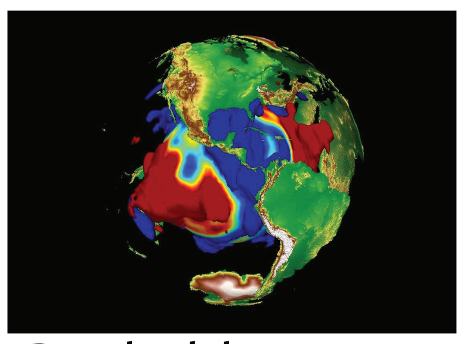

Download the poster at:
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ITHERC: Integrated, multi-scale, thermo-chemical modeling of the crust and lithospheric mantle in Ireland and the North Atlantic region

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Science Foundation Ireland For what's next
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1] Introduction

The aim of ITHERC project is to explore the crust and lithospheric mantle structure in Ireland and the surrounding North Atlantic region.

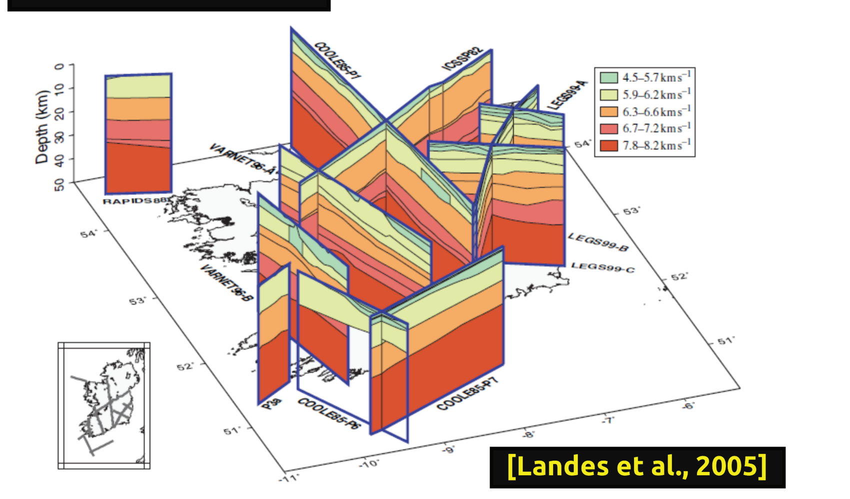
We will integrate multiple constraints, geophysical, petrological and mineralogical, to investigate the lithospheric thermal structure and chemical composition. Taking full advantage of such a diverse dataset requires a multi-disciplinary approach that implements all the available information in a self-consistent framework.

We will perform integrated geophysical-petrological modeling of the study area, adopting both inverse and forward approaches. To that aim, we will use, and further improve, the lithospheric modeling software LitMod (Afonso et al., 2008, Fullea et al., 2009), in particular extending to the crust the thermodynamically consistent approach already implemented in the lithospheric mantle. As a result, new models of the temperature and lithology of the Irish crust (including water content and porosity) based on all available constraints will be produced. The resulting models will shed light on the formation and evolution of the lithosphere and set the foundations for finer scale models, aiming to better assess Irish on- and off-shore mineral, hydrocarbon and geothermal resources.

2] Data

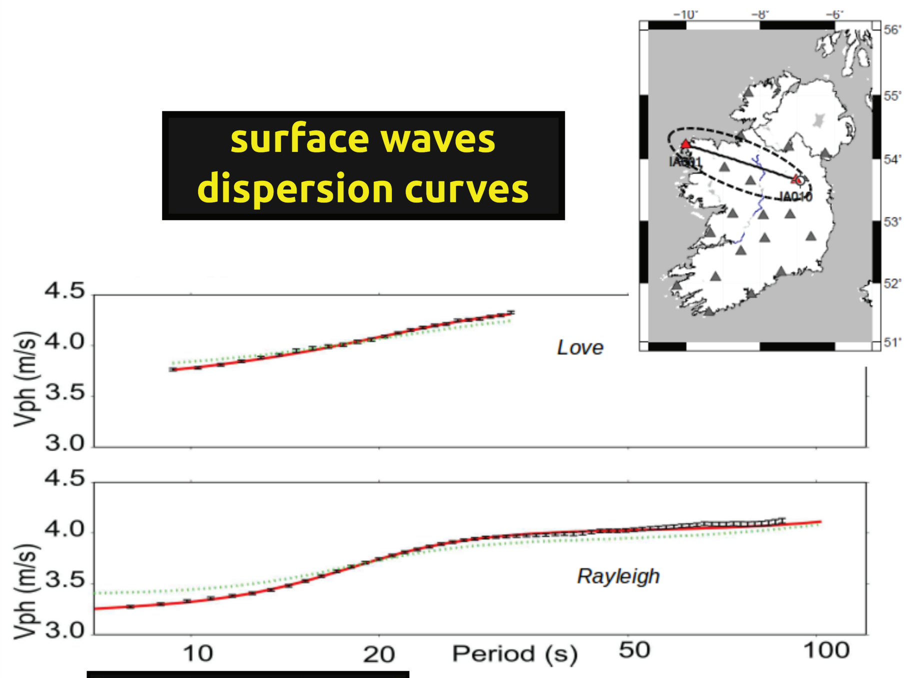
We adopt a multi-disciplinary approach involving different kinds of geophysical and geochemical data

Active seismics

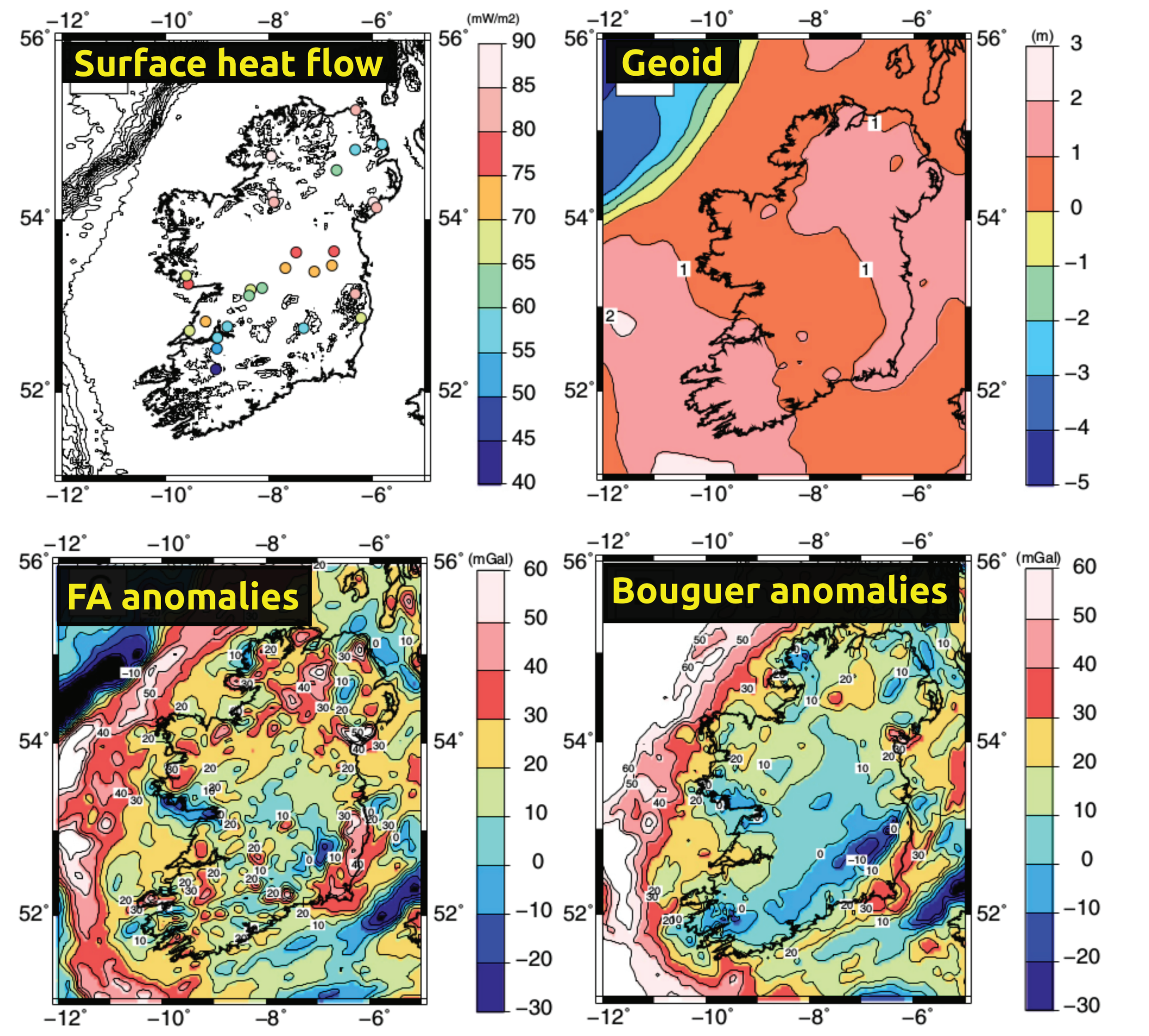


[Landes et al., 2005]

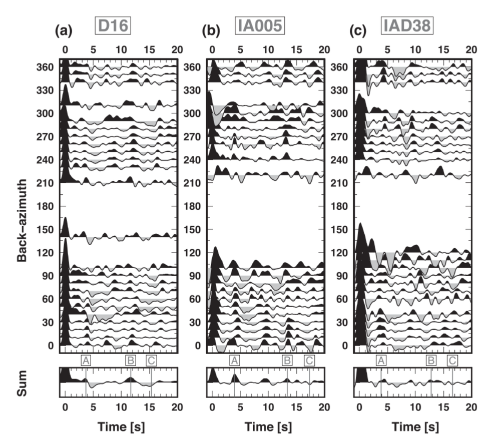
surface waves dispersion curves



[Bonadio et al., in prep.]

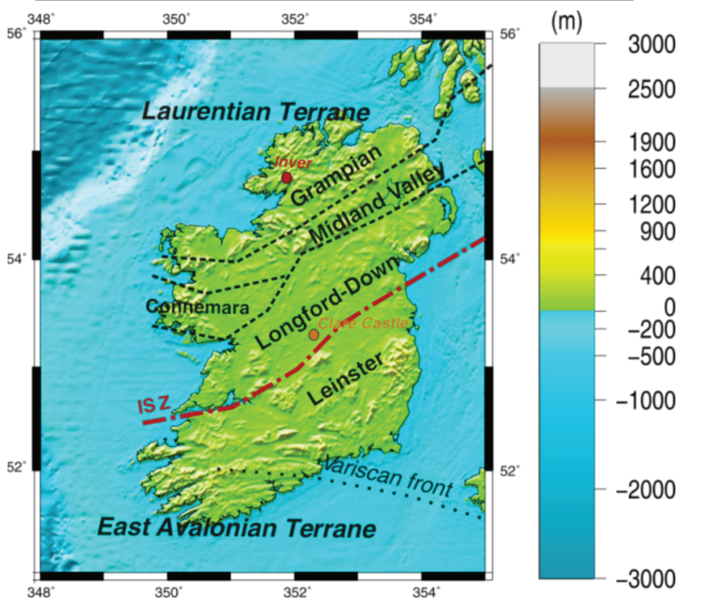


Receiver functions



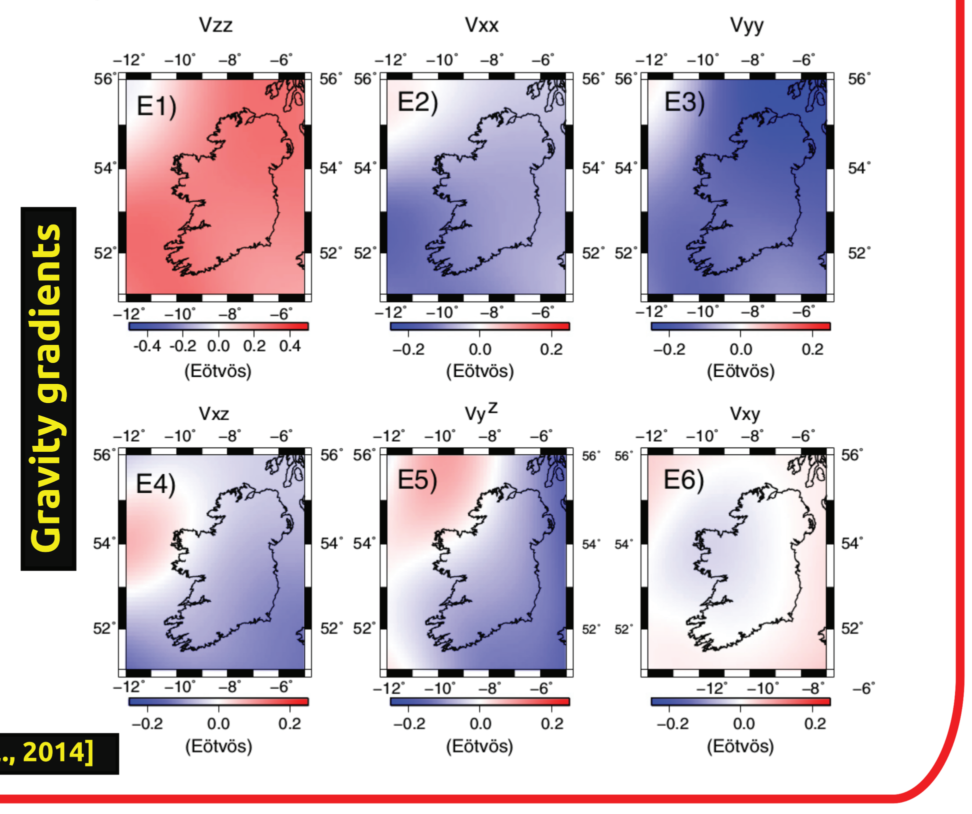
[Licciardi et al., 2014]

Crustal and mantle xenoliths



[Fullea et al., 2014]

Gravity gradients



3] Methodology

Input

Crustal and mantle layers:
- Composition
- Thickness
- Radiogenic heat production
- Thermal conductivity

Modeling

LitMod_3D
Integrated Lithospheric Modeling

- Pressure distribution
- Mineral assemblage
- Temperature distribution

Crust
- equilibrium mineralogies
- metastable mineralogies
- effects of hydrated minerals
- effect of porosity

Mantle
- equilibrium mineralogies
- effects of anelasticity

- Density distribution
- Seismic velocities
- Electrical resistivities

Output

- Elevation
- Potential fields
- Surface waves dispersion curves
- MT responses

Comparison with observation → Modification of the input structure

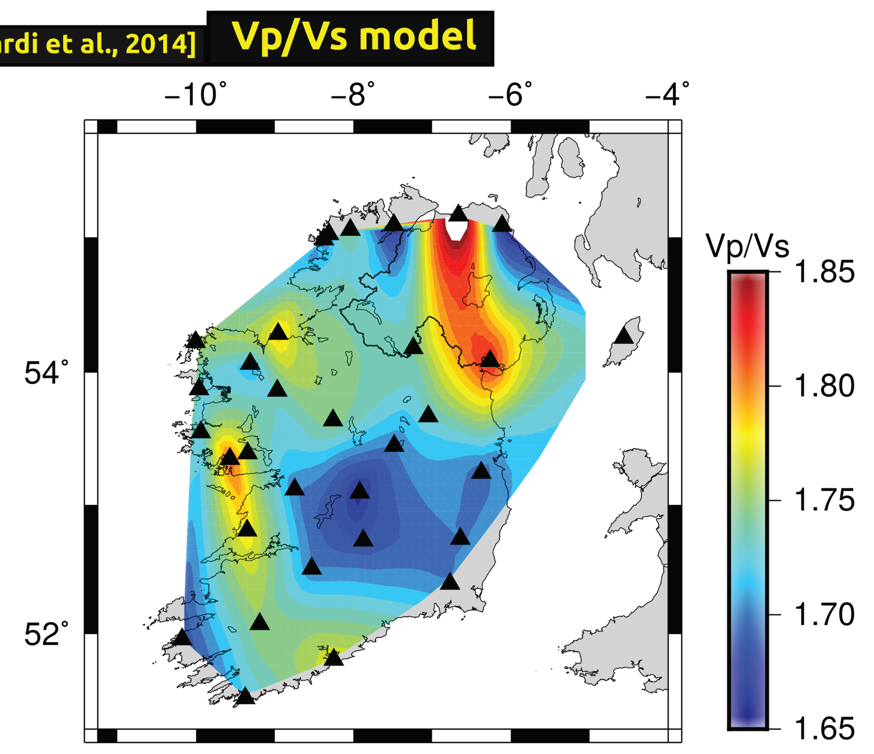
4] Preliminary results

Inverting a Vp/Vs model for chemical composition

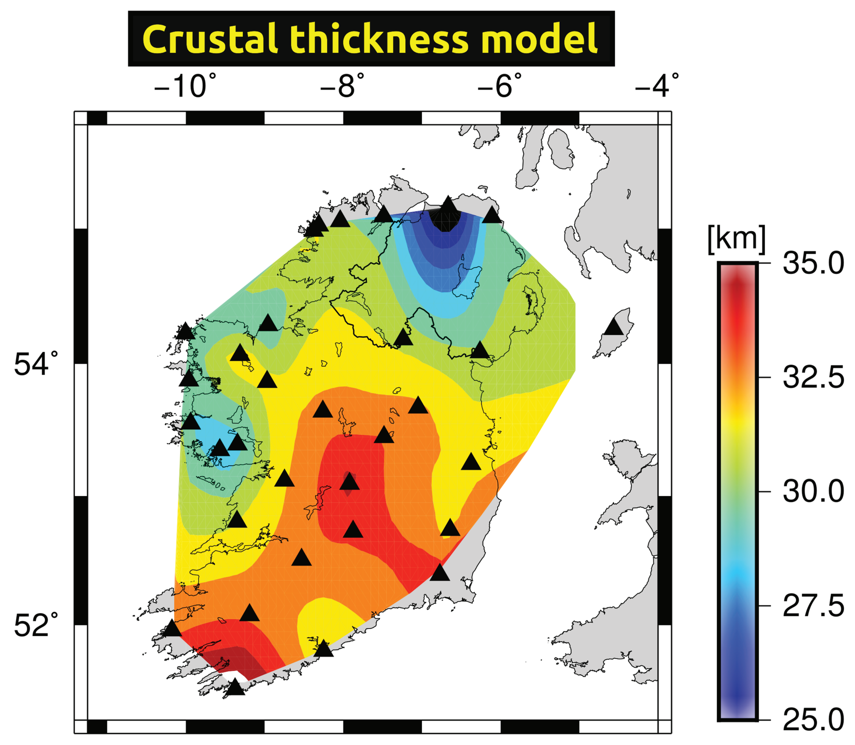
Modeled compositions

Composition	SiO2	FeO	Al2O3	K2O	Na2O	MgO	CaO	H2O
TMMF [1]	53.82	11.81	16.32	1.00	2.96	7.04	9.40	
TM [2]	57.10	9.10	15.90	1.30	3.10	5.30	7.40	
TM050 [3]	57.10	9.10	15.90	1.30	3.10	5.30	7.40	0.50
IN [4]	60.80	7.40	15.50	1.85	3.25	4.25	6.10	
SH [5]	64.50	5.70	15.10	2.40	3.40	3.20	4.80	
SH050 [6]	64.50	5.70	15.10	2.40	3.40	3.20	4.80	0.50
SHFS [7]	68.68	4.64	14.72	3.41	3.56	2.57	3.96	

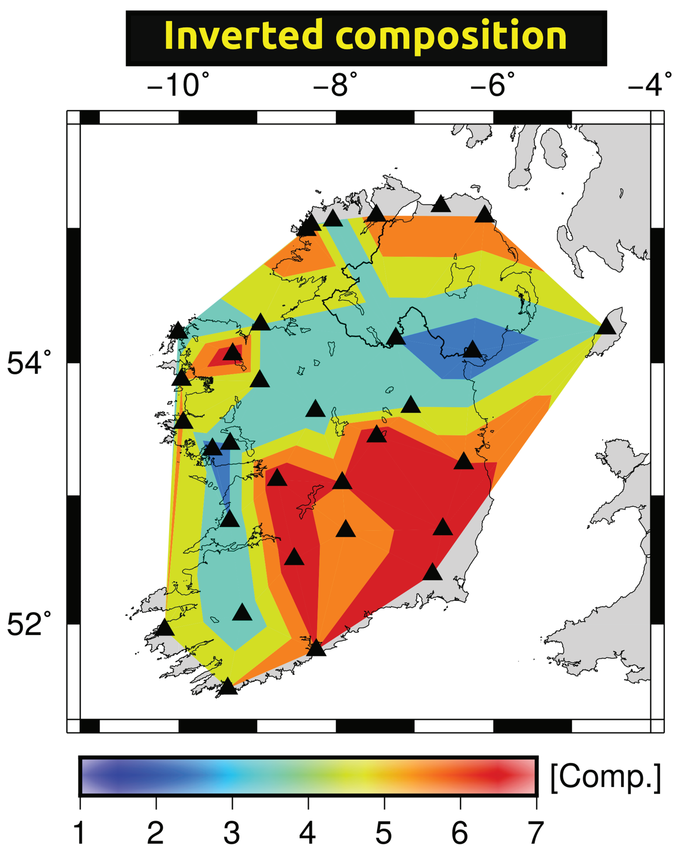
[Licciardi et al., 2014] **Vp/Vs model**



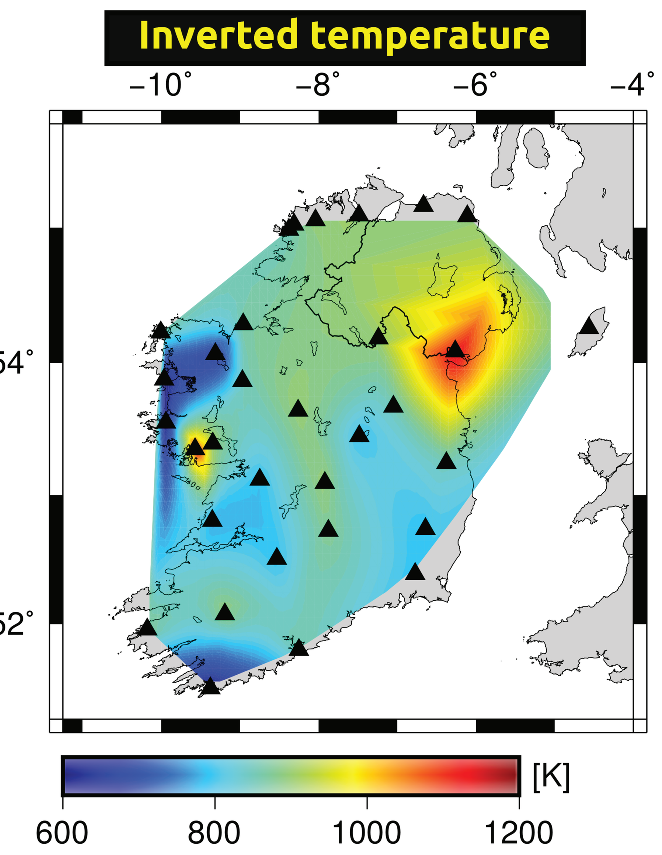
Crustal thickness model



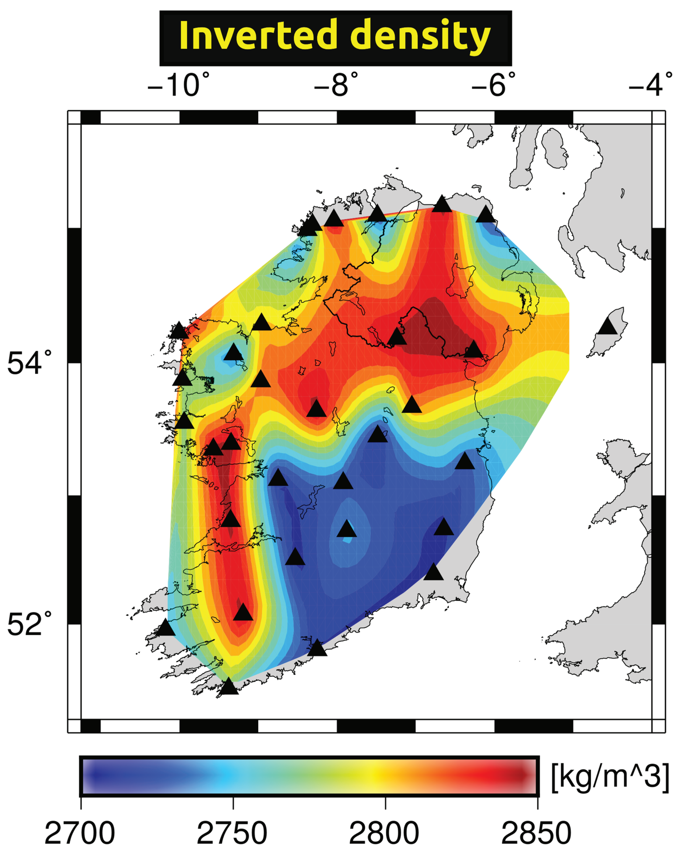
Inverted composition



Inverted temperature



Inverted density



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