In April 2010 we carried out a marine controlled-source electromagnetic (CSEM) and magnetotelluric (MT) study of the subduction zone offshore Nicaragua, to study migration of fluids into mantle-penetrating faults associated with plate bending, and fluid circulation in the sedimentary wedge. During a 28-day research cruise we collected a 300 km long CSEM/MT profile using 54 seafloor instruments, yielding excellent MT data from 10 to 20,000s and CSEM data to 10-15 km ranges. The MT data are predominantly 1 or 2D except in the bottom of the trench, where severe bathymetry and perhaps conductivity variations in the sediments create 3D distortions, which we excluded from 2D inversion. The resulting MT models show an increase in conductivity coincident with plate bending and decreased seismic velocities observed by others. Stitched 1D inversion of conventional CSEM data show an increase in crustal conductivity over the same region, as well as areas of increased conductivity in the sedimentary wedge where fluid seeps have been observed at the seafloor. The MT model features an enigmatic conductor at depth in the mantle beneath the abyssal plain, indicating possible melting. The CSEM experiment included two 30 km radius circular tows around sensitive, long-antenna CSEM receivers to study anisotropy related to faulting in the subducting plate. On the abyssal plain we see a pattern of EM polarisation consistent with fossil ridge-parallel mantle faulting, and on the outer rise we see reactivation and water penetration into shallower, crustal faults.