

Possibilities of using MARSSES instrument for long-term monitoring and subsurface studies in arctic and arid lands.

Y. R. Ozorovich¹, V. M. Linkin¹, J. Fink, W. D. Smythe², B. Zoubkov¹, F. Babkin¹

¹Space Research Institute, Russian Academy of Sciences, 84/32 Profsoyuznaya st., Moscow, 117810, Russia

Tel: 7-095-333-3177; Fax: 7-095-333-2177; e-mail: yozorovi@iki.rssi.ru.

²JPL/NASA, 4800 Oak Grove Drive, Pasadena, CA 91109, USA; e-mail: wsmlyth@spluvs.jpl.nasa.gov.

³hydroGEOPHYSICS, Inc., 5865 South Old Spanish Trail, Tucson, Arizona USA 85747

Introduction:

The MARSSES is the sounding instrument developed of searching for groundwater, water-ice or permafrost layers existing in some depth under the visible surface in the dry lands of Mars. One of the more important challenges facing natural resource managers today is how to identify, measure and monitor the cumulative impacts of land use decisions across space and time. The secondary task is to measure the soil properties of Martian subsurface, which includes porosity, electrical resistance of the liquid phase, thermal conductivity, temperature dependence. A main task of the MARSSES monitoring system is to examine changes in the subsurface properties of local areas regolith on the Martian surface on the base of the database of various soil slices in terrestrial conditions.

Comparative investigation of Martian and Terrestrial frozen rocks

The main goal of the MARSSES monitoring experiment, based on the MARSSES instrument is a comparative investigation of Martian and Earth's cryolithozone (possible investigation of subsurface relics of martian life), drylands soil slices, and the interpretation of geophysical data of subsurface soil structure [5], including :

- theoretical development of comparative models of subsurface frozen dryland structure for typical rocks which formed martian cryolithozone in the mixture of poligonites and montmorillonites;
- development of the software package for detailed analysis of subsurface martian structure - porosity, electrical resistance of liquid phase, thermal conductivity, temperature dependence, which are in agreement with the interpretation of data obtained in the field testing and laboratory supporting measurements;
- possibility to study subsurface frozen water component using TEM instruments and induced polarization (IP) device in several areas which are close to martian conditions: Antarctic, Iceland, Hawaii (volcanic area), arid lands;
- improvements of hardware and software on the base of field studies results in order to use in the Earth conditions, including environmental and geophysical application, and future space experiments on the Martian surface.

Preliminary results of field studies in the Arctic area and at Sir Bani Yas Island.

Results of the field season in the Arctic area revealed the existence of strong surface layer with high induced polarization (IP) effect. On the basis of gained results we have formulated the complex program of frozen soil structures sounding during future field expedition in the Arctic area. Various instruments are proposed to be employed including

TEM and DC techniques.

The first field measurements on Sir Bani Yas Island (UAE) revealed the existence of thermodynamic balance between phase conditions of subsurface water, fresh and salted.

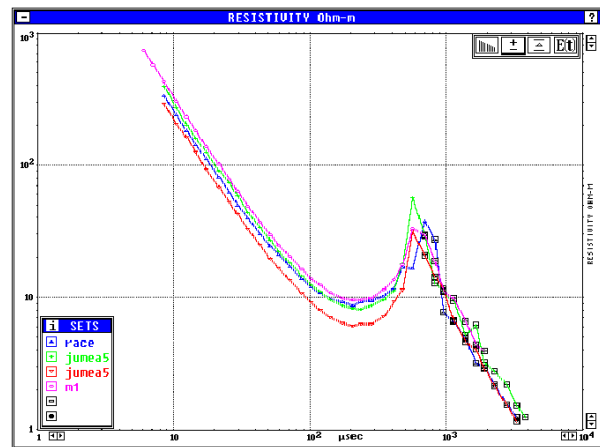
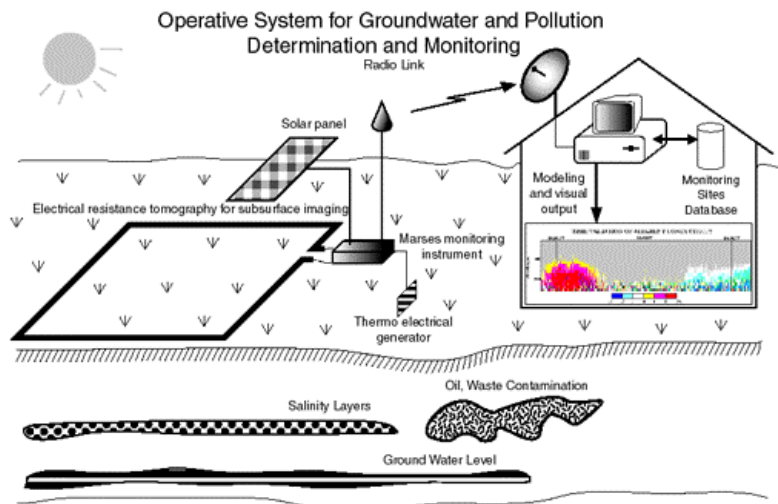


Figure 1 shows measurements on Sir Bani Yas Island, UAE



Controlling of this balance is an urgent task for operative monitoring subsurface system in drylands area in various regions of the world for long-term monitoring nature sub-

surface ecosystem.

Building of geographical slice using different instruments allows to obtain correct parameters for MARSSES TEM in order to employ it in frozen soils sounding on the surface of Mars and for many applications for long-term monitoring and subsurface studies in the Earth's conditions.

References:

[1] Clifford S.M. (1993) *JGR*, 98, 10973–11016. [2] Toulmin P., *et al*, (1977) *JGR*, 82, 4624–4634 [3] Fanale F.P. (1986) *Icarus*, 67, 1–18. [4] Kuzmin R.O., *et al*, (1988) *LPS Conf. XIX Abstracts*, 657–658 [5] Ozorovich Y.R., *et al*, (1988) Tentative of e/m sounding (low-frequency) sounding cryolithozone of Mars, Preprint IKI, No.1477 [6] Ozorovich Y.R., *et al*, (1988) Microwave remote sensing of martian subsurface parameters, Preprint IKI, No.1531. [7] Ozorovich Y.R., *et al*, (1999) Mars Electromagnetic Sounding Experiment - MARSSES, Proceedings of LPSC, March 15–19, 1999.