Measurement of vector electric field on the ocean bottom

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We have developed a new Ocean Bottom Electro-Magnetometer (OBEM), which measure electric field as a vector. The OBEM has five electrodes and it measures four electric potential differences between one electrode (common) and the other four electrodes. The electrodes are attached to arms, which extend from main unit with those lengths of 2 meters in horizontal and of 1 meter in vertical. We evaluated the vector measurement of electric field, especially its vertical component, using data from our MMR (MagnetoMetric Resistivity method) experiment in the central Mariana Trough during R/V Kairei KR02-14 cruise. A vertical dipole electric current of 19 amperes between sea surface and ocean bottom was used as a source. The OBEM measured the electric field due to this source. Vertical and horizontal components of the electric field were separated from vector electric field variation using OBEM attitude based on the two tiltmeters, because the OBEM had been set by a free fall. The meaningful separation of the vertical and horizontal components indicates successful measurement of vector electric field; the amplitude of vertical component is 100 micro-V/m in maximum, which is half of horizontal component. Furthermore, a forward model calculation shows that vertical component of electric field due to vertical dipole electric source is much more sensitive to conductivity structure beneath the ocean bottom compared to horizontal component, indicating importance of its vector measurement on the ocean bottom.