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Abstract

A COMPARISON OF ELECTROMAGNETIC AND MAGNETOTELLURIC SURVEYS

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A COMPARISON OF ELECTROMAGNETIC AND MAGNETOTELLURIC SURVEYS

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Inductive frequency domain electromagnetic soundings have been conducted at three magnetotelluric sounding sites on the flanks of Mt. Hood, Oregon. The transmitter was a horizontal loop transmitter with a moment of $\sim 10^6$ amp turns meter^2; a SQUID magnetometer and portable digital signal averager were used at the receiver. Separations of up to 1.5 km, and frequencies between 0.3 and 100 Hz were used. The MT soundings were conducted with the new remote reference scheme and data were taken in the .03 to 10 Hz band.

The strong radial flow patterns of the volcanics permit first order modeling of the MT data with 2 dimensional models at the three sites. At two of the sites a confined conductor at about 500 meters underneath a resistive upper section is evident; however, detailed modeling is certainly made difficult by obvious three dimensional and topographic effects. Model studies show that the depth to the conductor is underestimated by MT in this case. The em soundings, each with several receiver sites, yield remarkably consistent interpretations of a conductor of 15-25 ohm meter at 500-540 meters depth at both sites. Model studies in this case clearly show that the depth estimates are not as biased by the confined nature of the conductor as are the MT results.

The em data were interpreted in terms of amplitude and phase, in a joint inversion, for a two layer model. Orientation errors of the receiver were removed by numerically rotating the orthogonal receiver sensor to minimize the radial field component at low frequencies. Inversion on the ellipticity of the magnetic field, which is rotation independent, yielded the same models. Despite large moments and long averaging time the S/N ratio at frequencies lower than .3 Hz was poor. A new scheme has been devised using a remote reference natural field noise cancellation system that should lower the low frequency cut off by at least one decade.

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