

Paper Number: 1077

## Interaction of ELF-ULF Controlled Source Electromagnetic Waves with the Earth Crust and Ionosphere (FENICS-2014 experiment).

Zhamaletdinov A.A.<sup>1,2,3</sup>, Shevtsov A.N.<sup>1</sup>, Velikhov E.P.<sup>4</sup>, Skorokhodov A.A.<sup>1</sup>, Kolesnikov V.E.<sup>1</sup>, Korotkova T.G.<sup>1</sup>, Ryazantsev P.A.<sup>1</sup>, Efimov B.V.<sup>2</sup>, Kolobov V.V.<sup>2</sup>, Barannik M.B.<sup>2</sup>, Prokopchuk P.I.<sup>2</sup>, Selivanov V.N.<sup>2</sup>, Kopytenko Yu.A.<sup>3</sup>, Ismagilov V.S.<sup>3</sup>, Petrishchev M.S.<sup>3</sup>, Sergushinc P.A.<sup>3</sup>, Kopytenko E.A.<sup>3,5</sup>, Samsonov B. V.<sup>5</sup>, Birulya M. A.<sup>5</sup>, Tereshchenko P.E.<sup>6</sup>, Smirnov M.Yu.<sup>7</sup>, Korja T.<sup>7</sup>, Yampolski Yu.M.<sup>8</sup>, Koloskov A.V.<sup>8</sup>, Baru N.A.<sup>8</sup>, Poljakov S.V.<sup>9</sup>, Shchennikov A.V.<sup>9</sup>, Druzhin G.I.<sup>10</sup>, Jozwiak W.<sup>11</sup>, Reda J.<sup>11</sup> and Shchors Yu. G.<sup>4</sup>

<sup>1</sup>Geological Institute, Kola Science Centre, Russian Academy of Sci., Apatity, Russia <abd.zham@mail.ru>

<sup>2</sup>Center for Physical and Technological Problems of Energy in Northern Areas, Kola Sci. Center, Apatity, Russia

<sup>3</sup>Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, St. Petersburg Branch, Russia

<sup>4</sup>National Research Center "Kurchatov Institute", Moscow, Russia

<sup>5</sup>East European Geophysical Association (OOO VEGA), St. Petersburg, Russia

<sup>6</sup>Polar Geophysical Institute, Kola Sci. Center, Russian Academy of Sci., Murmansk, Russia

<sup>7</sup>University of Oulu, Oulu, 90570 Finland

<sup>8</sup>Institute of Radio Astronomy, National Academy of Sci. of Ukraine, Kharkiv, Ukraine

<sup>9</sup>Radiophysical Scientific Research Institute, Nizhny Novgorod, Russia

<sup>10</sup>Institute of Cosmophysical Research and Radio Wave Propagation, Kamchatka, Russia

<sup>11</sup>Institute of Geophysics, Polish Academy of Sciences, Warsaw, Poland

The theory, technique, and the first experimental results of a control source electromagnetic (CSEM) study of the Earth's crust and ionosphere with the use of two mutually orthogonal industrial transmission lines of 109 and 120 km length are described. The work is done in frame of FENICS-2014 (Fennoscandian Electrical conductivity from Natural and Induction Control Source soundings) experiment. The main part of measurements are executed on territory of the Fennoscandian shield at distances up to 856 km between transmitters and receivers for the deep sounding of the Earth's crust and upper mantle in frequency range 0.1–200 Hz. According to results of these studies the parameters of "normal" (standard) geoelectric section of lithosphere to a depth of 110 km are clarified, the anisotropy parameters are estimated and a geothermal and rheological interpretation in conjunction with the analysis of the seismic data are executed. Furthermore, for to study the propagation of ELF–ULF (Extra Low and Ultra Low Frequency) waves in the "Earth–Ionosphere" waveguide, the measurements apart from Fennoscandian shield are carried out (Fig. 1) at distances up to 5900 km from the source (in Ukraine, Spitsbergen, Poland, Kamchatka, and other areas).

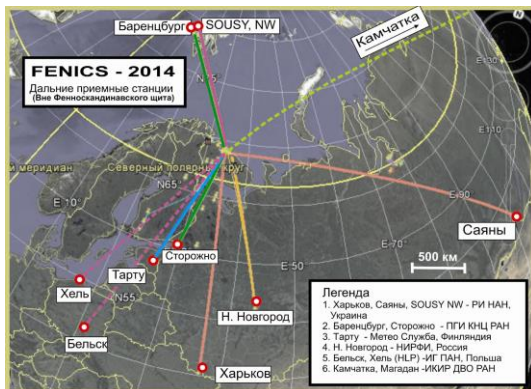


Figure 1. Location of distant measuring points in the FENICS-14 experiment.

The following results were obtained from these studies. 1. The high degree of horizontal uniformity of the lithosphere at depths from 10 till 110 km. Parameter of anisotropy is around of 1.2. 2. Rheological and geothermal interpretation have been made. The upper creep boundary is observed at the depth of 80 km for "abnormal" (heat) type of section and 110 km for the "normal" (cold) type. 3. The lowered transversal resistance

(till  $2 \cdot 10^9 \cdot \Omega \cdot m^2$  ) is observed at the region where the Moho boundary dips up to 55–60 km.

4. The new data are obtained about the features of influence of the ionosphere and displacement currents on the electromagnetic waves propagation. 5. Results of primary observation are collected in the form of a database in a binary format and are accessible for all participants.

ACKNOWLEDGEMENTS. The work has been implemented with the support of the Russian Foundation for Basic Research, the project No.13\_05\_12044\_ofi-m.

