Programma Nazionale di Ricerche in Antartide (PNRA)

Final project report

Project ID	2003/2.01
Title	Feasibility study to realize a permanent seismic network in Antartica
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Duration	2 years
Assigned funding	€ 30.000,00

Activities and results

Activities in Antarctica

The main target was to install a remote seismic station as a prototype to realize a permanent seismic network. Because the actual financial support has been unfit for the project, the satellite data transmission has been replaced by a wireless one from the seismometric station and the computer center at the MSZ Italian base. Moreover, the delay in allocation of founds forced us to use financial support of the Istituto Nazionale di Geofisica e Vulcanologia sede di Roma. In more details, the goal of the expedition was to oversee the sites of interest for installing the permanent network. That is why one seismic station has been installed using the telemetry for transmitting data. The instruments are located in the "grotta sismica", very close to MSZ base, where have been recording very broad band sensors since long time; this allows us to compare and to check both our recordings and data transmission. Our seismic sensor is an S13 horizontal component, it has been modified in order to enlarge the recorded frequency band up to 40 seconds. Such instrumental improvement has been planned and realized by the roman branch of INGV lab of " Nuove Tecnologie". The digitizer is "GAIA", a geophysical one with low noise and 24 bits, developed by "Laboratorio di Sismologia" of INGV roman branch. GAIA is able to send data, synchronised by GPS, via Ethernet. The "grotta sismica" is supplied with an Ethernet port and it is in the network of MSZ base, this has allowed us to realize a private network between GAIA and a server named backnet (planned and realized by INGV), located in the PAT and with two IP addresses. One IP address is needed to receive and store data on the private LAN of the "grotta sismica". The second IP address is needed to see and share the stored data via UDP/IP with every other point belonging to both the private LAN and MSZ and even in some point outside redirecting data to another remote address. Data are shown as soon as they are recorded by a viewer called SiStream 1.0 planned and realized by INGV.
What was missed in Antarctica is the wireless data transmission using the chosen wi-fy modality. To fill this gap we have realized in Italy a network of seismic stations in sites where the climatic conditions were close as much as possible to those in Antartica. The sites are located in Alpi Carniche of Friuli Venezia Giulia region, north-east of Italy. Thanks to CRS-Centro Ricerche Sismologiche (INOGS) of Udine, who is in charge for the radio network for data transmission, we linked our stations to such network having data in real time. The choice of transmitters has been done according the following criteria:

- "rugged" type, i.e., particular suited for heavy external environments, able to cope with very low temperatures and strong stresses;
- energy demanding as low as possible in agreement however, with wind and/or solar power supply;
- antennas suitable for strong winds and sensitive as less as possible to build ice/snow up phenomenon

Tests for long distance transmissions (~50 Km) have shown the undisputed superiority of the 5 GHz transmitters according to their characteristics:

- dynamic change in frequency (Dynamic Frequency Scanning, DFS) able to select the best frequency according to actual conditions at that time, i.e., interference, reflections, multipath, etc., allowing

the transmitter to adapt itself. Such features are not shown by 2.4 GHz transmitters;
- transmission power control (TPC) very important in optimizing the power supply by selecting high power transmission when it is needed only
- antennas better devoted to cope with ice and wind leaving the gain unchanged
- the OFMD modulation (Orthogonal Frequency-Division Multiplexing) implemented; as a consequence the interference due to the multipath reflections is negligible. It is worth noticing that the multipath reflections are very strong in environments very reach in snow and ice.

As far as the tests of antennas concerns, because we have used them in presence of heavy weather conditions such as snow precipitations, very low temperatures, very strong winds, we have been able to discard those antennas that have shown problems in transmitting data.

Products

A – papers in scientific magazines

B – book chapters

C - proceedings of international conferences

D – proceedings of national meetings and conferences

E – thematic maps

F – patents, prototypes and data bases

G – exhibits, organization of conferences, editing and similar

H - formation (PhD thesis, research fellowships, etc.)

Research units

Date: 14/01/09

Notes