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GEOLOGICAL MODELLING AT THE CROATIAN GEOLOGICAL SURVEY

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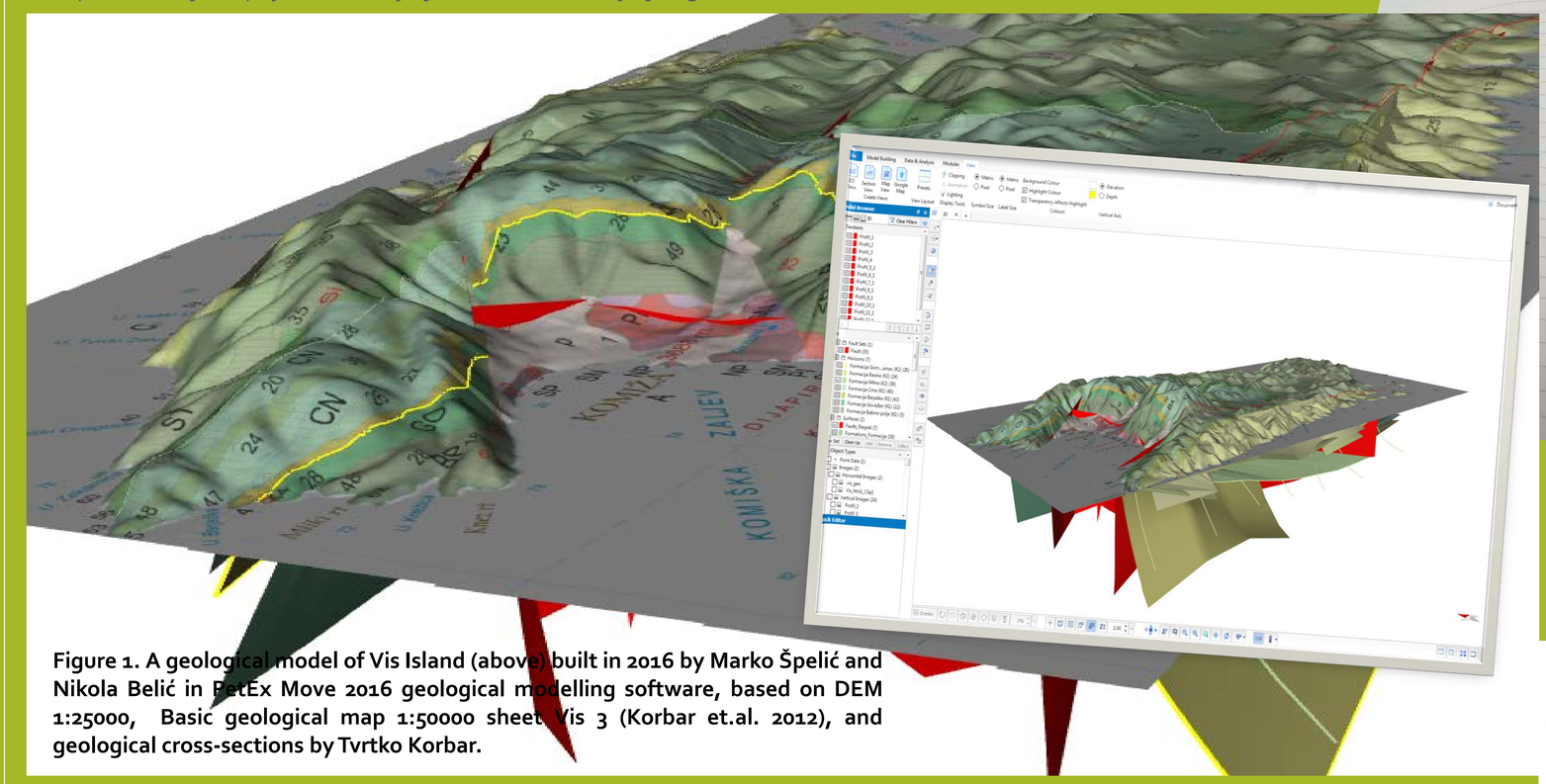
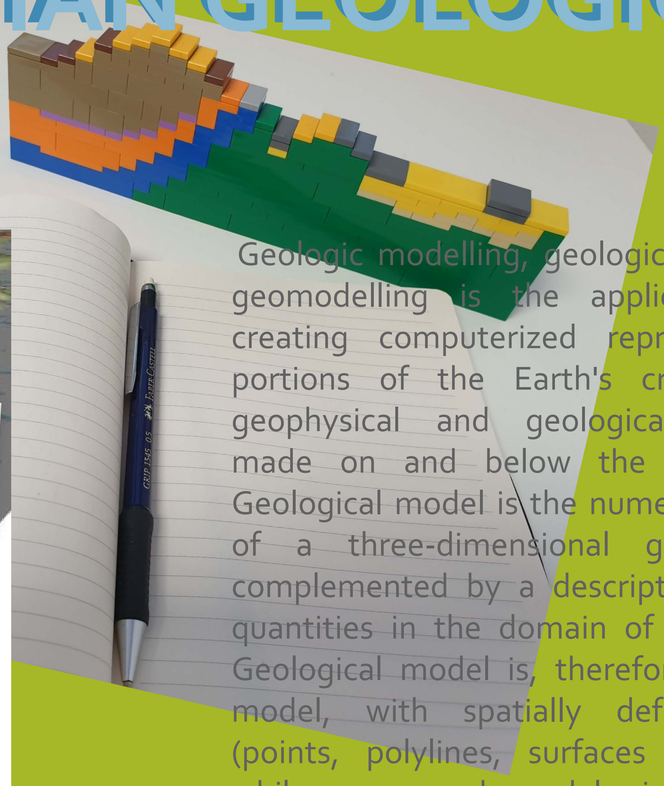


Figure 1. A geological model of Vis Island (above) built in 2016 by Marko Špelić and Nikola Belić in PetEx Move 2016 geological modelling software, based on DEM 1:25000, Basic geological map 1:50000 sheet Vis 3 (Korbar et.al. 2012), and geological cross-sections by Tvrtko Korbar.



Geologic modelling, geological modelling or geomodelling is the applied science of creating computerized representations of portions of the Earth's crust based on geophysical and geological observations made on and below the Earth surface. Geological model is the numerical equivalent of a three-dimensional geological map complemented by a description of physical quantities in the domain of interest (Wiki). Geological model is, therefore, a numerical model, with spatially defined elements (points, polylines, surfaces and volumes), while maps and model views correspond graphical representations.

Geological modelling on the Croatian Geological Survey is a developing discipline. In the past few years only a small number of geological models were made, mostly for the internal use, or as training results for ongoing projects. Most models were, or are currently being developed within scientific projects GeoTwinn and Geosekva. Some models have been developed for the purposes of scientific publication, scientific articles and PhD Thesis. This poster will give a review of selected geological models developed during the past few years. It will also show the examples of different types of geological models, list of input data needed, and give a basic workflow, in steps. Geological modelling requires aquisition of different spatial data as input, including primarily digital elevation model - DEM (or similar), different basemaps, and other spatial data containing information about the position, and elevation. In the process, a whole series of maps is produced, from review data maps to different result maps and model representations.

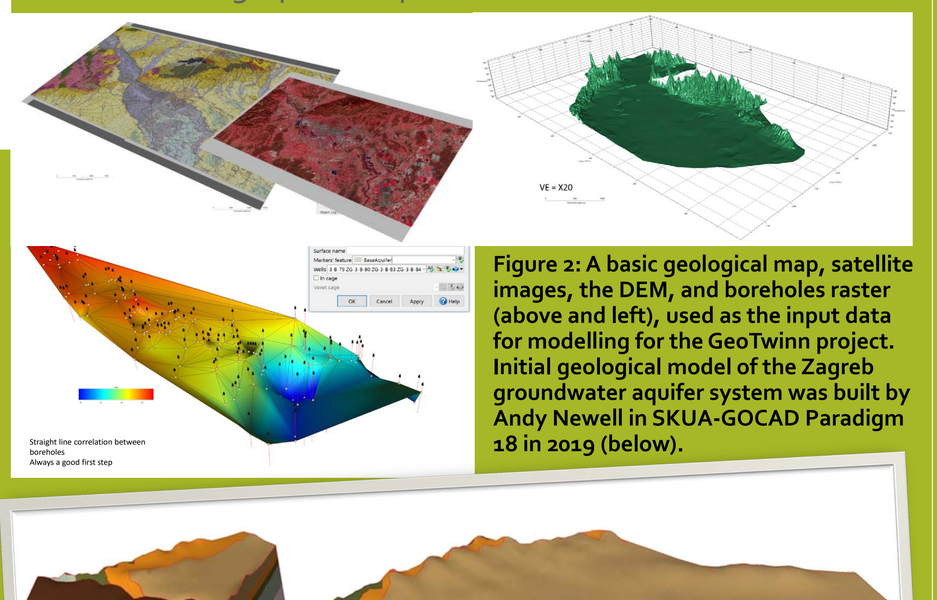
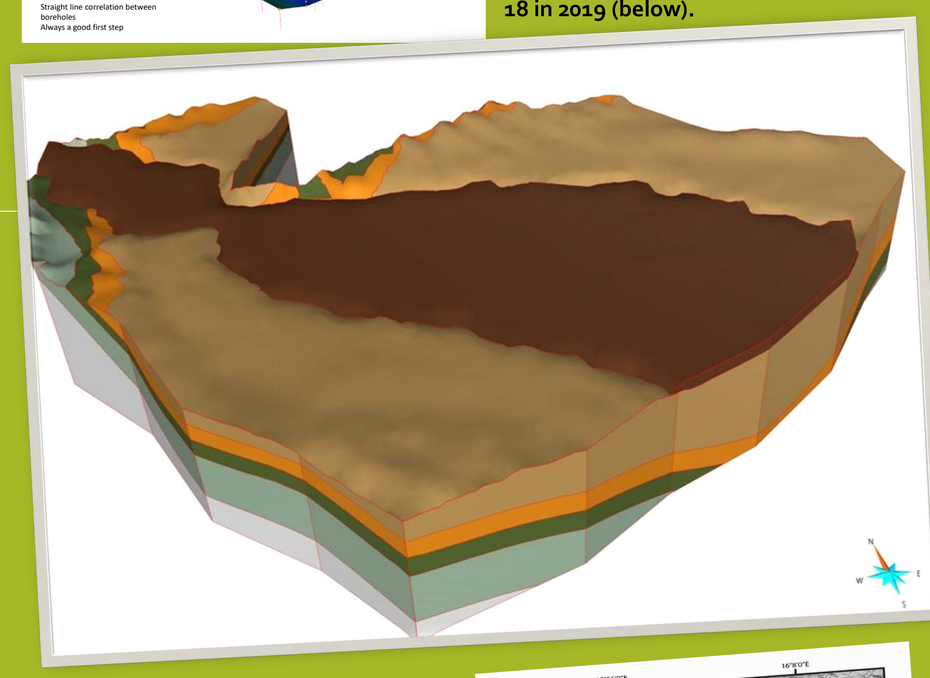


Figure 2: A basic geological map, satellite images, the DEM, and boreholes raster (above and left), used as the input data for modelling for the GeoTwinn project. Initial geological model of the Zagreb groundwater aquifer system was built by Andy Newell in SKUA-GOCAD Paradigm 18 in 2019 (below).



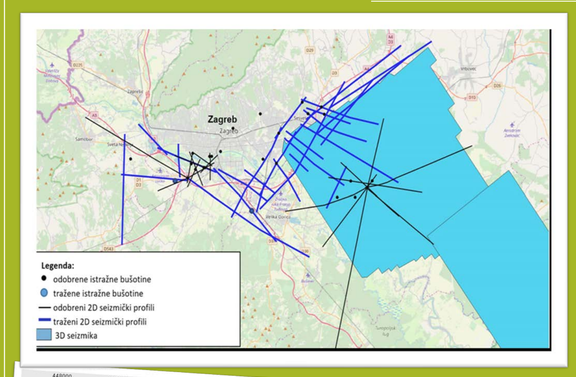
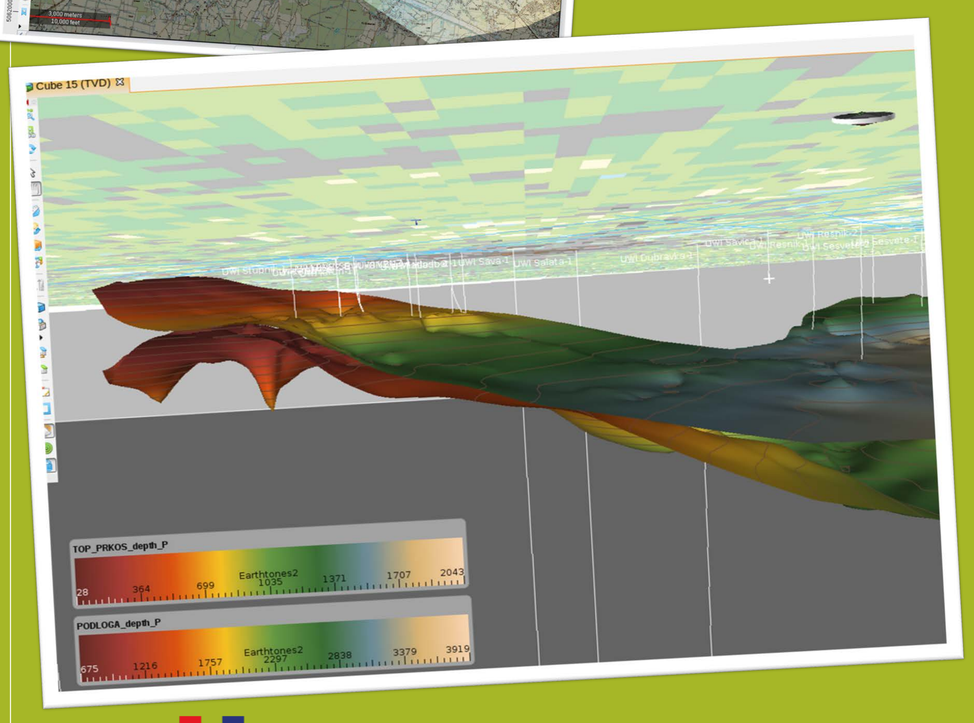


Figure 3. The input data review map (top), resulting maps showing position of top and bottom surfaces of the geothermal aquifer (middle), and the initial geological model of Zagreb geothermal aquifer system (bottom), built using Halliburton DecisionSpace Geosciences ep1 in 2020 by Marko Špelić and Marko Budić for the purposes of the GeoTwinn project.

The development of a geological model of a certain area is based on the unification of all geological data (geological maps, cross-sections and columns - lithology, well data and surface structural measurements) in a single three - dimensional view of terrain surfaces and geological structures of the subsurface.

A basic geological model can be built from DEM, a geological map and cross-sections (Fig. 1), which are typically a geologists interpretation of surface data, while more complex models could be built using 'hard' (measured) data such as well (borehole) and seismic data (Figs. 2 and 3), or even seismological data – hypocentres Fig. 4).



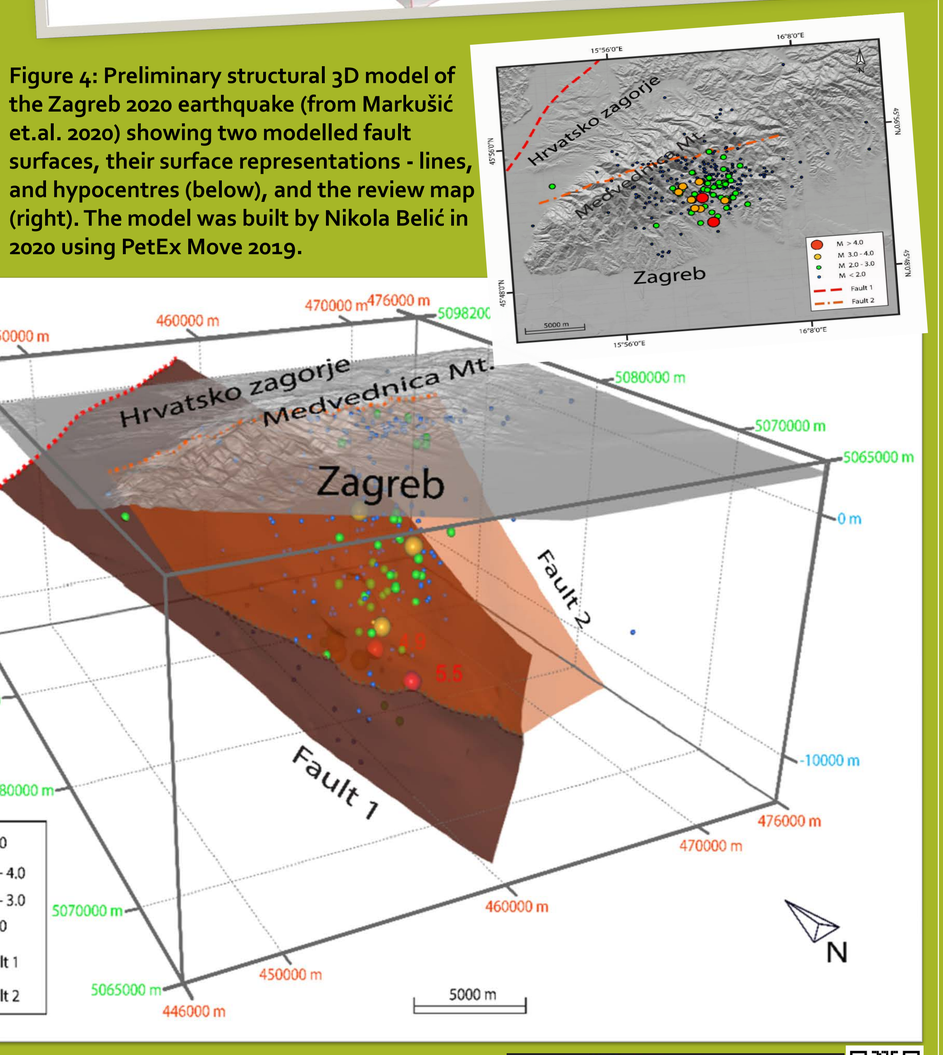


Figure 4: Preliminary structural 3D model of the Zagreb 2020 earthquake (from Markušić et.al. 2020) showing two modelled fault surfaces, their surface representations - lines, and hypocentres (below), and the review map (right). The model was built by Nikola Belić in 2020 using PetEx Move 2019.

References:

Korbar, T. et.al. (2012) Basic Geological Map of the Republic of Croatia scale 1:50.000 – sheet Vis 3 & Biševo 1.

Markušić, S. Stanko, D., Korbar T., Belić, N., Penava, D. and Kordić, B. (2020). The Zagreb (Croatia) M5.5 Earthquake on 22 March 2020. Geosciences 10, 252.

Basic geological map of Yugoslavia 1:100000; sheet Zagreb (Šikić, K. et.al., 1978) and sheet Ivanić grad (Basch, O., 1981).

Sattelite images: https://apps.sentinel-hub.com/eo-browser/?

Topographic map of the Republic of Croatia 1:25000: https://geoportal.dgu.hr/wms?

Wikipedia - Geologic modelling; https://en.wikipedia.org/wiki/Geologic_modelling

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