

## Multiparameter measuring systems for Gas geochemical precursors of Earthquakes and Volcanic eruption

Thomas Streil

SARAD GmbH, Management, Germany (streil@sarad.de)

The approach to earthquake and volcanic eruptions forecast by geophysical, geo-chemical and hydrological measurements is a long and winding road. Nevertheless, the results show a progress in that field (e.g. Kobe earthquake, El Hero eruption).

Research into earthquake forecast by means of seismological, geophysical and geo-chemical parameters has continued for more than five decades. Up to now, the use of precursors in earthquake forecast topics is to a large extent empirical, due to the many difficulties that still exist in understanding the physics of earthquakes.

A large number of investigations concerning geo-chemical and hydrological measurements (e.g. CO<sub>2</sub>, Rn, He, H<sub>2</sub>, Hg, N<sub>2</sub> or several ionic concentrations as well as fluctuations of the groundwater head, flow rate) and the electrical conductivity has shown possible starting points for a correlation between the tectonic stress built up in the crust and anomalous effects of the observed parameters .

The actual situation on the measurement sites shows a large number of instruments from several manufacturers, each with its own communication path and data base format. In many cases adds the operator "self-made" equipment for sampling and to join the various equipment. The effort for this is mostly very high and often some technical compromises must be made which reduces the performance of the single instruments.

To overcome this situation was developed the DACM (Data Acquisition and Control Module) technology. Instruments based on this technology can be modified anytime by the user without special knowledge and the claiming of the manufacturer.

The DACM based offers a set of components which can be configured, parameterized and controlled with respect to the requirements on site. Typical components are Radon/Thoron modules (soil gas, water, air, exhalation), signal inputs for sensors like Co<sub>2</sub>, Methane, SO<sub>2</sub>., control outputs for instance for pumps, magnetic valves for flux measurements but also complex functional blocks like spectrometers, PID regulators etc. A complex sampling schedule can be created within few minutes by a graphical software interface.