importance of this parameter at long period. The positive influence of distance from the base (noise source) is clear at short period. Surprisingly enough, we also find a small increase of the LP noise with distance. A possible cause for this could be the time variability since it has not been possible to record simultaneously on the different sites.

Two earthquakes recorded in January 2000 (last campaign)