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A super-wide band magnetotelluric instrument

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The magnetotelluric sounding of Earth crust is one of the principal geophysical methods to construct the upper crust electric conductivity cross-section for the depths from first meters till several hundred kilometers. Practically all territory of Europe and of some other regions in the world are studied by an array of magnetotelluric research and corresponding conductivity maps are constructed. Modern calculation technology and theoretic development of magnetotelluric method allow us today to construct a 3-dimensional pattern of underground electronic structure. The new possibilities in data processing and interpretation imply higher requirements back to the parameters of the magnetotelluric stations for primary data collection. Higher resolution and wider frequency band are the major requirements. As it is known, for magnetotelluric sounding the natural (ionospheric) source of electromagnetic radiation in plane wave approximation is used and two electric and two magnetic components of this wave have to be measured. The necessary frequency band covers the range from ˜10-5 till 104 Hz. Higher frequency are also used but here mostly artificial sources of primary signal are applied. Practically there is no problem to cover with one electric sensor with high enough sensitivity the total frequency band, but as to the magnetic field the necessary resolution can be obtained only with two types of sensors: flux-gate magnetometers for lower part of the frequency band and induction coil magnetometers for upper one. There are two important questions here - the value of overlapping frequency band for both types of sensors and the construction of data collection unit (the one or two separate blocks). Both these questions are studied and the optimal approach for the super-wide band magnetotelluric instrument is proposed. The obtained parameters of the manufactured instrument and the results of field tests are reported. The possibility of the application of this instrument to other branch (e. g., earthquake precursors monitoring) is discussed. This study was partially supported by STCU grant 3165.