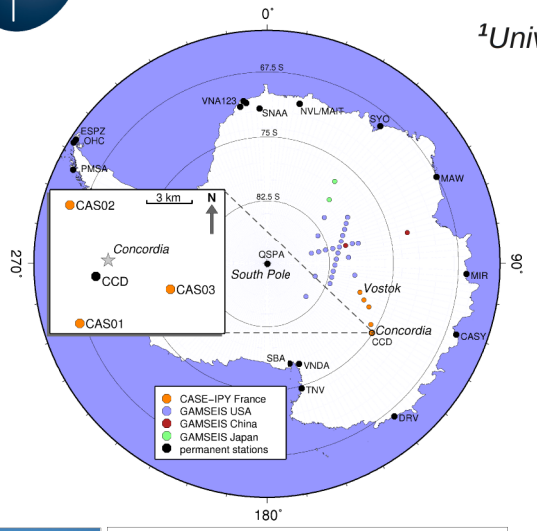
CASE-IPY: autonomous seismic stations newly deployed on the East Antarctic Plateau

J.J Lévêque[1], A. Maggi[1], A. Souriau[2], G. Wittlinger[1] and V. Farra[3]

[1]Université de Strasbourg & CNRS, [2]Université de Toulouse & CNRS, [3]IPGP & CNRS

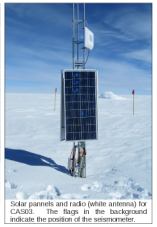


CAS04, the first station installed on the Concordia-Vostok profile. Team members (left to right): Jean-Yves Thoré, Joseph Enfaland, Alessia Maggi. Photo taken by Karim Agabi (4th member of the team).

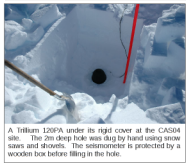
The CASE-IPY experiment is the French contribution to the IPY initiative POLENET (see map for locations of POLENET seismic stations). Its objective is the deployment of an array of seismometers between Concordia and Vostok, in Antarctica. Three prototype stations were deployed near Concordia in Jan 2008, and four profile stations in Jan 2010 (see photos below).

Battery and acquisition box for CASE stations. Power is supplied by 3 solar panels, stored in an array of 10 gel-acid batteries, and distributed by two regulators (white boxes in the photo). The acquisition system, a Reftek-130, is placed next to the batteries. Timing information is provided by a Garmin GPS receiver also placed within the box.

Trillium 120PA seismometer, in our test site at Concordia base. The instrument is placed on a granite base, and insulated using a foam base and rigid cover.



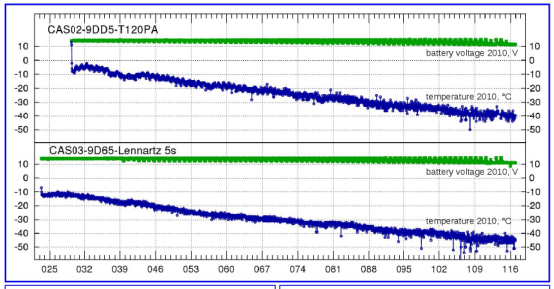
Solar pannels and radio (white antenna) for CAS03. The flags in the background indicate the position of the seismometer.

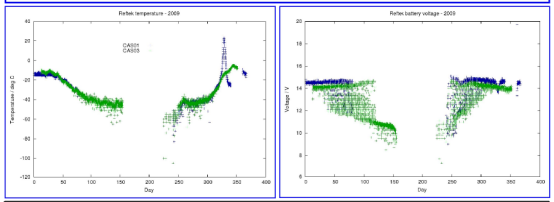


A Trillium 120PA under its rigid cover at the CAS04 site. The 2m deep hole was dug by hand using snow saws and shovels. The seismometer is protected by a wooden box before filling in the hole.

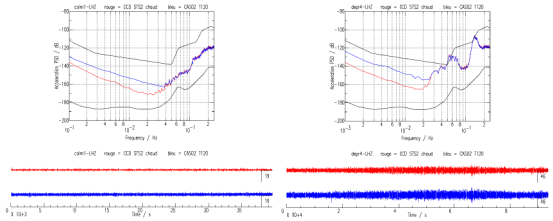
The battery and acquisition box is installed closer to the snow suface for easy access.

Installation of stations along the Concordia-Vostok profile was carried out using a Twin Otter aircraft.

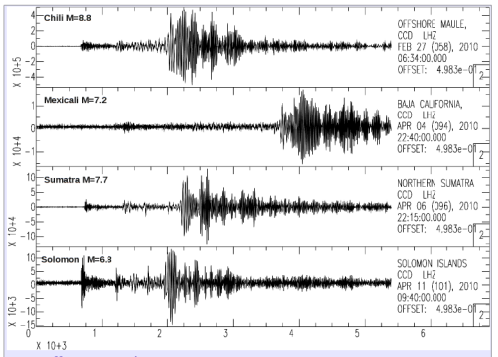




State-of-health of CASE stations. Data from the prototype stations, including state-of-health, is telemetered daily to Concordia. Plots show acquisition system voltage and temperature readings for 2010 and 2009. The stations are powered by solar panels and batteries. We have enough batteries to carry on recording approximately 1 month after the last sun-down.



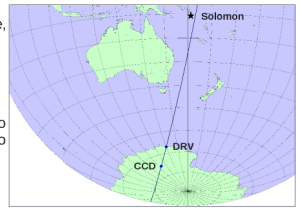
Installation quality. Power density spectral plots for a quiet day (left) and a noisy day (right), comparing data from CAS02 and CCD, our observatory high-quality station at Concordia (12m depth). Noise characteristics of the two installations are identical for periods below 30s; despite its surface installation, CAS02 is still a good station at long periods.

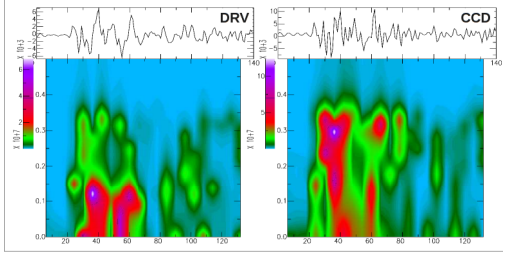


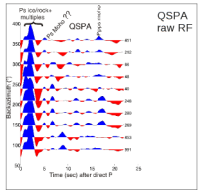
Ice effect on seismograms. Vertical component seismograms from CCD for 4 large earthquakes in 2010 The ~3 km of ice under the Concordia stations induce reverberations in the signals not present at rock stations.
The Solomon Islands event occurs on the great-circle path passing through DRV (Dumont-d'Urville, installed on rock) and CCD. Highly energetic reverberations are visible behind the P-waveform and in the corresponding spectrogram for CCD.

Spectrograms of the P-wave, vertical component, at DRV and CCD for the Solomon earthquake, 11 Apr 2010, M=6.8.

This event is located close to the DRV-CCD great-circle so differences in P waveforms are mostly due to phenomenons occuring close to station.

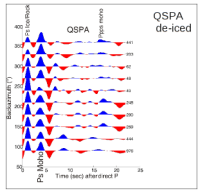


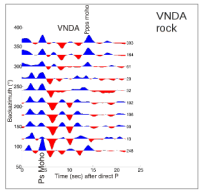


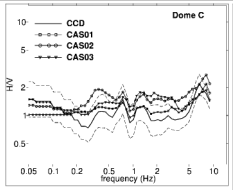


Ice effect on receiver-functions

Receiver functions are also strongly affected by ice-cover. Example shows standard RF for QSPA (South Pole), and RF after removal of the ice-effect. This latter RF is comparable to that from other antarctic rock stations (e.g. VNDA). Presence of ice must be taken into account in RF studies.

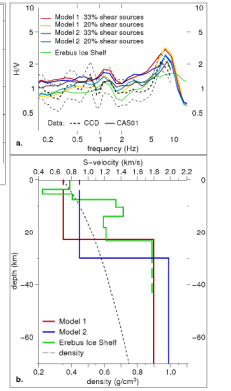






Snow layers at Concordia

We have used standard H/V methods to model the seismic velocity of the snow layers beneath the seismic stations at Concordia.
It reveals the presence of a 23m thick firn layer overlying consolidated snow.



Lévêque, Maggi and Souriau, 2010. Seismological constraints on ice properties at Dome C, Antarctica, from H/V measurements. Antarctic Science, *in press*