# Seismic potential of a French intra-cratonic basin, the Paris Basin, through 3D numerical modelling

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**Résumé**

Intra-cratonic basins are commonly considered tectonically stable regions, yet they may still exhibit low-level or episodic seismic activity. Understanding *where*, *when*, *how much*, and *why or why not* seismicity occurs in such contexts remains a key scientific challenge. To address these questions, we investigate the Paris Basin using large-scale and long-term 3D numerical modelling to explore the physical processes responsible for stress accumulation, long-wavelength deformation, and the near-absence of seismicity in the region in contrast with the moderately seismic surrounding areas.
The large-scale question is addressed using a model domain that covers an area of 600 km × 800 km and extends to a depth of 250 km. This allows for a comprehensive and integrated view of lithospheric-scale processes while minimizing boundary effects. Numerical simulations are performed using **PTatin3D**, a finite-element thermo-mechanical code particularly well-suited for testing complex geometries, rheologies and boundary conditions.

A significant bibliographic synthesis has been carried out to compile and harmonize geological, geophysical, and thermal data across local to regional scales. This includes information on major tectonic structures, surface and subsurface heat flow measurements, basin 3D geometry, crustal composition, Moho and lithosphere-asthenosphere boundary depths. In addition, extensive data on radiogenic heat production, rock density, and thermal conductivity have been gathered and homogenized to provide input parameters for the numerical simulations that are consistent with observations (gravity and heat flow data). A series of targeted parametric tests allows us to assess the influence of crustal rheology and boundary conditions, e.g., regime and orientation of stress, deformation rates, or thermal state, on the localization and intensity of deformation.
This comprehensive compilation and modelling effort enables a more accurate representation of the lithospheric structure and thermal regime of the Paris Basin. It also offers key insights into how integrating data at multiple scales enhances our ability to constrain geodynamic models and to explain the absence of observed seismicity despite ongoing (slow) deformation.

*Intervenant

**Mots-Clés:** Paris Basin, 3D numerical modelling, tectonic, thermicity, rheology, deformation, PTatin