

Surface wave tomography of Northern Europe

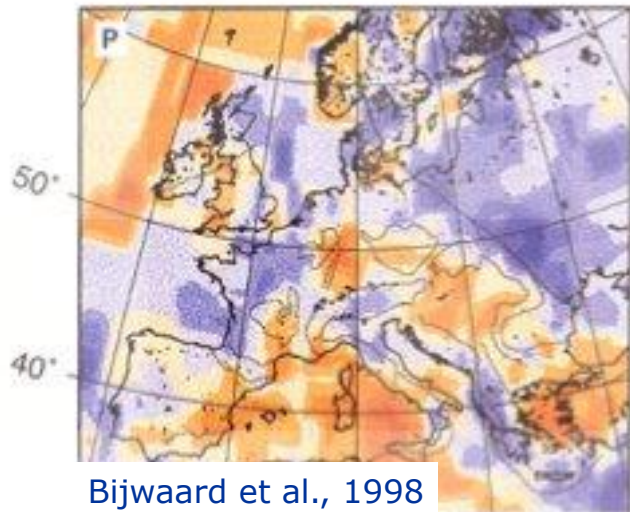


Christian Weidle, Valérie Maupin

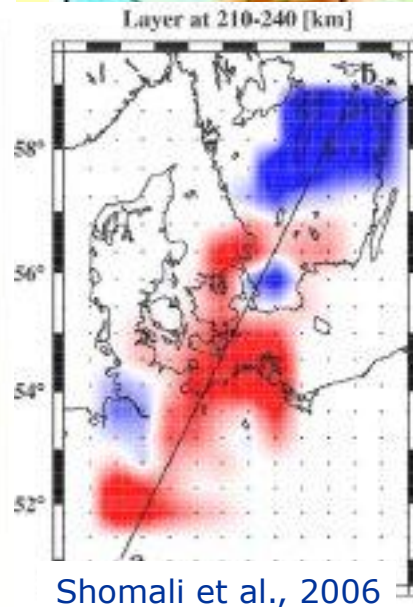
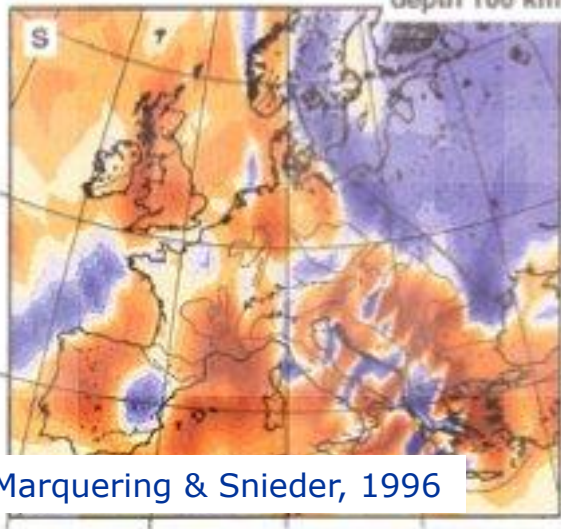
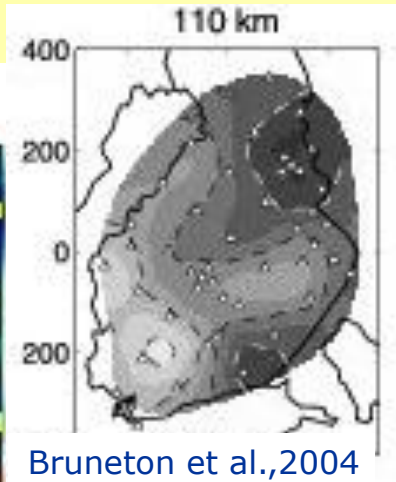
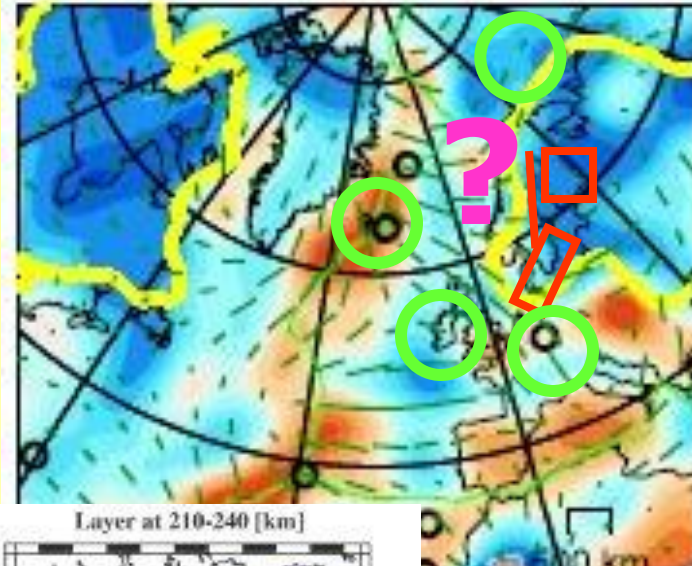
Dept. of Geosciences, Univ. Oslo, Norway

Acknowledgements: J. Schweitzer (NORSAR), A. Levshin (Univ. Colorado, USA)

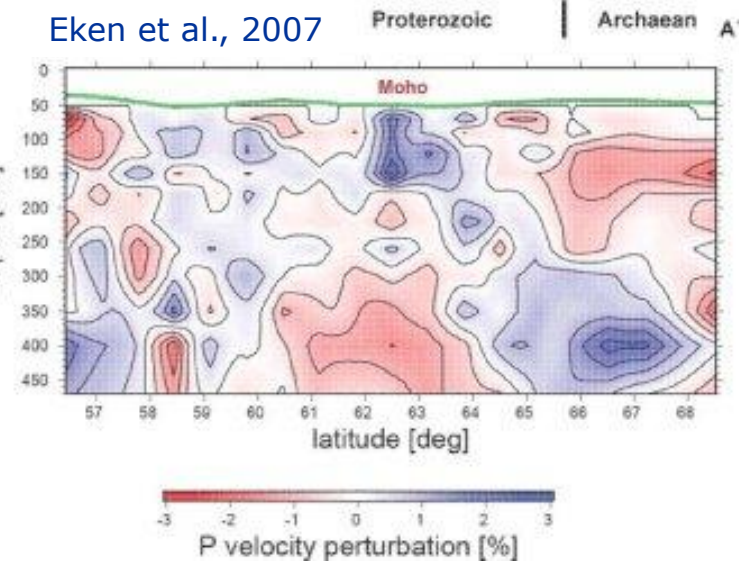
What do we know?



(b) 100 km, δS_v Pilidou et al., 2005



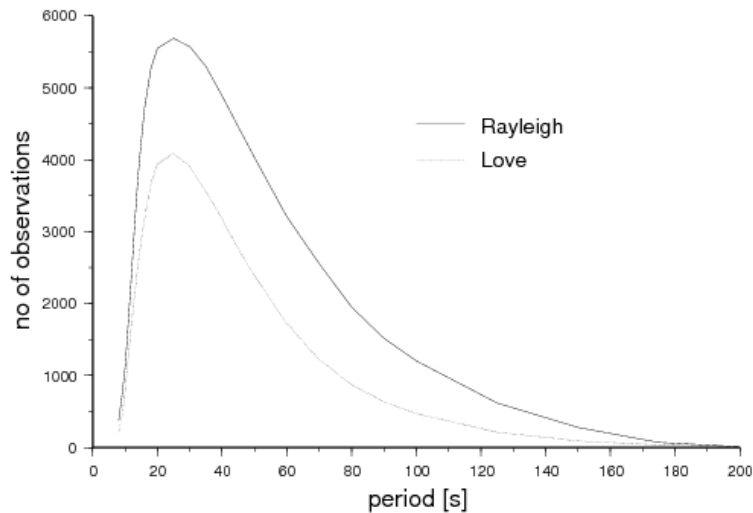
Eken et al., 2007



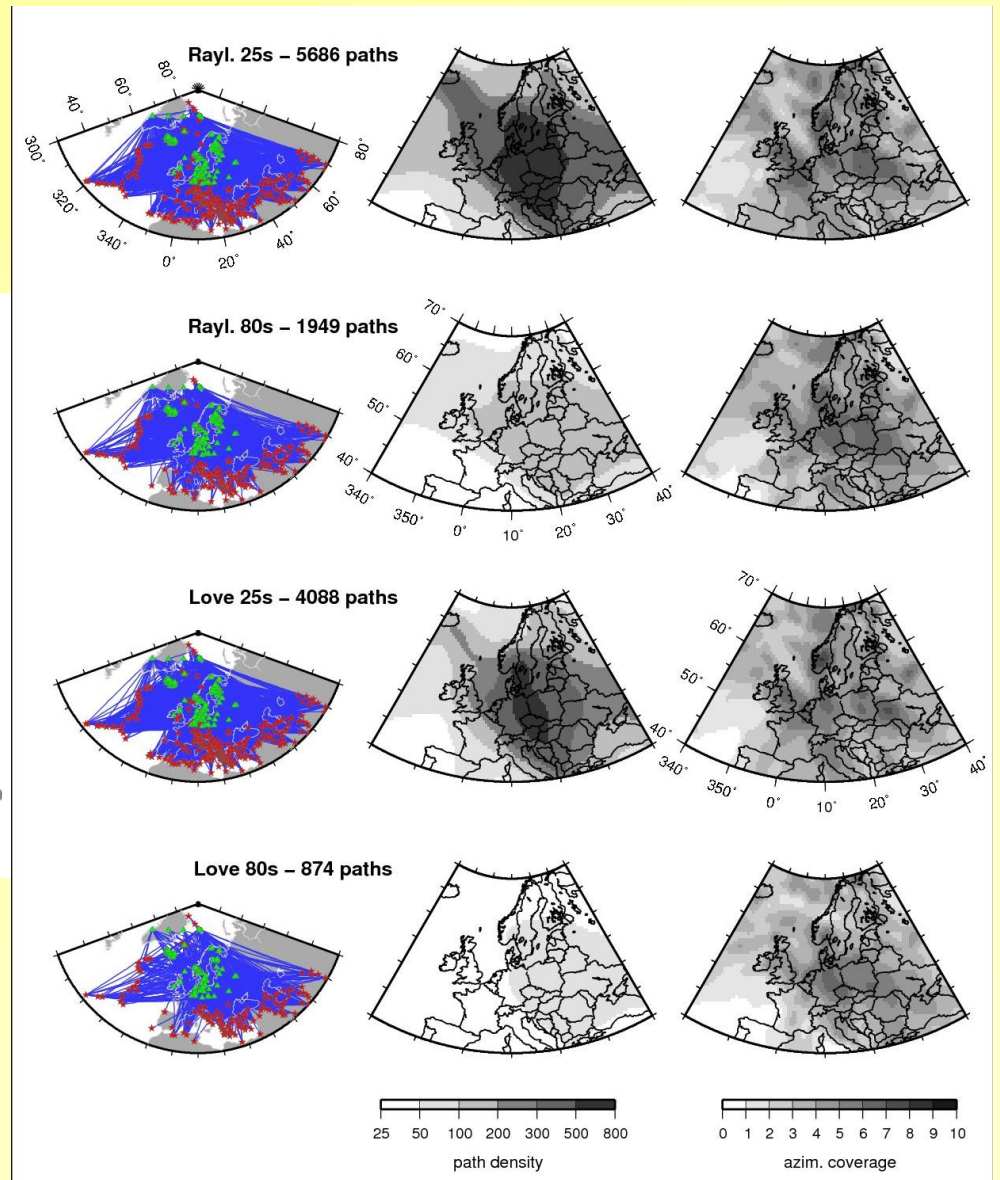
Goes et al., 2000

Data statistics

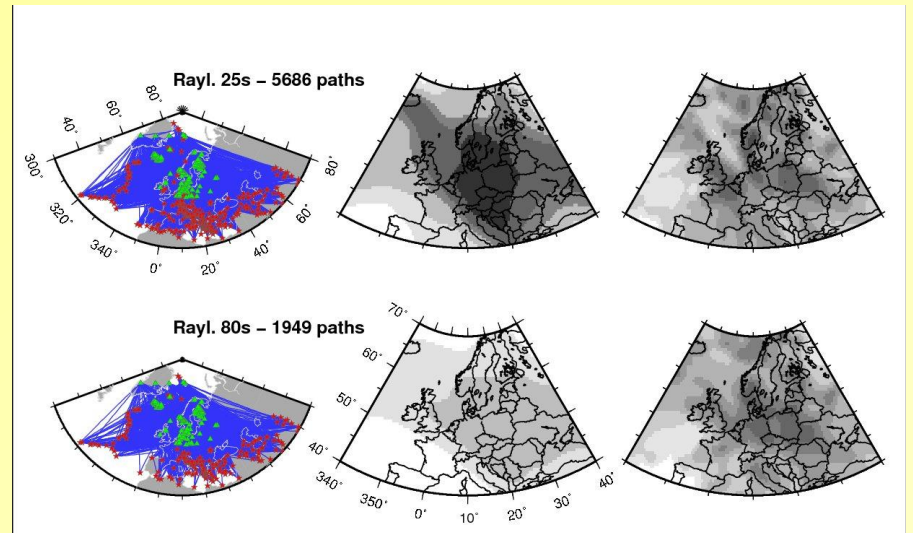
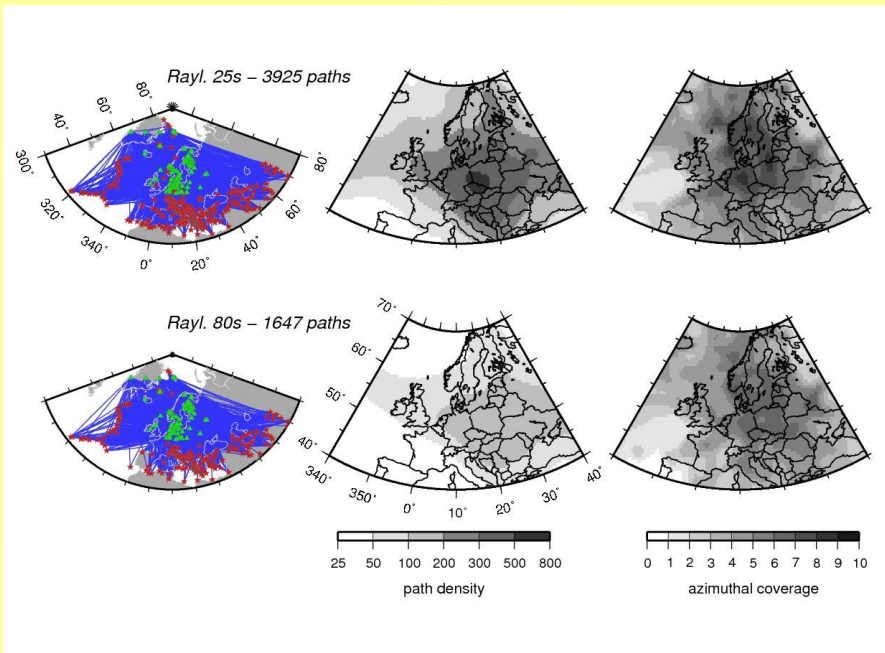
- group velocity measurements (FTAN)
- Love and Rayleigh waves
- periods 14s to 200s



- dominant periods around 30s
- intermediate size of earthquakes
- for inversion 16s to 150s
- 2-D inversion code by Barmin et al. (2000)



Data statistics



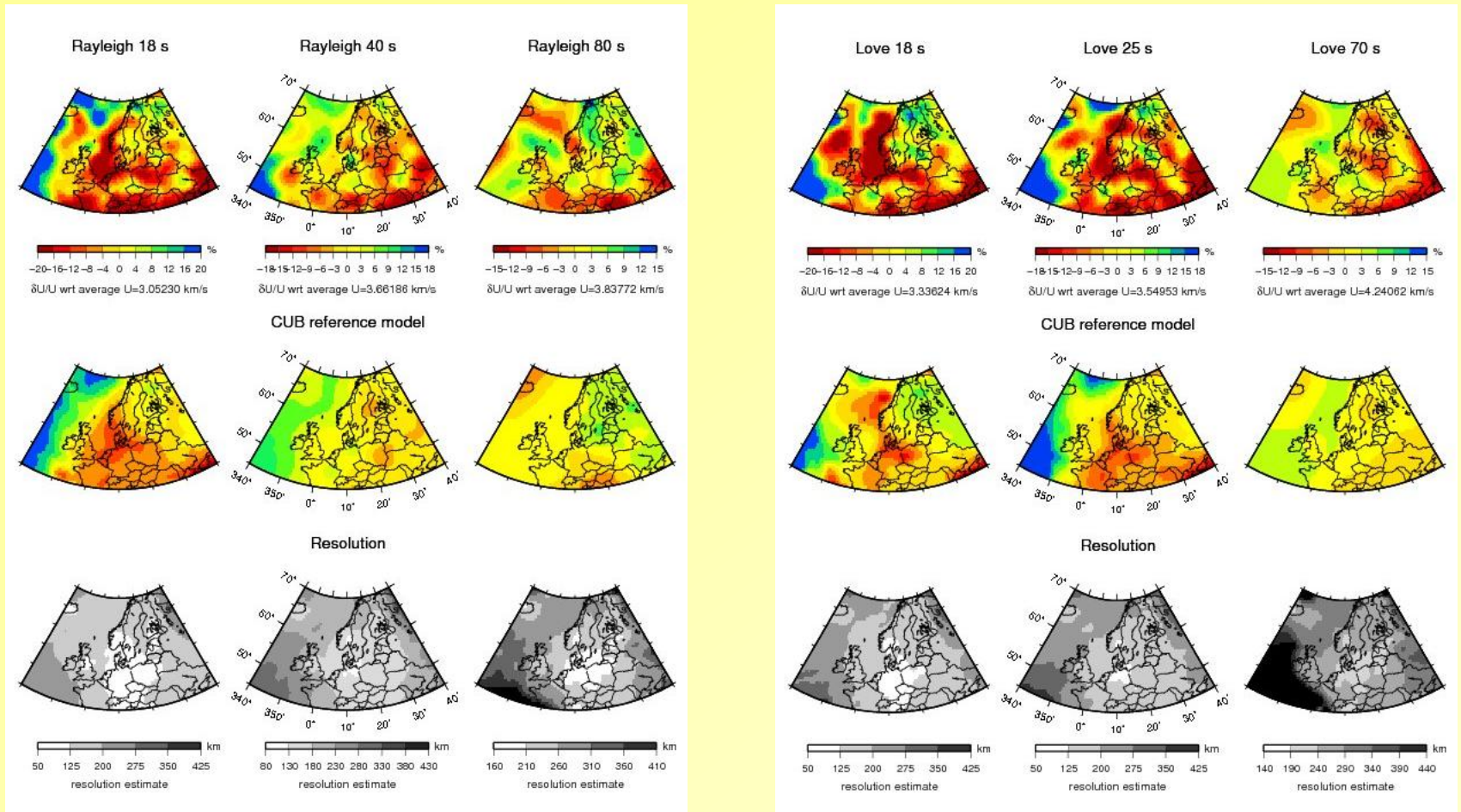
Full dataset

HOTSPOT and NORSAR recordings removed

- decrease in number of data
- increase in azimuthal coverage

→ geometries in group velocity maps persist

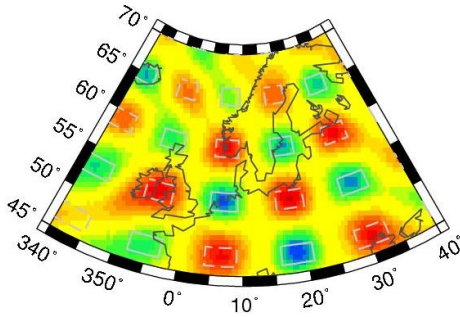
Group velocity tomography



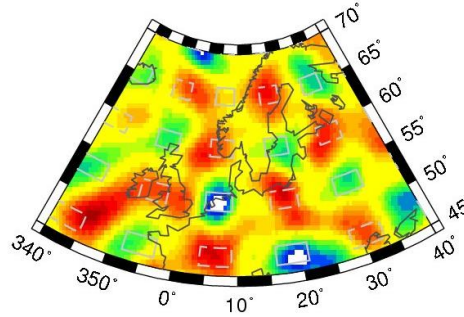
- 2-D reference model CUB
- inversion on 1x1 deg grid
- lateral resolution < 300km even at 80s
- strong enhancement in details and amplitudes

Group velocity tomography

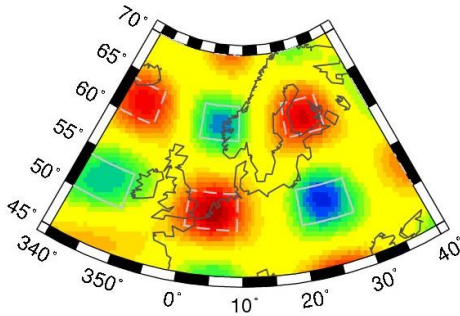
25s period, 6x3 checkerboard



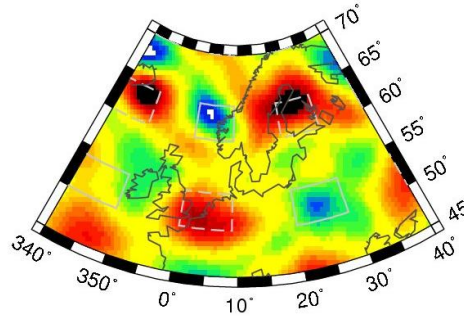
25s period, noise $\sigma=0.05$ km/s



80s period, 10x5 checkerboard



80s period, noise $\sigma=0.05$ km/s



Synthetic reconstruction tests:

- without noise, reconstruction is convenient
- with added noise lateral smearing and change in geometries is observed, however smeared amplitudes are significantly smaller than structural ampl.

1-D linear inversion – reference models

Inversion of 2-D g.v. maps for S-wave velocity

- point-by-point 1-D inversions
- approach Maupin & Cara (1992) modified for group velocities
- correlation length 20 km in all `layers`, uncoupled across interfaces
- interfaces fixed

Reference models:

1-D model PREM → insufficient due to tectonic variety

3-D crust & 1-D mantle (ak135):

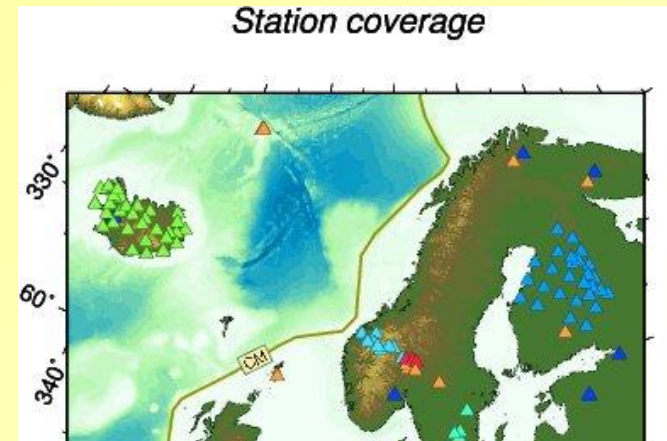
a) CRUST2.0 → oceanic regions interpolated

b) EUCRUST07 → incl. offshore models

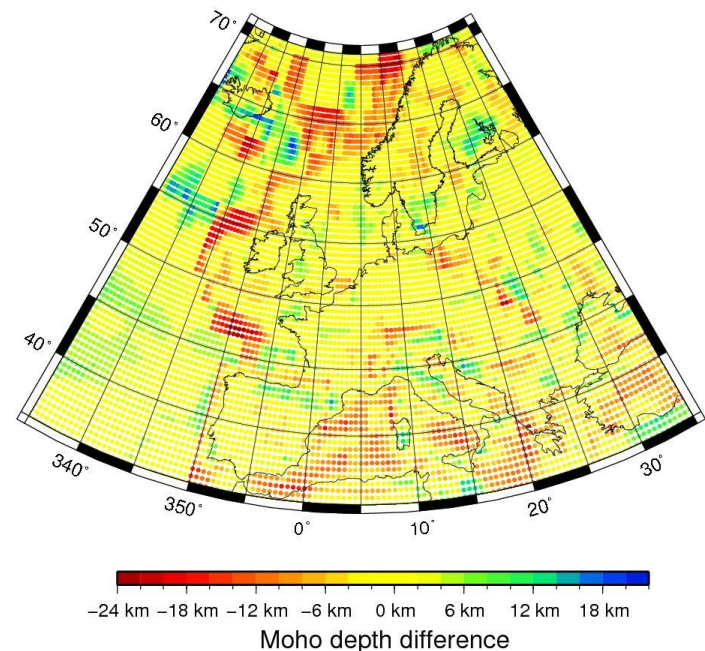
(standard conversions where necessary)

3-D model: CUB20 (Shapiro & Ritzwoller, 2002)

→ Invert on 1x1 deg (PREM & EUCRUST07)
and 2x2 deg (CRUST2.0 & CUB20) grids

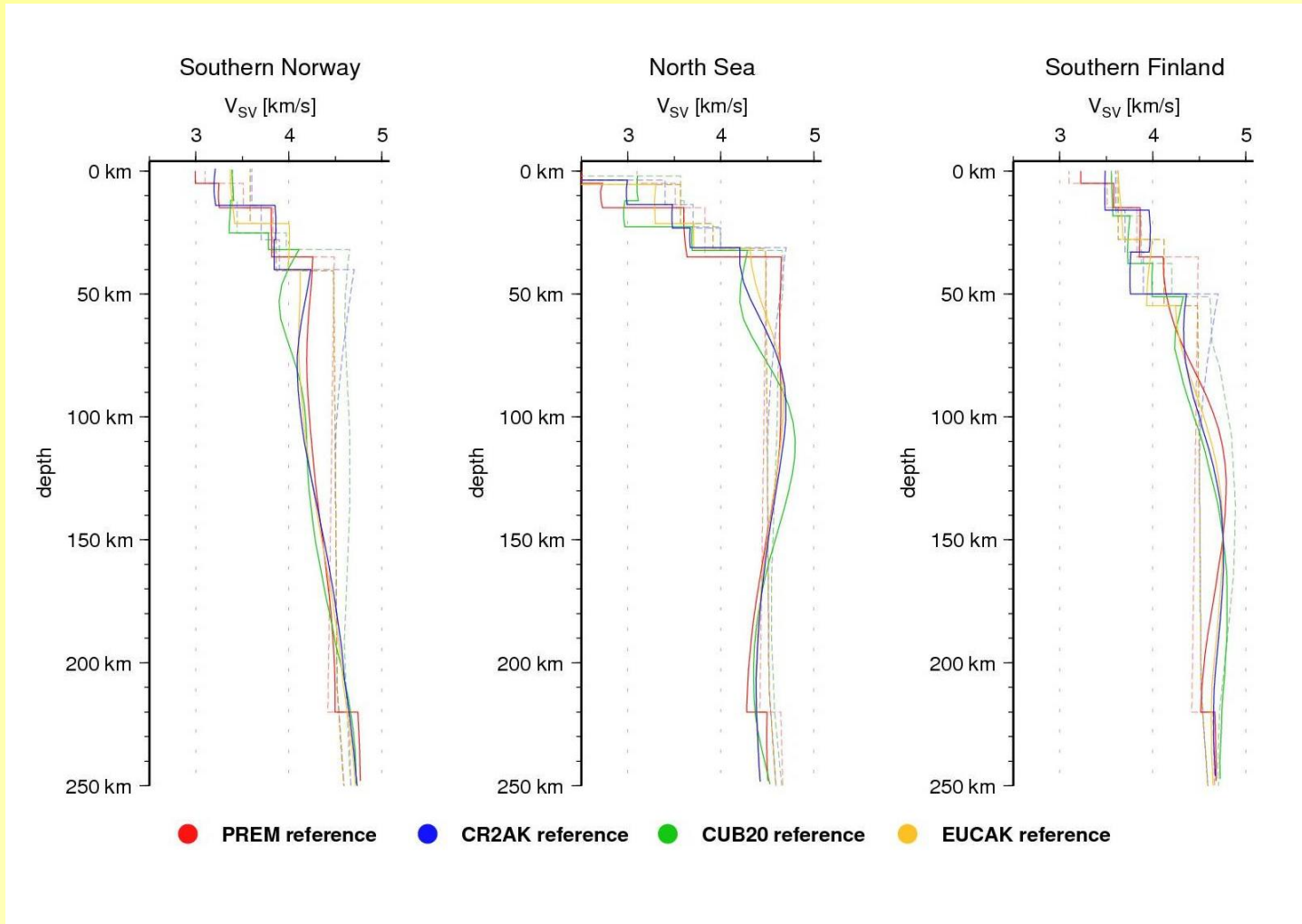


EUCrust07 [0.5deg] – CRUST2.0

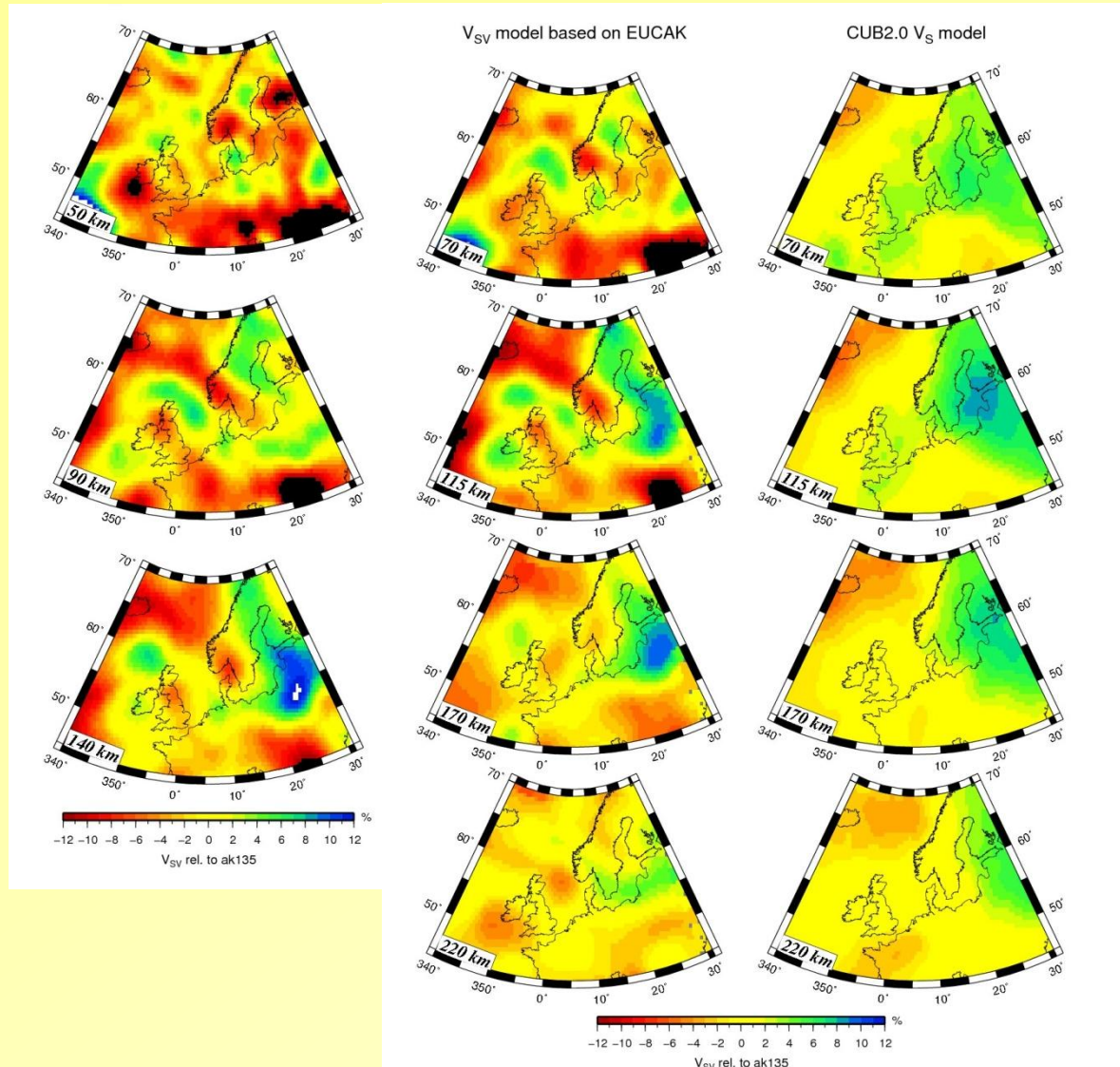


1-D linear anisotropic inversion

- Group vel. in the mantle most sensitive to V_{SV} and ξ
- V_P in the crust non-negligible but better constrained through ref.models

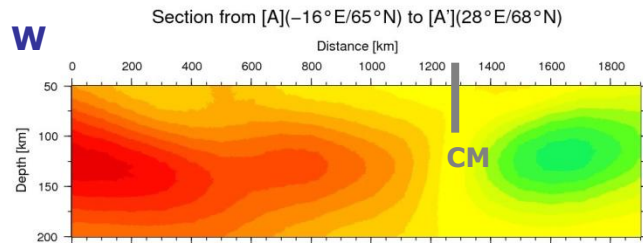
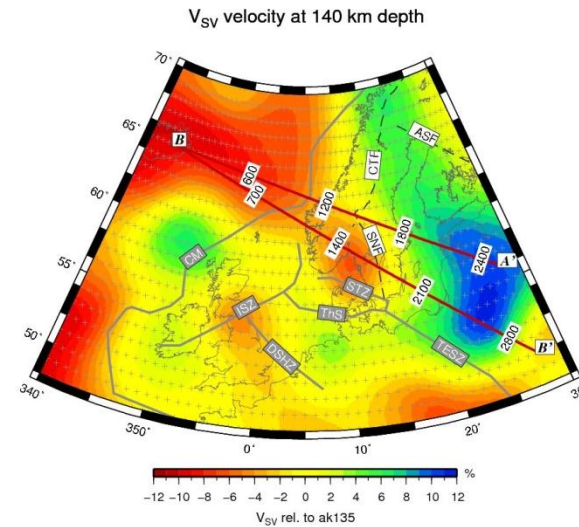
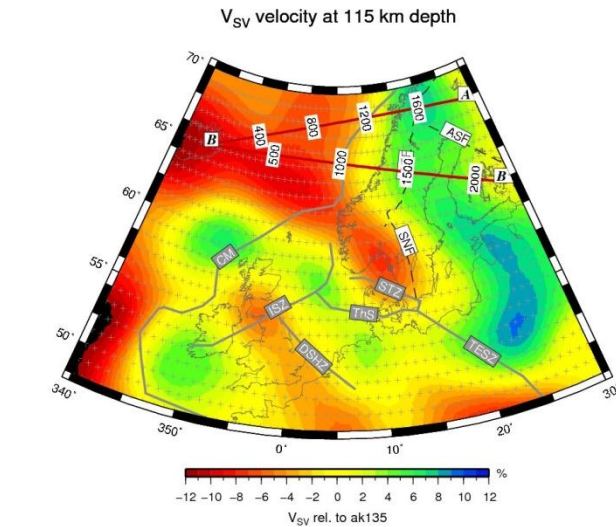


3-D model for Northern Europe

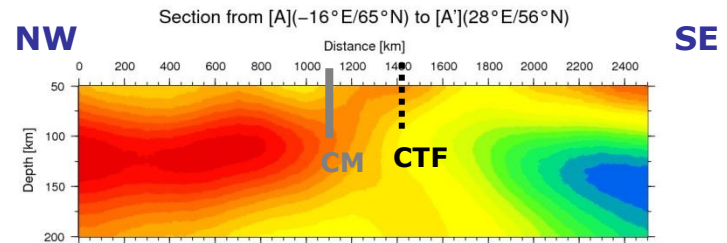


3-D model for Northern Europe

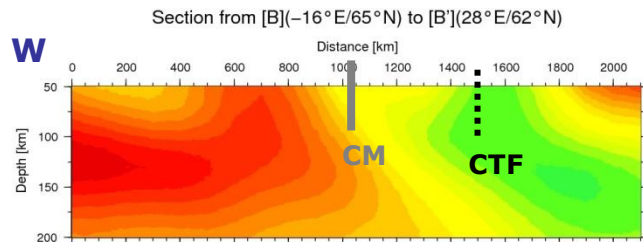
Radial profiles from Iceland



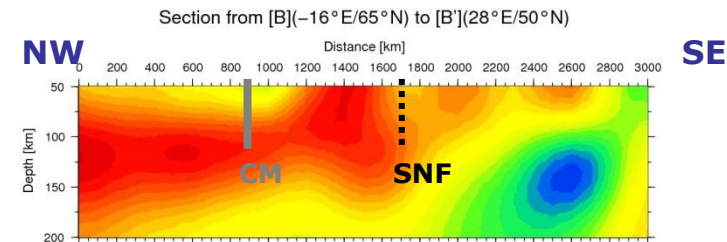
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SE



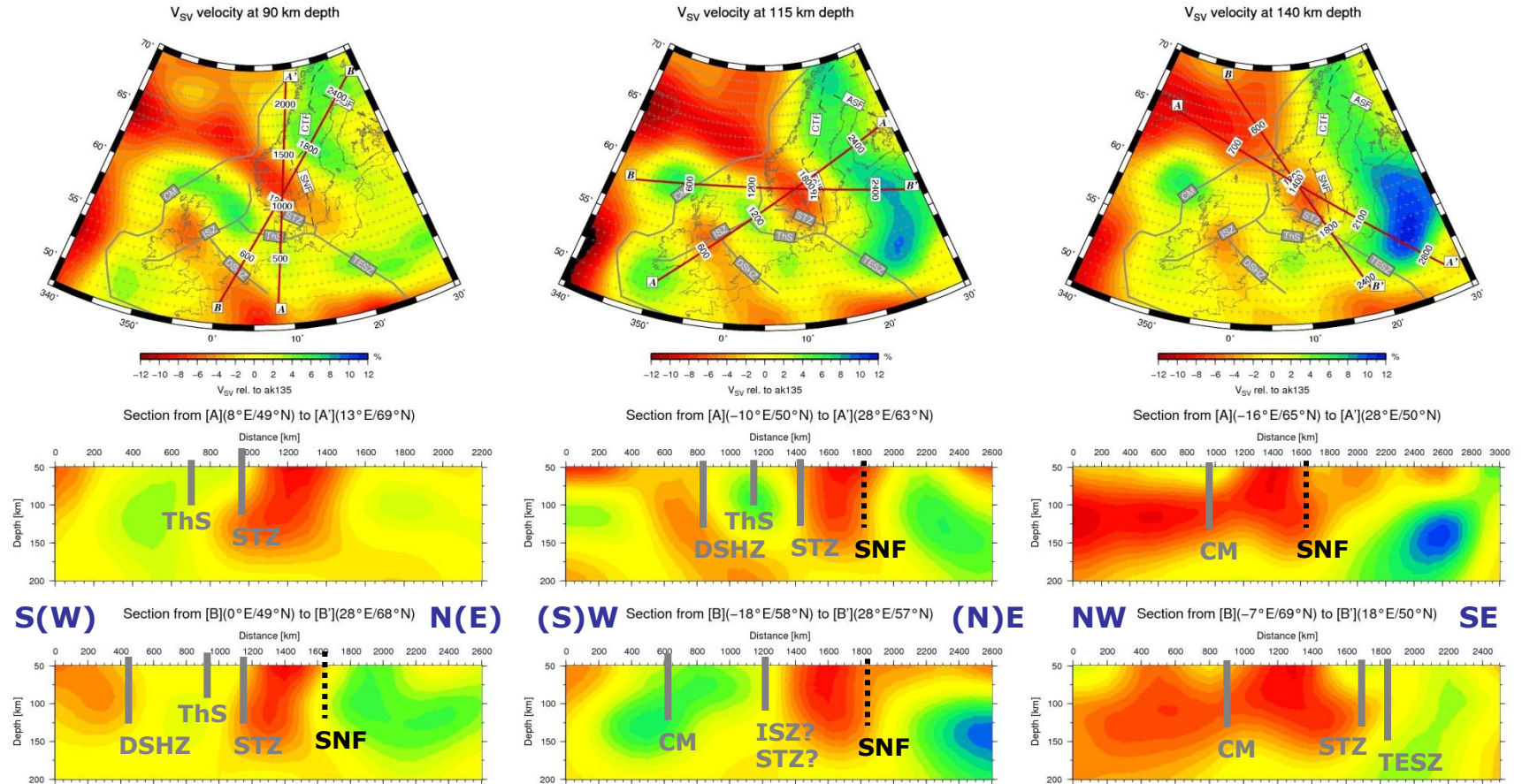
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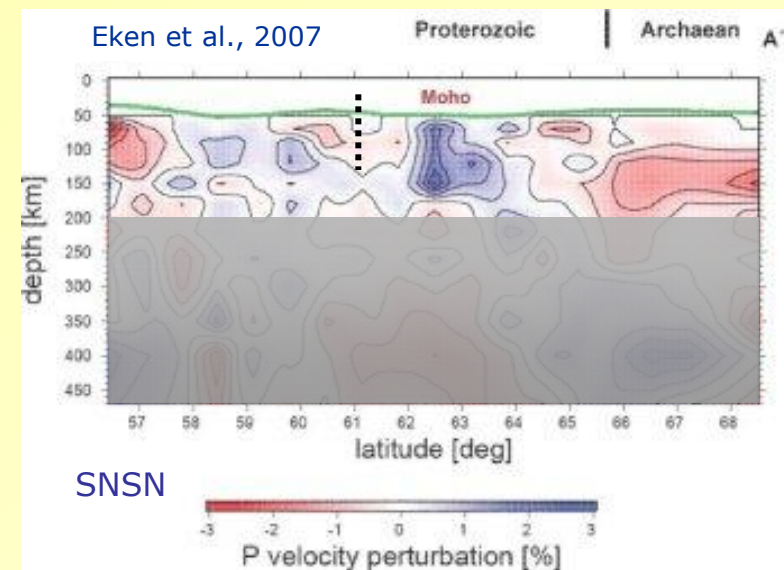
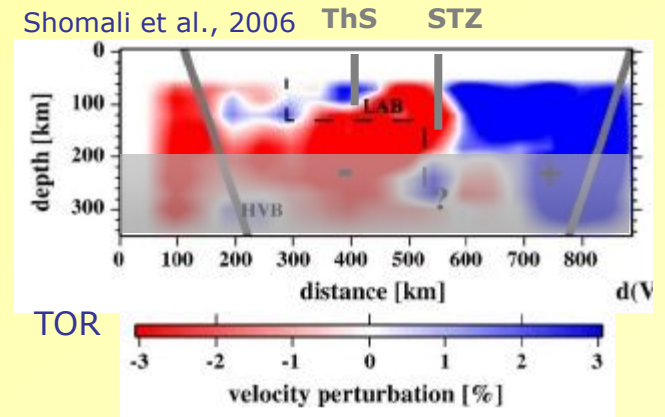
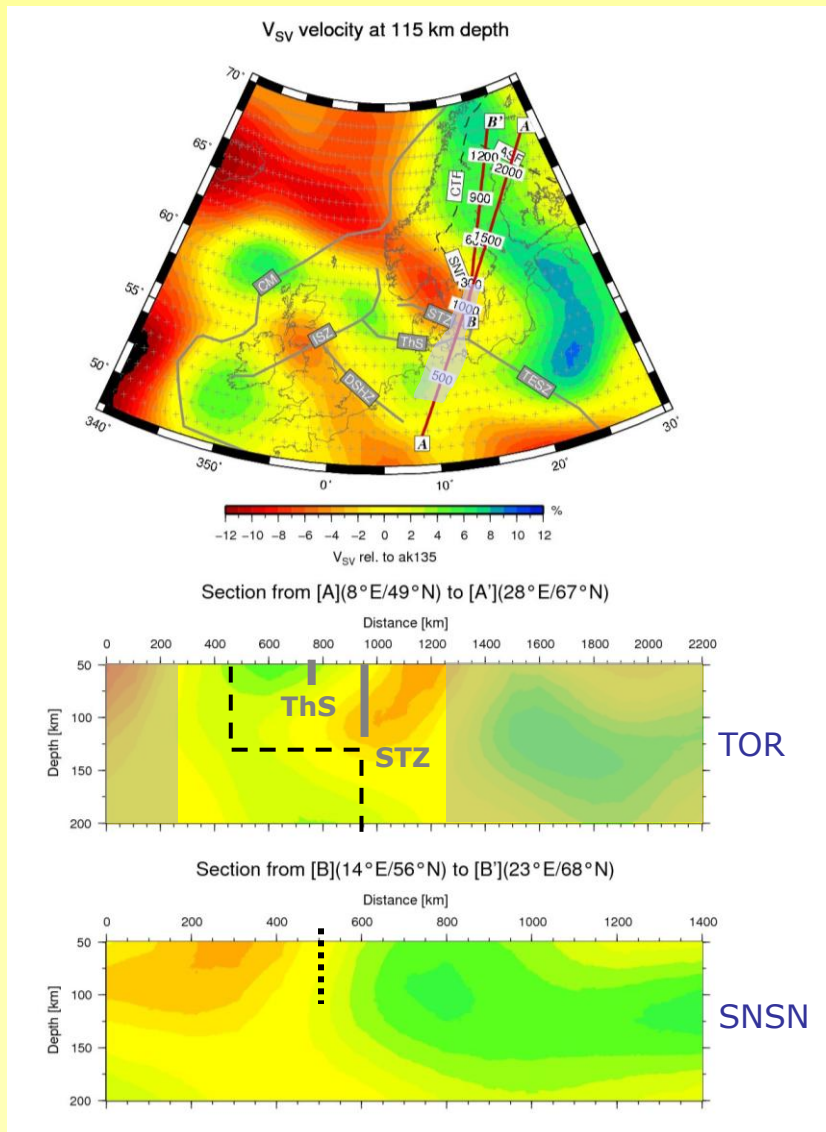
3-D model for Northern Europe

Radial profiles centered in Southern Norway



3-D model for Northern Europe

Comparison with TOR and SNSN tomographies



3-D model for Northern Europe

Safe points:

- stable model at depths > 70km
- good correlation to previous studies
- good geometrical fit to ancient plate boundaries
- CM in
- low-v

Careful

- 1x1d
- ampl
- linear
- uncer

Impact for TopoScandiaDeep:

- model is readily available → as reference and / or background for modelling
- S.Norway: major problem to be tackled is velocities between sub-Moho and ca. 70 km → in conjunction with absolute receiver functions ?
- model could be updated in the course of project to include MAGNUS data, updated crustal model, ...

