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Alpine fold and thrust structures: insight from the Säntis area (Switzerland)

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The Säntis area offers one of the most spectacular insights into the fold-and-thrust belt of the Helvetics nappes. The nearly perfect outcrop conditions, combined with the exemplary intersection of formation boundaries with topography, make it a natural laboratory for structural geology. Since the pioneering work of Heim (1905) at the beginning of 20th century, the area was mapped in detail (Eugster et al., 1982) and investigated in terms of deformation mechanisms (e.g. Groshong et al., 1984), structural evolution and fold-thrust interaction (Funk et al. 2000, Pfiffner 1982, 1993 & 2011). The proposed restorations are mostly 2 dimensional palinspastic reconstructions, either in map or in cross sectional view.

The main goal of this research is to better understand the geometrical relationships between folding and thrust faulting, investigating for example fault-propagation folds and analyzing the lateral changes of folds and thrust structures along strike. A three-dimensional model of the area is built using 3D MOVE, combining cross-sections from Pfiffner (2000 & 2011), the geological map 1:25.000 by Eugster et al (1982) and a digital elevation model (DEM) with a regular grid of 20X20 m.

Seven main horizons are reconstructed, corresponding to the base of the Palfris Shale, Öhrli and Betlis Limestones, the Helvetic Kieselkalk, Schrattenkalk and Garschella Fm and the Seewen Limestone. The main structural elements in the Säntis area, such as the Säntis Thrust or the Sax-Schwende Fault, were also implemented in the model. The 3-D model obtained highlights the shape of the main anticline-syncline pairs (e.g. Altmann-Wildseeli, Schafberg-Moor, Roslenfirst-Mutschen, Gulmen etc…); such fold trains vary in amplitude and wavelength. The model also shows clearly the lateral extension and the trends of the principal faults. A restoration of the horizons is presented and discussed.

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