AN: **H33B-1308**
TI: A numerical study of geological CO2 sequestration in a multi-compartment reservoir offshore the northern Adriatic sea, Italy
AU: ***Castelletto, N**
EM: *castelletto@dmsa.unipd.it*
AF: *DMMMSA, University of Padova, Padova, Italy*
AU: **Ferronato, M**
EM: *ferronat@dmsa.unipd.it*
AF: *DMMMSA, University of Padova, Padova, Italy*
AU: **Gambolati, G**
EM: *gambo@dmsa.unipd.it*
AF: *DMMMSA, University of Padova, Padova, Italy*
AU: **Janna, C**
EM: *janna@dmsa.unipd.it*
AF: *DMMMSA, University of Padova, Padova, Italy*
AU: **Teatini, P**
EM: *teatini@dmsa.unipd.it*
AF: *DMMMSA, University of Padova, Padova, Italy*
AU: **Politi, M**
EM: *monia.politi@enel.com*
AF: *Engineering and Innovation Division, ENEL, Brindisi, Italy*
AU: **Vincke, O**
EM: *olivier.vincke@ifpen.fr*
AF: *Mécanique Appliquée, IFP Energies nouvelles, Rueil-Malmaison, France*
AU: **Donda, F**
EM: *fdonda@inogs.it*
AF: *Geophysics of the Lithosphere, OGS, Trieste, Italy*
AB: It is widely recognized that fossil fuel power plants will continue to play an important role in the energy supply for a large number of countries in the decades to come. The implementation of suitable CCS technologies is a mandatory requirement for abating the GHG emissions into the atmosphere and obtaining a sustainable power generation from fossil fuels, especially coal. At present, carbon dioxide sequestration in saline aquifers is indicated as one of the most promising techniques which, however, implies a complex multidisciplinary effort involving a number of hydrological, geomechanical and geochemical issues. In the present contribution a geomechanical modeling study of the CO2 disposal into a deep saline aquifer located at about 1500 m depth in the Northern Adriatic Sea, Italy, is discussed. The model makes use of a 3D structural non-linear Finite Element (FE) code allowing for the assessment of the geomechanical safety of the sequestration and the prediction of the expected land uplift with the potential related hazards. The caprock sealing capacity and the injected formation integrity are investigated by two safety factors that account for a shear and a tensile failure mechanism, respectively. The land surface stability is also addressed in terms of absolute and differential displacements, the latter being the key factor controlling the safety of the existing ground structures and infrastructures. Moreover, the possible fault activation is modelled with the aid of special Interface Finite Elements (IFE), specifically designed for the simulation of fault slippage and opening. The geological structure of the storage unit is very complex due to the presence of several faults and thrusts that partition the injectable porous volume into different blocks, possibly disconnected from the hydraulic point of view. Based on a detailed interpretation of a 3D seismic survey, a FE-IFE model that accurately reproduces the geology of the selected site has been developed. A hypoplastic constitutive law derived from radioactive marker measurements carried out in the Adriatic Sea is selected for the geomechanical characterization of the porous formation. Several scenarios are addressed according to different distributions of the petrophysical properties, i.e. permeability and porosity, rock compressibility and initial in-situ stress and pore pressure. A set of simulations is performed with CO2 injected at a rate of 1 Mton/year through two vertical wells. A sensitivity analysis on the parameters defining the yield surface, i.e. friction angle and cohesion in the Mohr-Coulomb criterion, shows that only a 4- to 7-year injection period appears to be safe in relation to any risk of potential

shear and tensile failure.
DE: [1822] HYDROLOGY / Geomechanics
DE: [1847] HYDROLOGY / Modeling
SC: Hydrology (H)
MN: 2011 Fall Meeting