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Investigating the elastic properties of sedimentary basins on different spatial scales

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The study of subsurface fluid motion is important e.g. for understanding ground water motion or processes of compaction, diagenesis, and hydrocarbon migration in sedimentary basins. The multidisciplinary project INFLUINS (INtegrated FLUid dynamics IN Sedimentary basins) aims for investigating the coupled dynamics of near surface and deep fluid patterns and material transport in the Thuringian Basin (Germany).

In order to gain information on how fluid flow processes depend on basin architecture, and therefore its physical properties, we first image the subsurface structure of the Thuringian Basin using seismic methods. Then, relations between hydraulic and elastic material parameters are required to also image the hydraulic structure of the basin's subsurface. As hydraulic properties often significantly vary with spatial scales, such a study requires a combination of small- to large-scale seismic data sets.

In the framework of INFLUINS a variety of seismic data sets aiming for different subsurface parameters and spatial scales have been acquired. Basin scale seismic data sets are available from a set of 2D reflection seismic profiles as well as 2.5D and 3D seismic travel time tomography. Laboratory scale seismic data characterizing the basin's rocks is provided by ultrasound experiments on drill cores from the Thuringian Basin. Deep drilling conducted in the framework of INFLUINS in 2013 provides further useful data sets for our purpose: we acquired core material for laboratory ultrasound analysis and sonic-log data. As the drill site is located at the cross point of two seismic reflection profiles and also within the array of seismic stations we used for the 3D travel time tomography, it serves a direct transfer of elastic properties between different scales.