Proposed Studentship

Robust characterisation of seismic structures in the mantle

Supervisor(s): Paula Koelemeijer, David Waltham, Christophe Zaroli (Strasbourg), Ana Ferreira (UCL)

Project Description:

Project background:
Over the last decades, significant progress has been made in the seismic imaging of Earth's interior. Tomographic images of three-dimensional structures in the mantle inform us about the fate of subducting plates, the location of upwellings and how the mantle flows and cools down over time. However, uncertainties in these images are often not quantified and model amplitudes are not representative of true Earth structure. Consequently, we cannot uniquely constrain the origin of seismic anomalies in the deep mantle, complicating interpretations in terms of compositional heterogeneity and mantle flow patterns.

This project aims to address these issues by utilizing newly developed, computationally fast and versatile inverse methods that can be applied to a wide range of applications. Specifically, we aim to use the SOLA method that retrieves unbiased model amplitudes and provides uncertainty information (Zaroli, 2016; Zaroli, Koelemeijer & Lambotte, 2017). Depending on the interests and background of the student, the research will focus on e.g. the relationships between different seismic velocities, which allow us to investigate phase transitions in the mantle (Koelemeijer et al., 2018), or seismic anisotropy (the direction-dependence of seismic velocities), which provides critical information on dynamic processes in the Earth (Ferreira et al., 2019).

The research conducted by the student is expected to be primarily computational and forms part of an international multidisciplinary collaboration, with regular research visits to Strasbourg expected.

Funding:
This PhD studentship is fully funded through a Royal Society Enhancement Award to PI Koelemeijer. Funding is available for 3.5 years, covering university fees for UK/EU students and a stipend, as well as travel to the project collaborator in Strasbourg and international conferences.

The student would ideally start on 1st October 2019, although there is some flexibility in the start date.

Training:
The PhD student will obtain training in global seismology, inverse methods and multidisciplinary interpretations. Specifically, the student will gain skills in the modelling, analysis and interpretation of seismic data, as well as scientific computing and programming. The project will also provide general training in communication, presenting and writing skills, with general skills training also available through the Researcher Development Programme at Royal Holloway.

Person specification:
We are looking for a highly motivated student with strong quantitative skills and a background (preferably a Masters) in geophysics, physics or Earth Sciences. Experience with programming is desired. Interested students should not hesitate to get in touch to learn more details of the project.

Applications:
For the application, please apply directly to Royal Holloway following this link:
https://www.royalholloway.ac.uk/studying-here/applying/postgraduate/how-to-apply/

Ensure to mention the Royal Society Enhancement Award Scholarship in the online application ("How are you paying your fees" in subsection "Additional Information" in the Section on "Supporting Statements").

Please also submit a cover letter (detailing your background and motivation for this project) and a CV directly to the PI Paula Koelemeijer (p.koelemeijer@es.rhul.ac.uk).

Interviews are expected to take place in the last week of June / first weeks of July.

For any questions or to discuss potential project ideas, please email PI Paula Koelemeijer (see above).

References:

Ferreira, A. M. G., M. Faccenda, W. Sturgeon, S.-J. Chang & L. Schardong (2019). Ubiquitous lower-mantle anisotropy beneath subduction zones. *Nature Geoscience*, https://doi.org/10.1038/s41561-019-0325-7.

Koelemeijer, P., B.S.A. Schuberth, D.R. Davies, A. Deuss & J. Ritsema (2018). Constraints on the presence of post-perovskite in Earth's lowermost mantle from tomographic-geodynamic model comparisons. *Earth and Planetary Science Letters,* Vol. **494**, 226-238, https://doi:10.1016/j.epsl.2018.04.056.

Zaroli, C., P. Koelemeijer & S. Lambotte (2017). Toward seeing the Earth's interior through unbiased tomographic lenses. *Geophysical Research Letters*, Vol. **44**(22), 11,399-11,408. https://doi.org/10.1002/2017GL074996

Zaroli, C. (2016). Global seismic tomography using Backus-Gilbert inversion. *Geophysical Journal International*, Vol. 207(2), 876-888. https://doi.org/10.1093/gji/ggw315

Details on how to apply can be found here ***www.rhul.ac.uk/studyhere/postgraduate/applying***
Please contact the Postgraduate Programmes Co-ordinator, if you have additional questions about the department or application procedures (email: ***pgadmin@es.rhul.ac.uk*** *; tel: 01784-443581).*
Applicants are requested to send an additional copy of their CV directly to the lead supervisor of the project in which they are interested. Please also contact the supervisor if you have any questions about the project itself