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ANALYSIS OF DOMAIN DECOMPOSITION AND GLOBAL SOLVERS FOR CONTROLLED-SOURCE ELECTROMAGNETICS

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Abstract. Electromagnetic signals have been used in Geophysics as a powerful tool to obtain information of the subsurface since many years ago. Controlled-source electromagnetic methods (CSEM) have shown to be a very valuable tool in off-shore hydrocarbon prospecting but also have been used in CO_2 deposition monitoring and studies of the behaviour of coastal aquifers. In order to model the behaviour of electromagnetic fields in the subsurface, Maxwell's equations -in our case two-dimensional- must be solved. The discretization of the equations is carried out by means of the finite element method, which in general leads to the resolution of large sparse linear systems that require robust computational algorithms. The aim of this presentation is to compare the efficiency of two different resolution strategies, in terms of CPU time, memory usage, among other criteria, namely: (a) Domain decomposition (DD): The domain where the equations are being solved is divided into a large number of small subdomains, leading to the iterative resolution of a large number of small linear systems. The algoritmhs that arise from this technique are meant to be implemented, for instance by using the standard MPI, in parallel architecture computers. (b) Global resolution: Unlike DD, the domain is not subdivided, which leads to a single large sparse linear system. In order to find its solution we use the solver PARDISO, designed to run on shared-memory architecture computers.