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3D geological model of the Po Plain subsurface: an example of open geological base data for basin analysis

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The Po Plain is a one-of-a-kind place where to study the evolution of the orogen-foreland pair. It is a complex geological system consisting mainly of Triassic to Quaternary sedimentary successions that have recorded the tectonic evolution of the paleoAdriatic continental margin during the Middle-Late Triassic and Jurassic time interval, as well as the development and mutual interaction of the Western Alps, Southern Alps and Northern Apennines orogenic belts, and related synorogenic basins, during the Cenozoic.

These peculiarities allow for achieving analyses on several topics (e.g., the relations between opposite-verging thrust systems, the role of the inherited paleogeography, the geometry and evolution of the foredeep and thrust-top basins, the presence and the activity of seismogenic faults), individually treated by previous studies, with focus on limited time-intervals, or detailed 3D models of limited areas.

Nevertheless, a comprehensive and accessible 3D model of the general framework of the entire Po Plain subsurface is still unavailable.

In this respect, the HotLime Project (GeoERA Programme) will fill the gap providing a publicly accessible 3D framework model of the geometry of some stratigraphic horizons, focusing on crucial stratigraphic intervals, extended from Piemonte to Emilia-Romagna Region - Adriatic coastline, covering an area larger than 21,000 km^2. In the HotLime Project, the model will be used as input for the geothermal assessment of carbonate reservoirs.

The 3D model, built as a whole, will include five regional-wide stratigraphic horizons (e.g. top or unconformity surface), from Triassic to Pleistocene, plus additional less extended horizons, and the 3D geometry of more than 150 faults (i.e., Mesozoic extensional faults and Paleogene to Neogene thrusts).

This comprehensive 3D geological model of the Po Plain subsurface is based on an integrated analysis of surface and subsurface geological/geophysical data (the latter provided by ENI SpA),

that allows for better interpreting and correlating the key horizons. The input dataset includes: 305 well data; 799 2D seismic profiles, with a mean spacing of 5 km; detailed surface data from geological maps at different scales. The final 3D model benefits from the comprehensive and coherent interpretation of the overall input dataset, and the time-depth conversion of the 3D model as a whole through a 3D velocity model.

The objective of this work is to build a general-purpose 3D geological model that will serve a multiplicity of specific topics, and provide a powerful 3D image of this complex foreland basin. It highlights the position and geometry of inherited structures and allows for analyzing their relations with stratigraphic variations of the sedimentary infill (e.g., unit thickness); besides, the comparison of the mutual relations of the compressional faults with the pre-existing discontinuities. The fault distribution and clustering will be also compared with the deformations observed on the highly-detail modeled Pliocene and Pleistocene horizons, giving a fundamental input for the calculation of slip/uplift rates and definition of the activity of the faults.

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