



The Abdus Salam
International Centre for Theoretical Physics



H4.SMR/1775-26

**"8th Workshop on Three-Dimensional Modelling of
Seismic Waves Generation, Propagation and their Inversion"**

25 September - 7 October 2006

PLATE DEFORMATION - 1

Roberto Sabadini

**Dipartimento di Scienze della Terra "A. Desio"
Università di Milano**

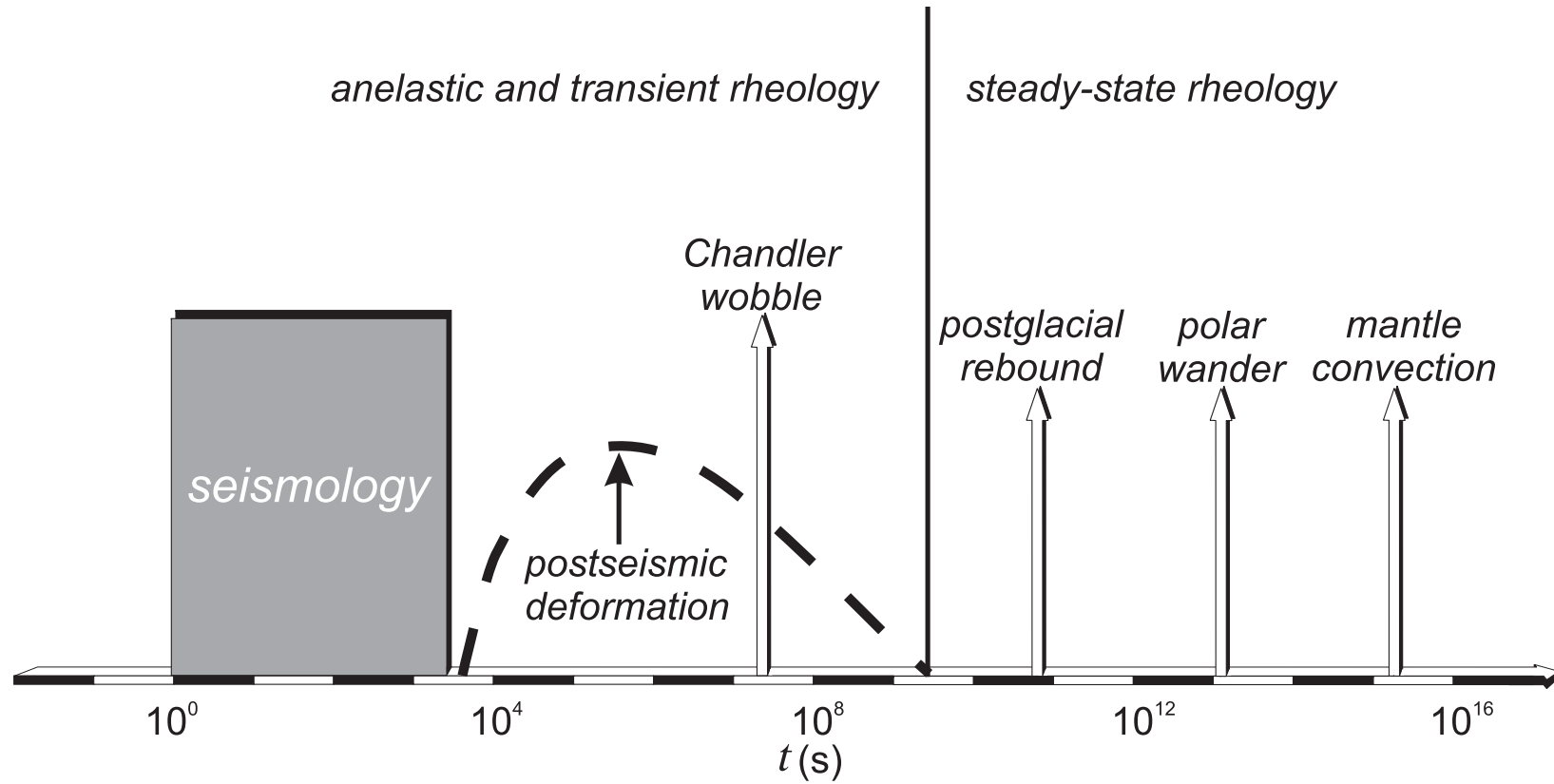


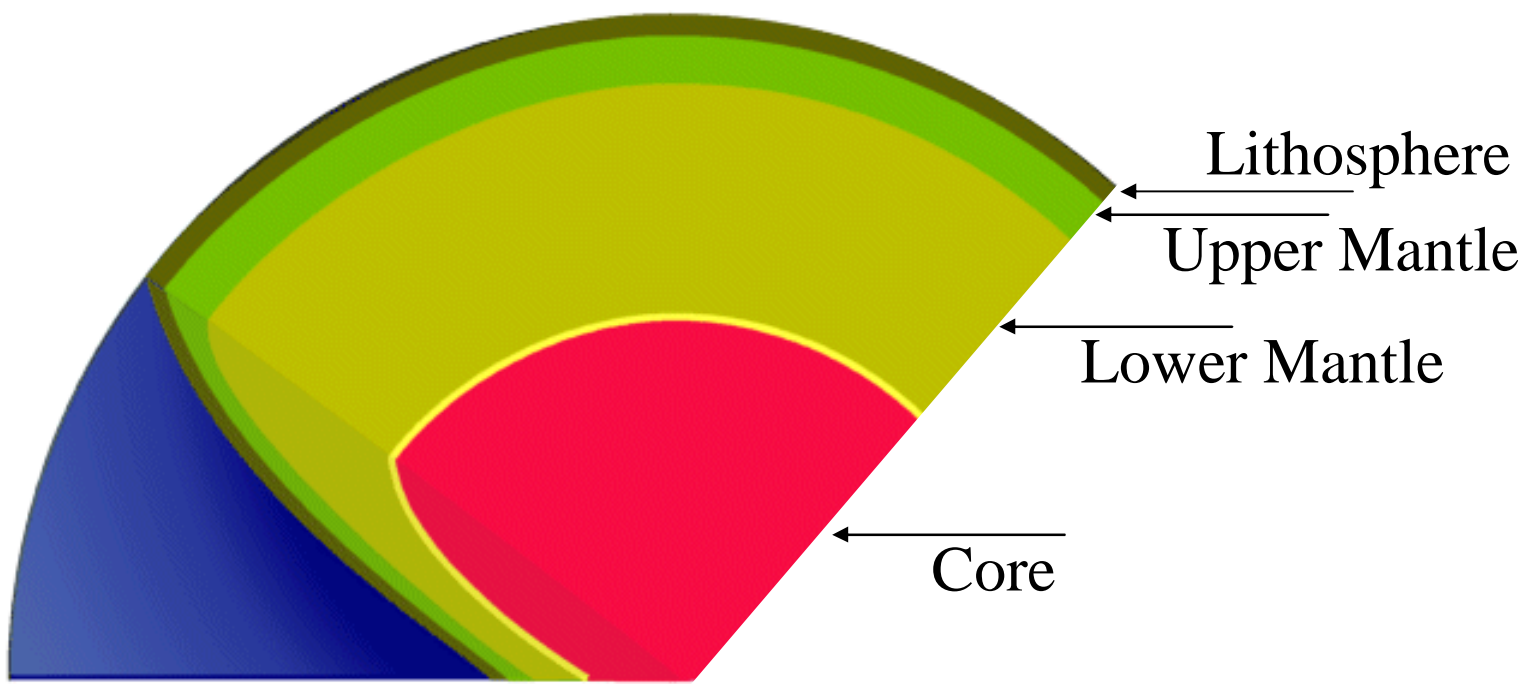
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$$\text{Maxwell time} = \nu_1 / \mu_1 \sim 0 (10^2 \text{ y})$$



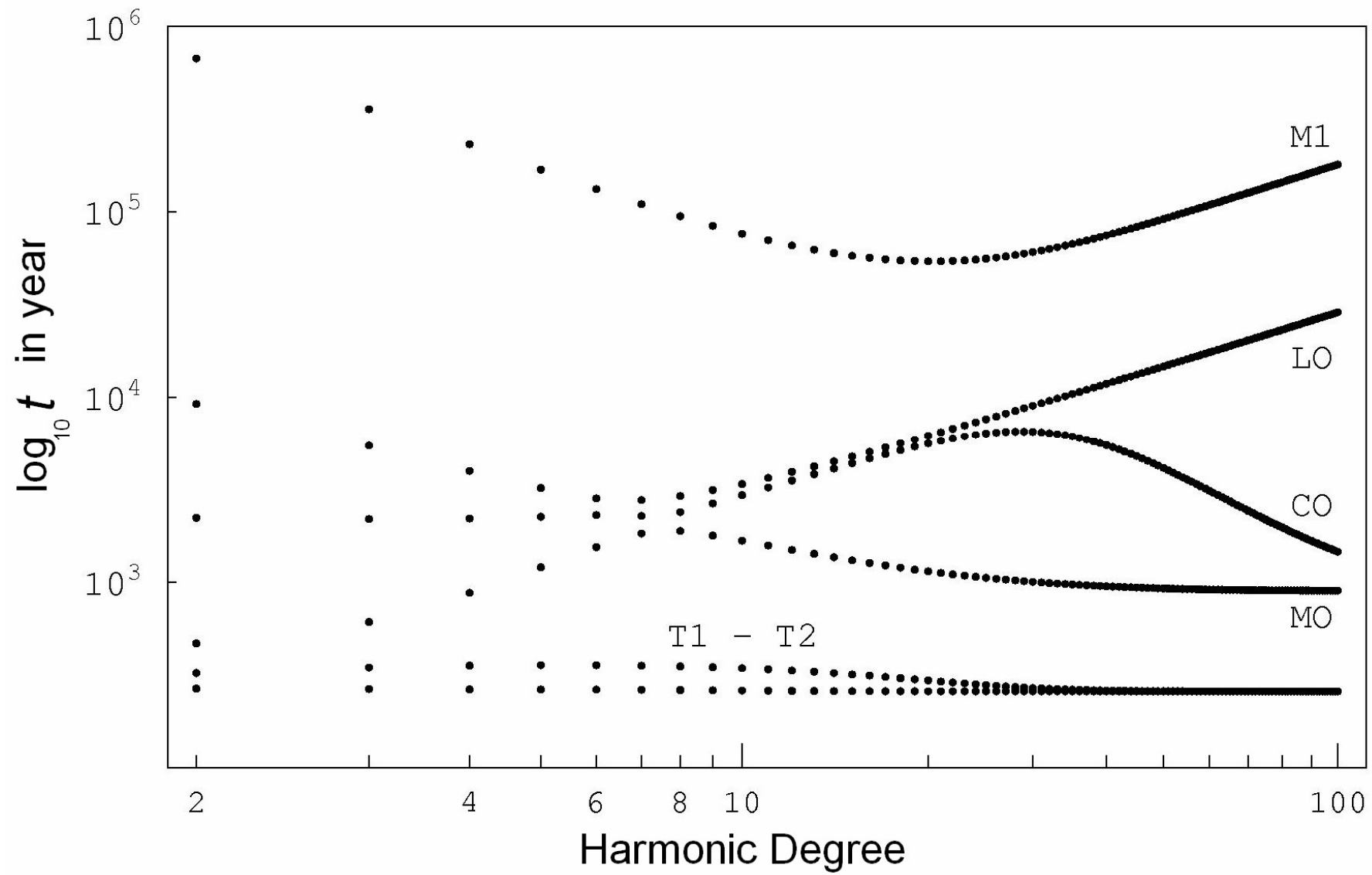


Lithosphere

Upper Mantle

Lower Mantle

Core





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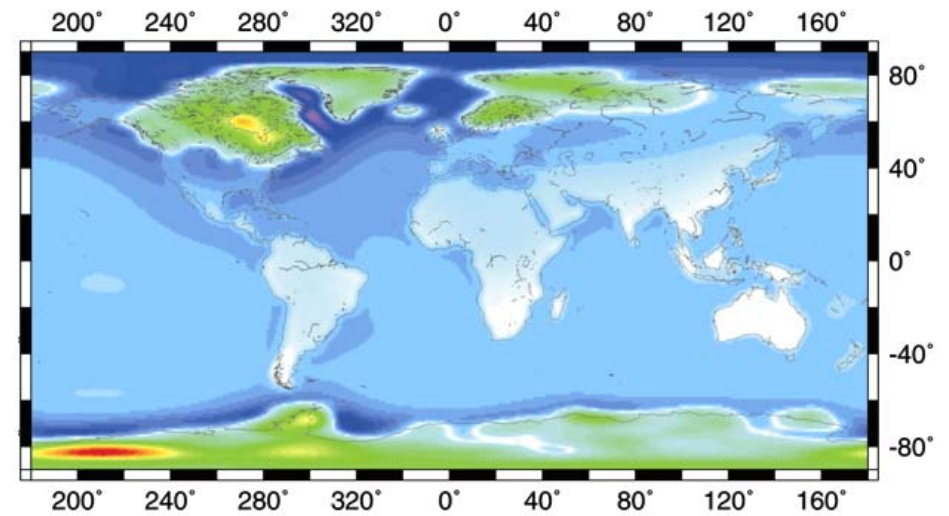
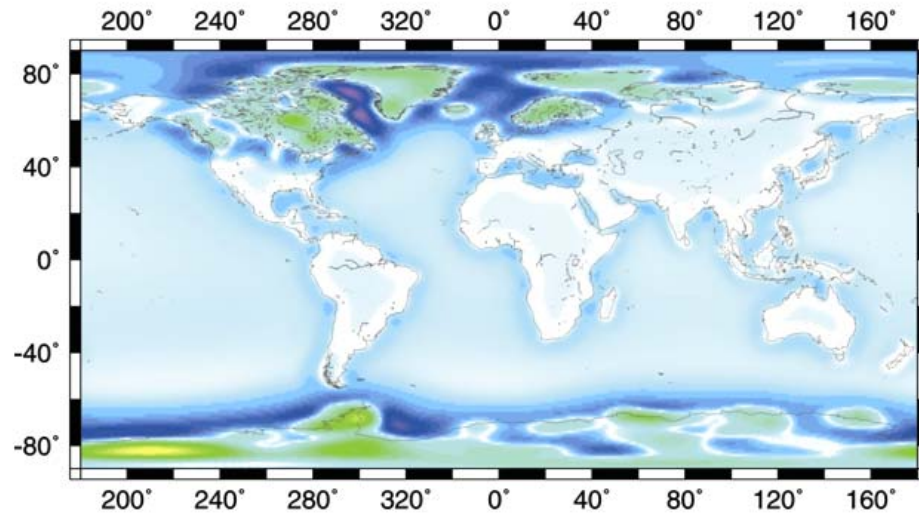
Lithosphere=80 Km

MOD 21

$$v_{UM}=0.5 \times 10^{21} \text{ Pa s} \quad v_{LM}=1.0 \times 10^{21} \text{ Pa s}$$

MOD 26

$$v_{UM}=0.5 \times 10^{21} \text{ Pa s} \quad v_{LM}=1.0 \times 10^{22} \text{ Pa s}$$



Radial velocity cm/yr



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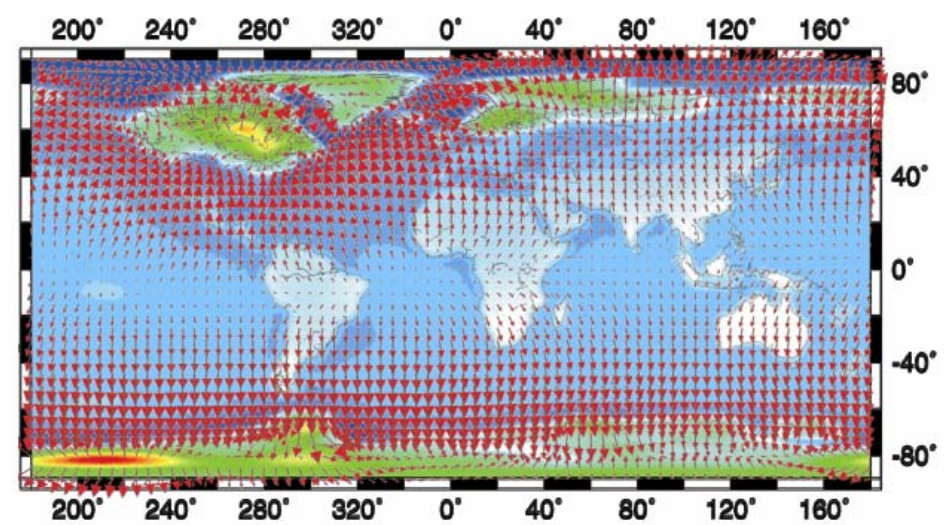
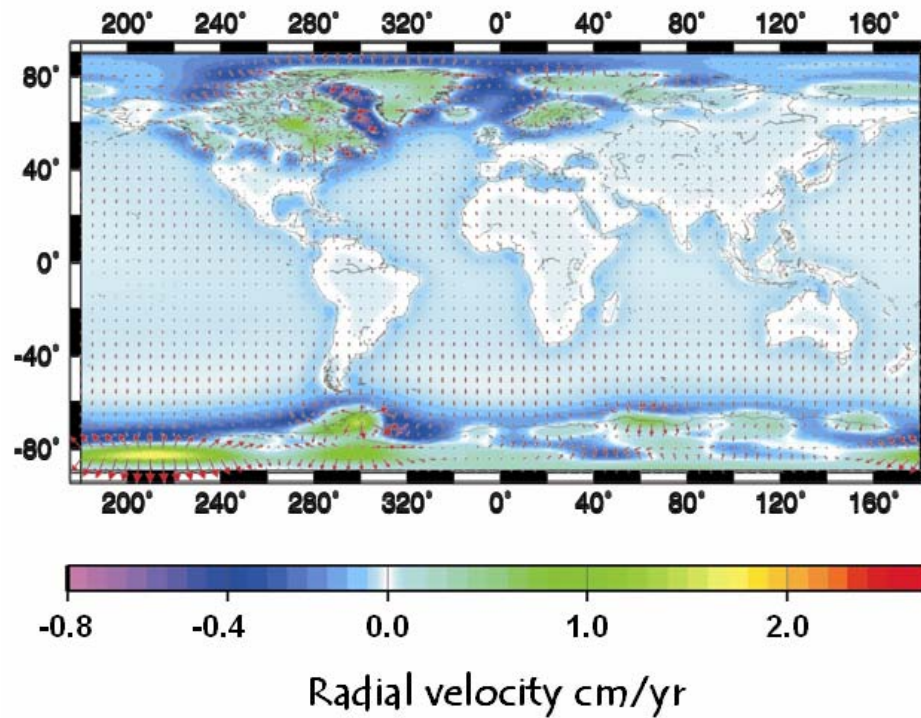
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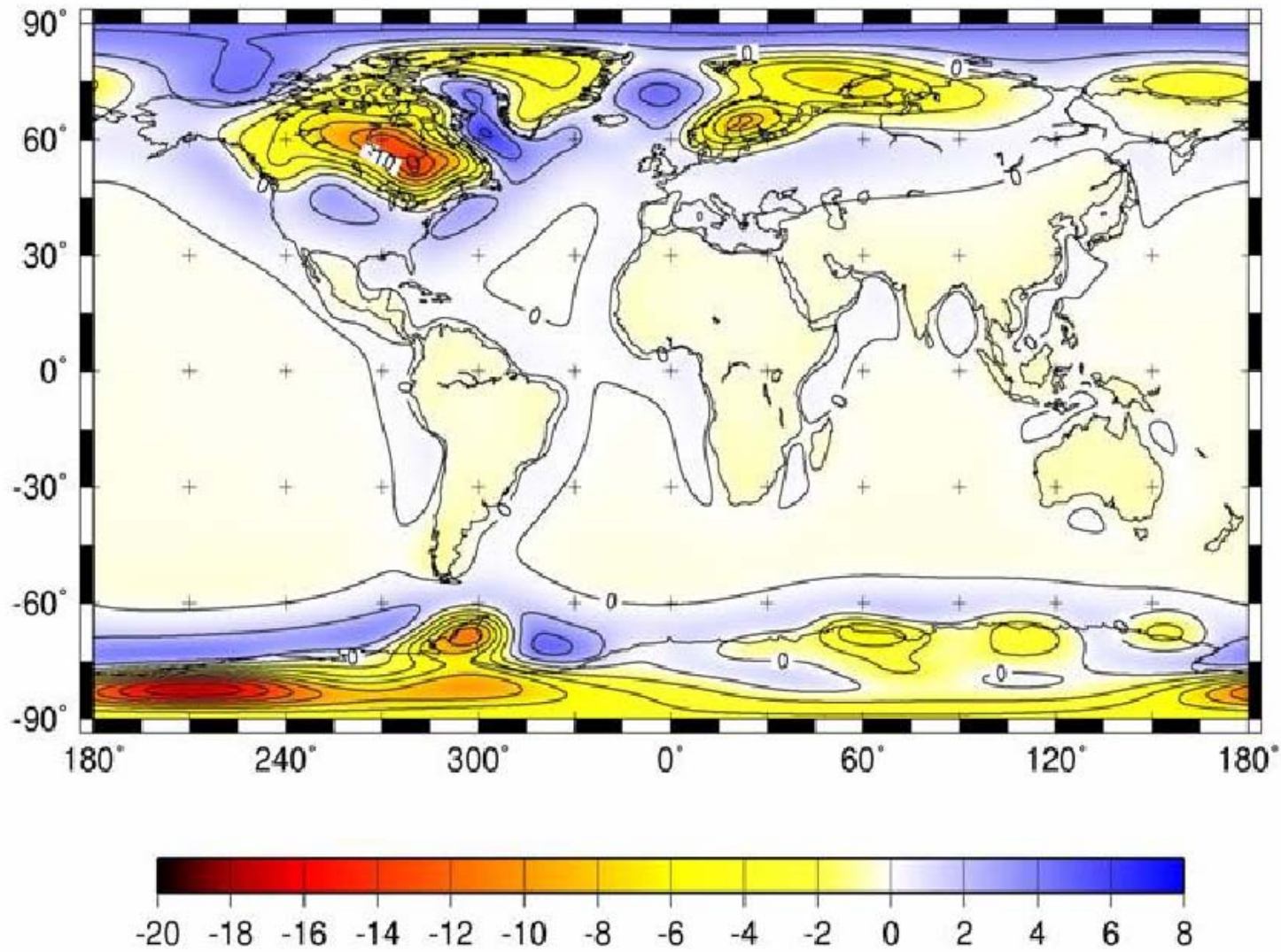
MOD 21

$$v_{UM} = 0.5 \times 10^{21} \text{ Pa s} \quad v_{LM} = 1.0 \times 10^{21} \text{ Pa s}$$

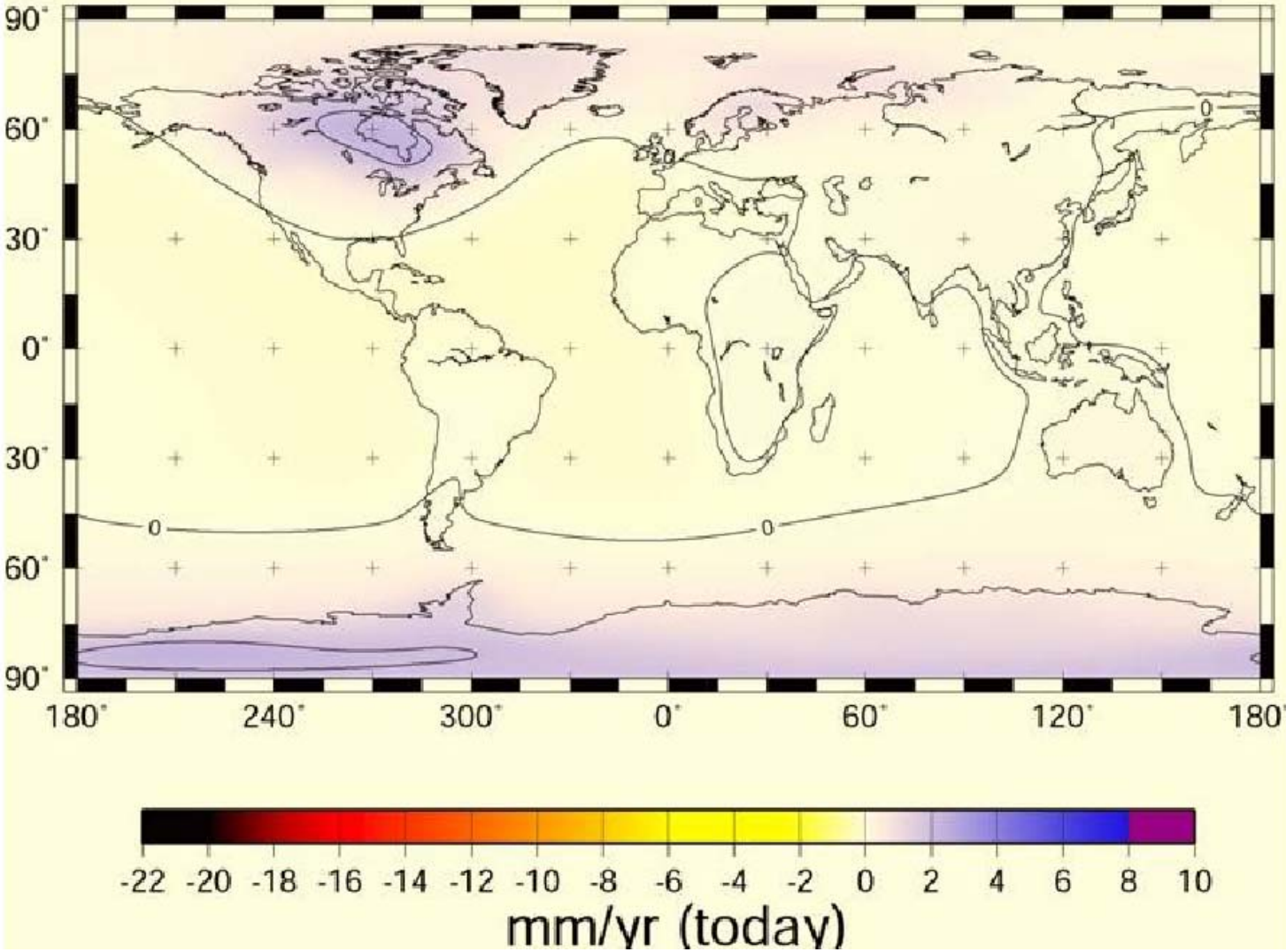
MOD 26

$$v_{UM} = 0.5 \times 10^{21} \text{ Pa s} \quad v_{LM} = 1.0 \times 10^{22} \text{ Pa s}$$

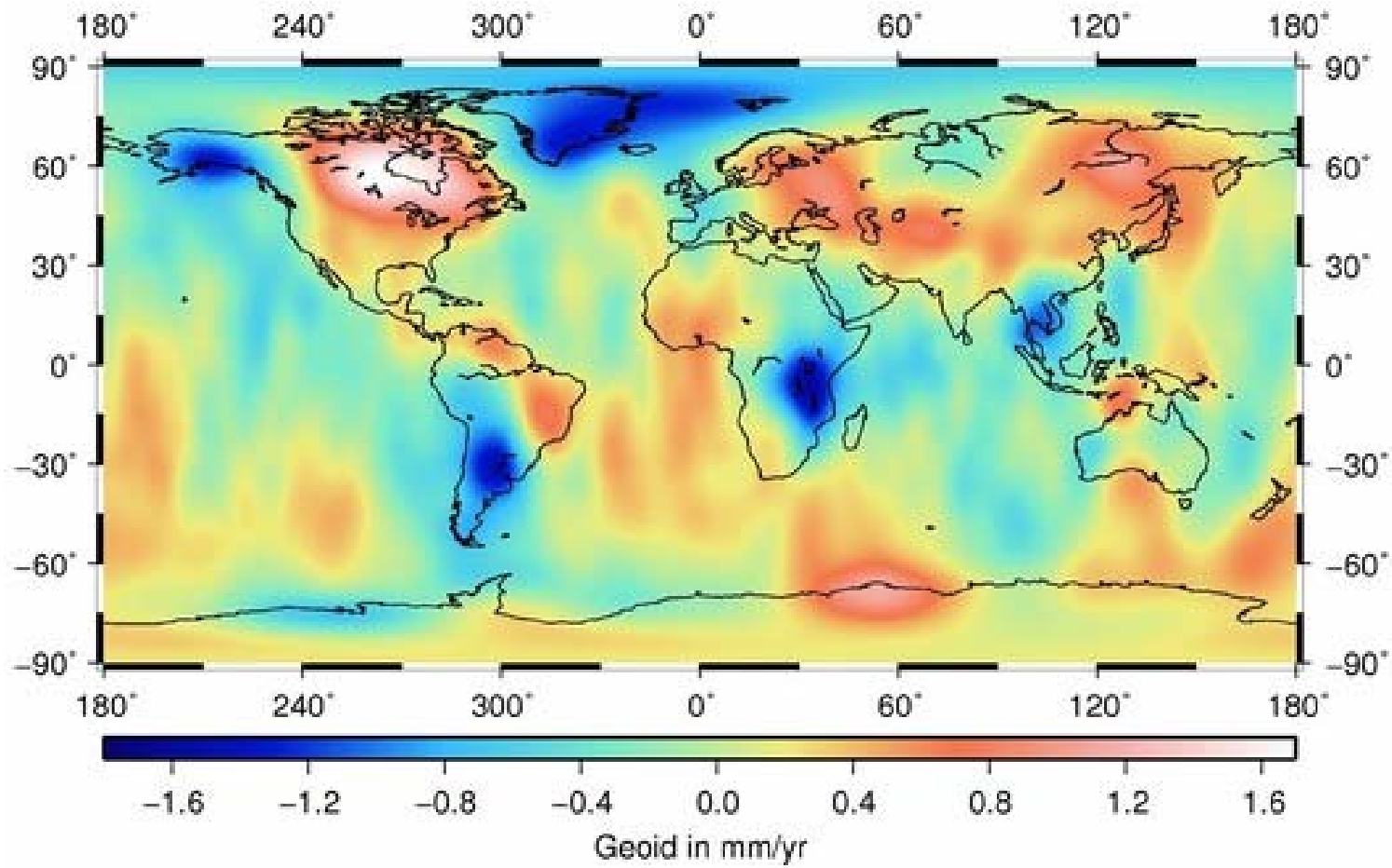




GDOT modelG4



Geoid changes from GRACE





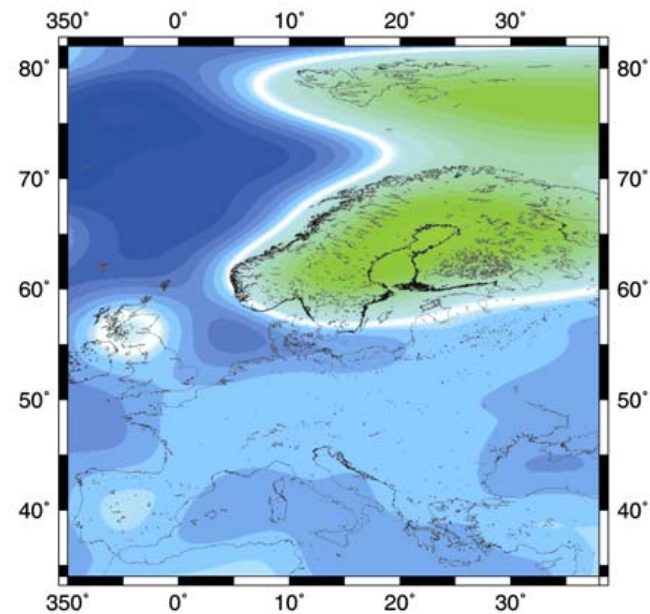
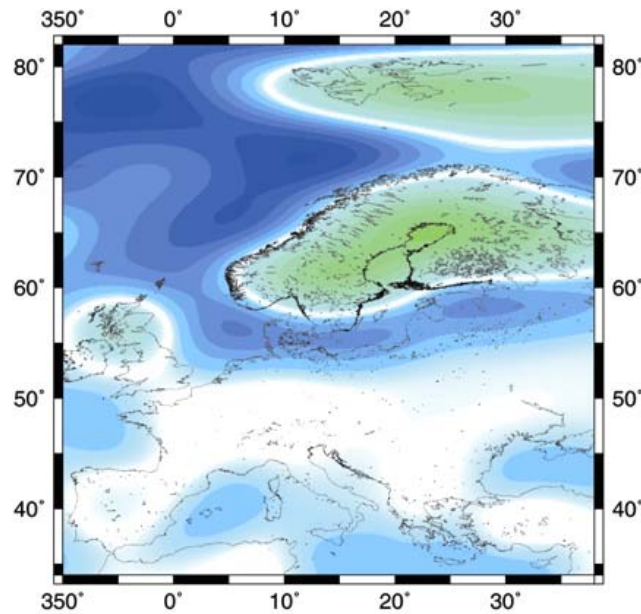
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-0.8 -0.4 0.0 1.0 2.0

Radial velocity cm/yr



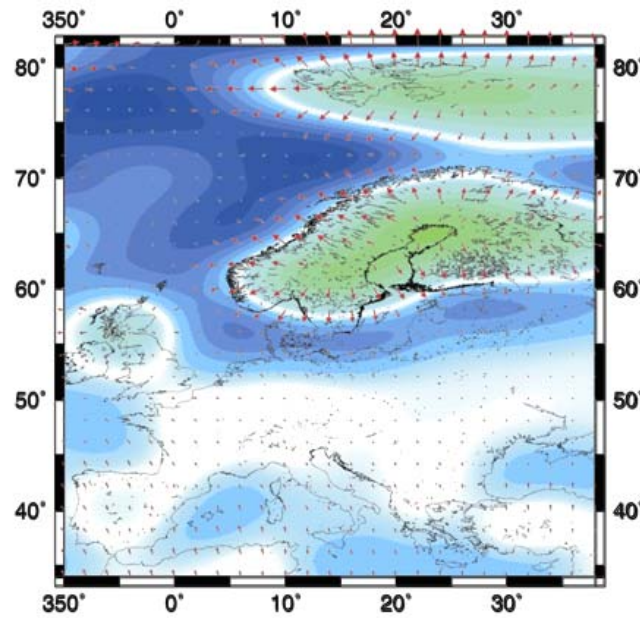
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Lithosphere=80 Km

MOD 21

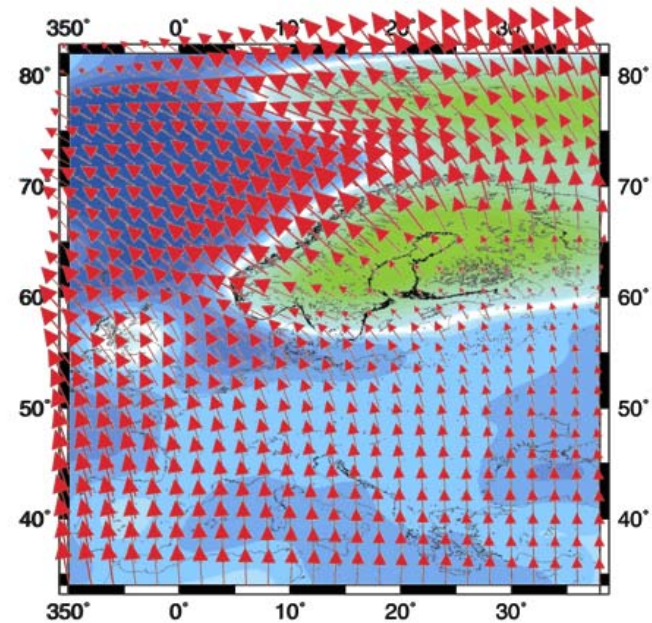
$$v_{UM}=0.5 \times 10^{21} \text{ Pa s} \quad v_{LM}=1.0 \times 10^{21} \text{ Pa s}$$



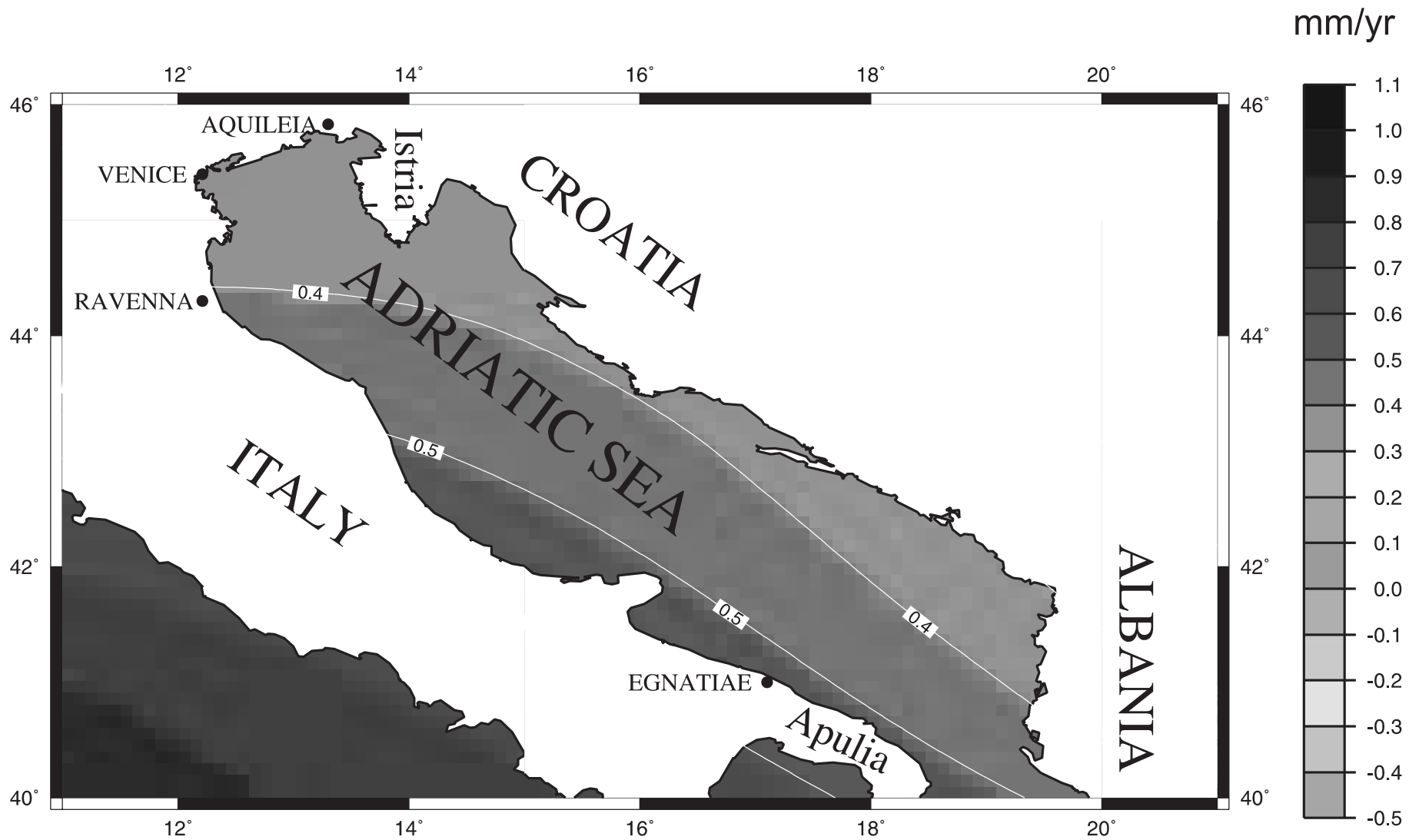
Radial velocity cm/yr

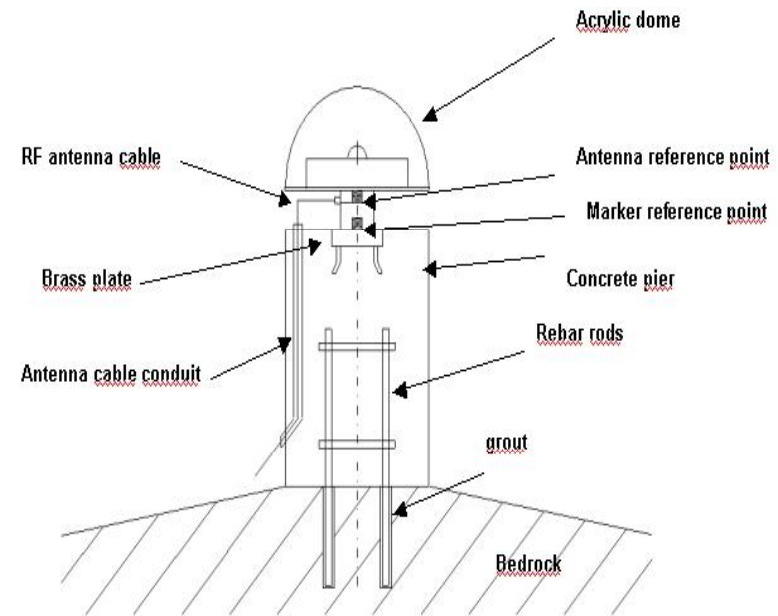
MOD 26

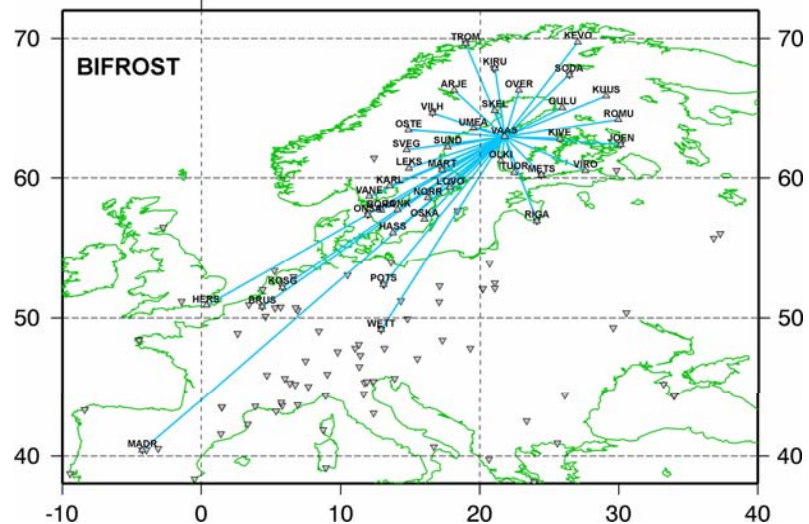
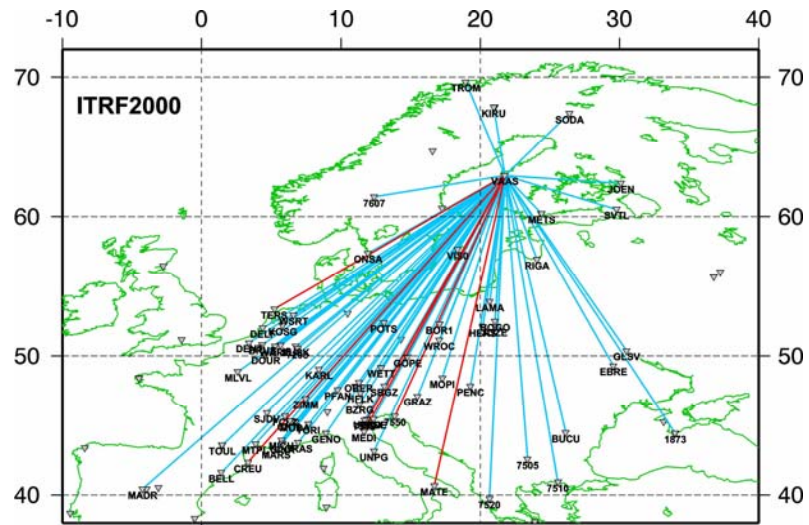
$$v_{UM}=0.5 \times 10^{21} \text{ Pa s} \quad v_{LM}=1.0 \times 10^{22} \text{ Pa s}$$

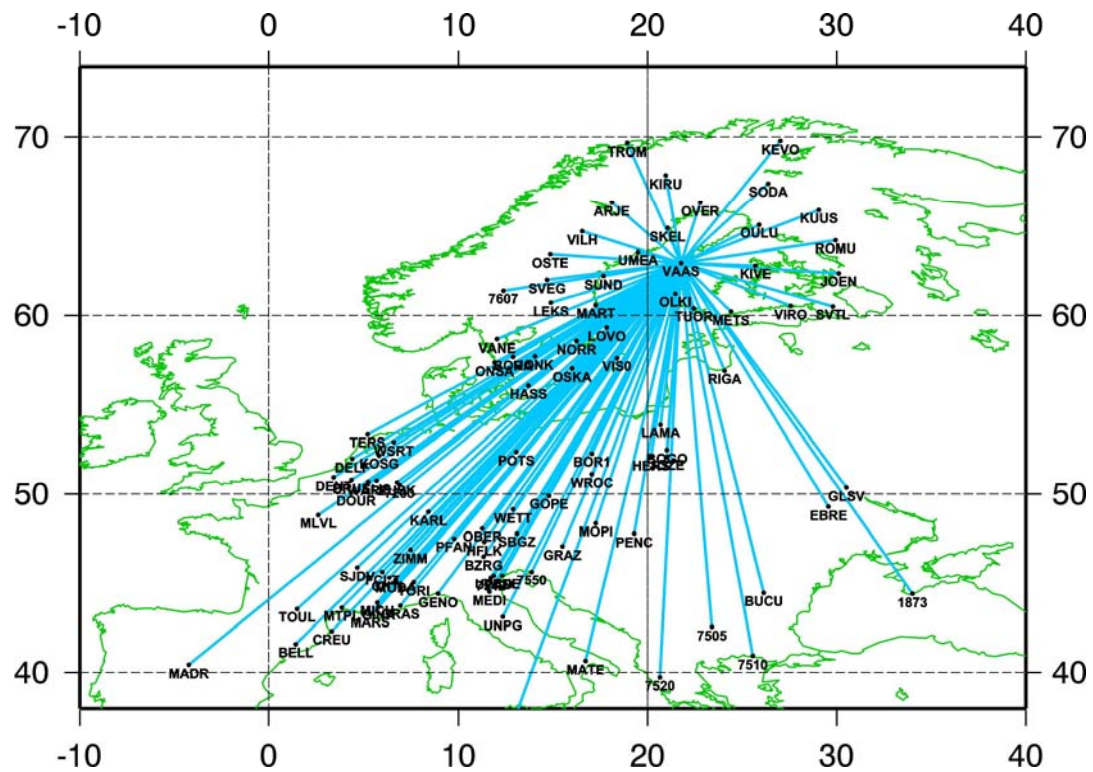


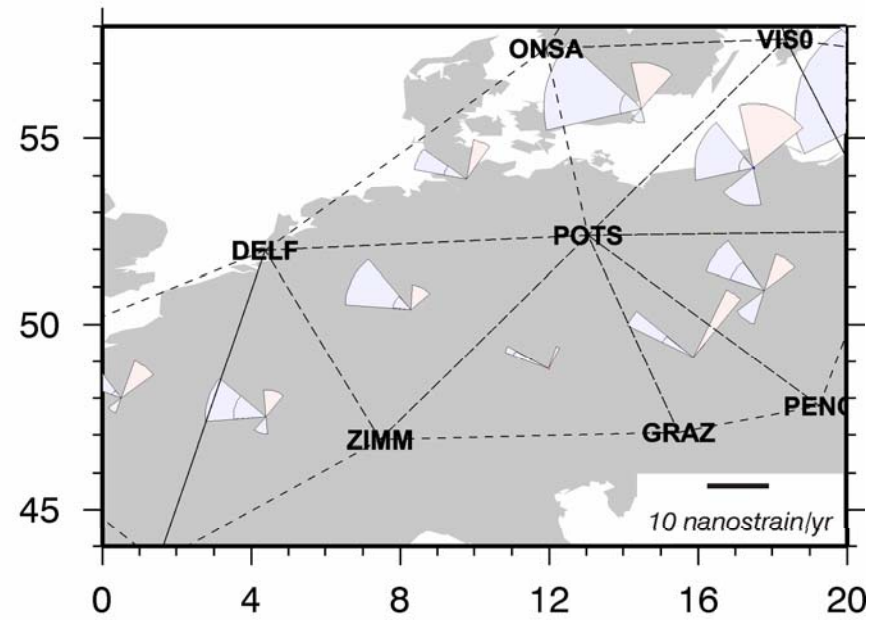
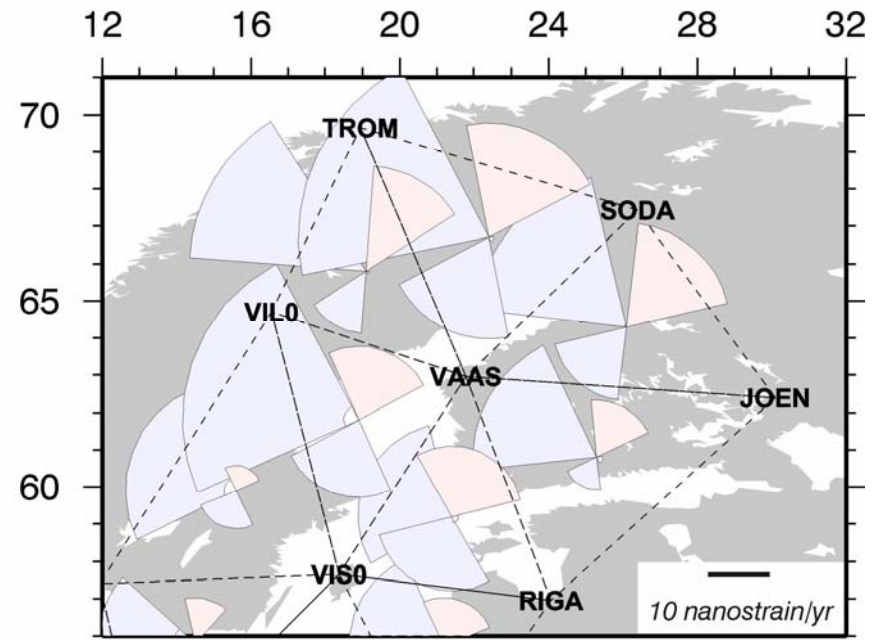
Tangential Velocity \rightarrow 0.3 cm/yr

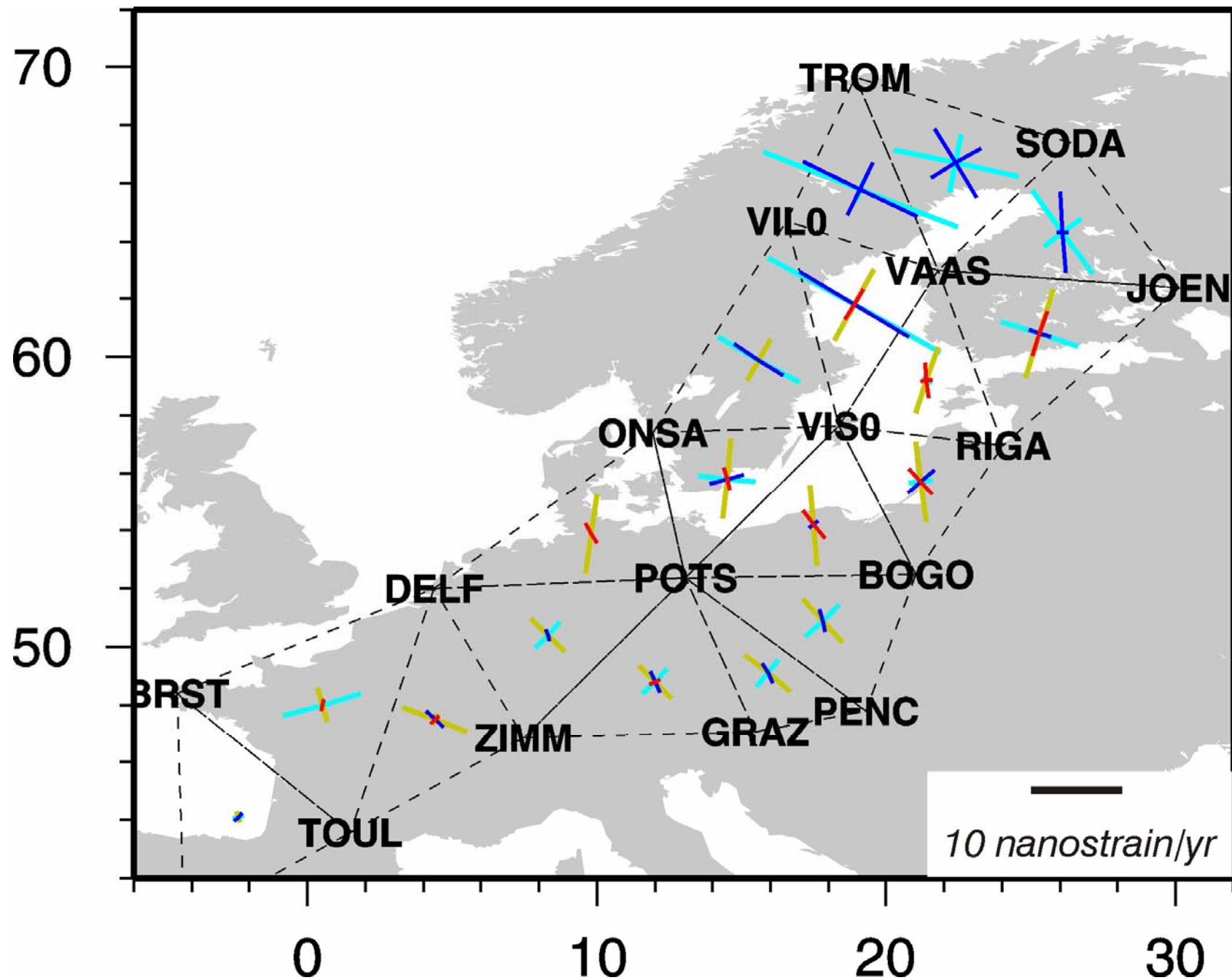




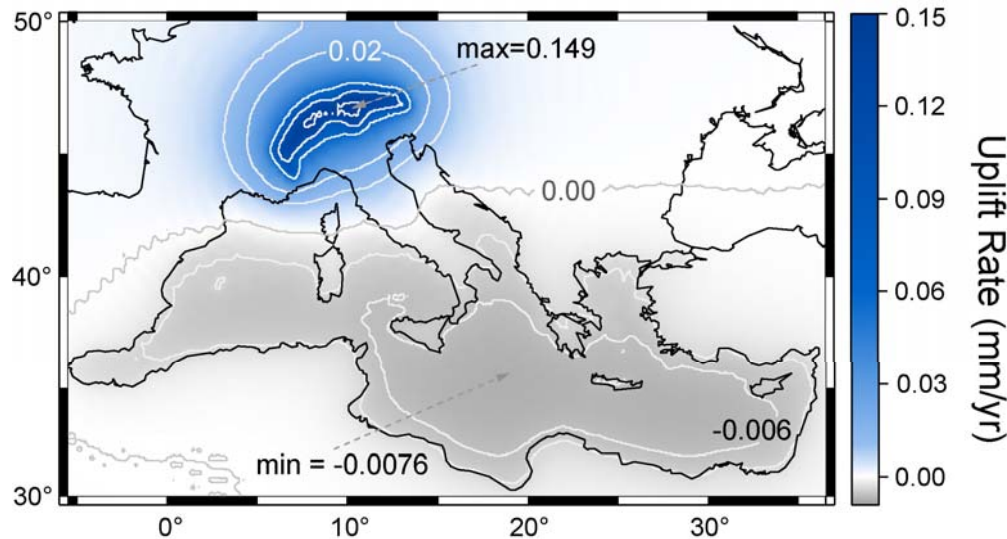








Low resolution Technique

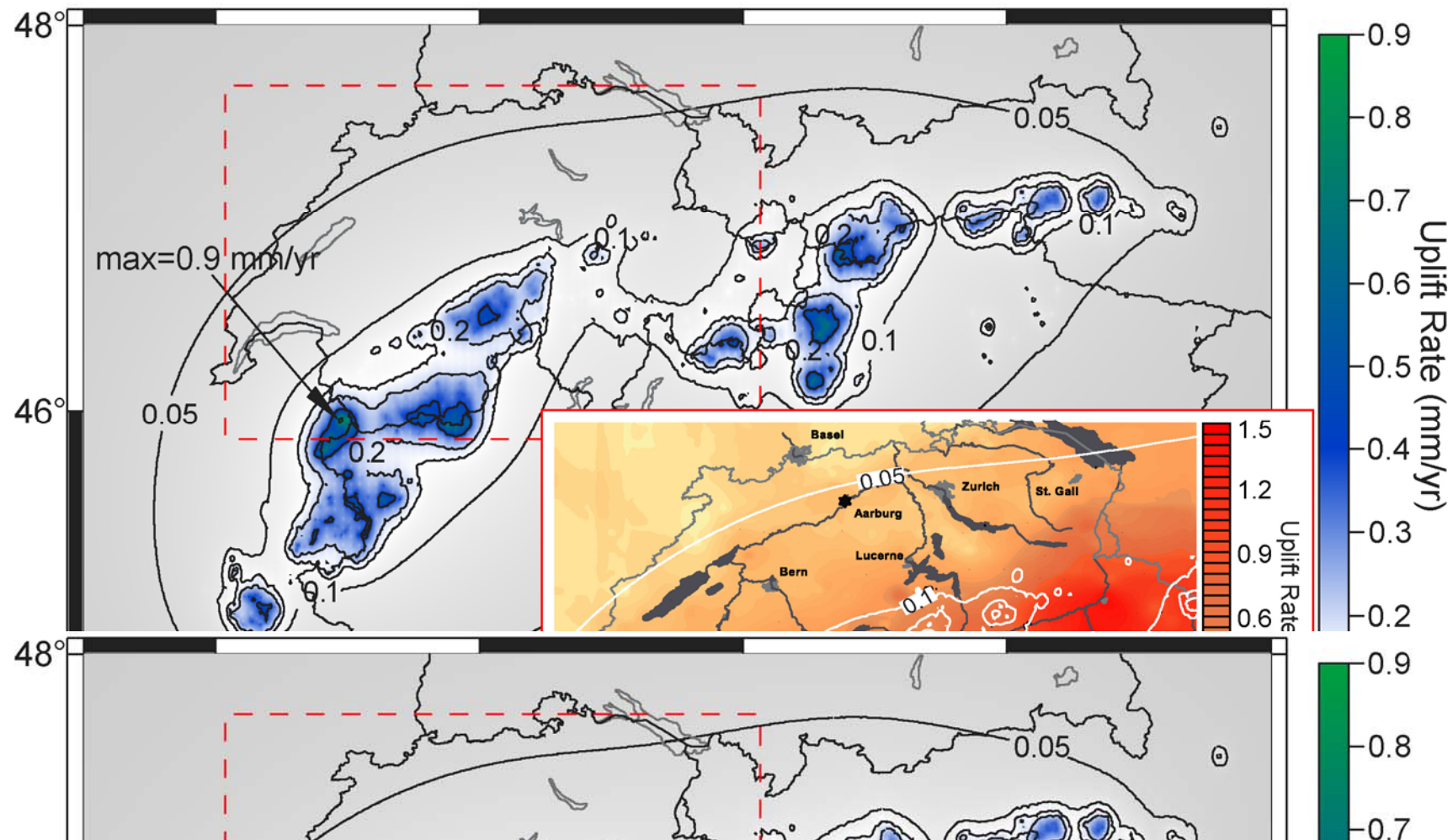


Low resolution map of the uplift rate caused by glacier mass balance of -0.71 m/yr

The coefficient of glacier area reduction per year and the mass balance, averaged over 1996-1999 years

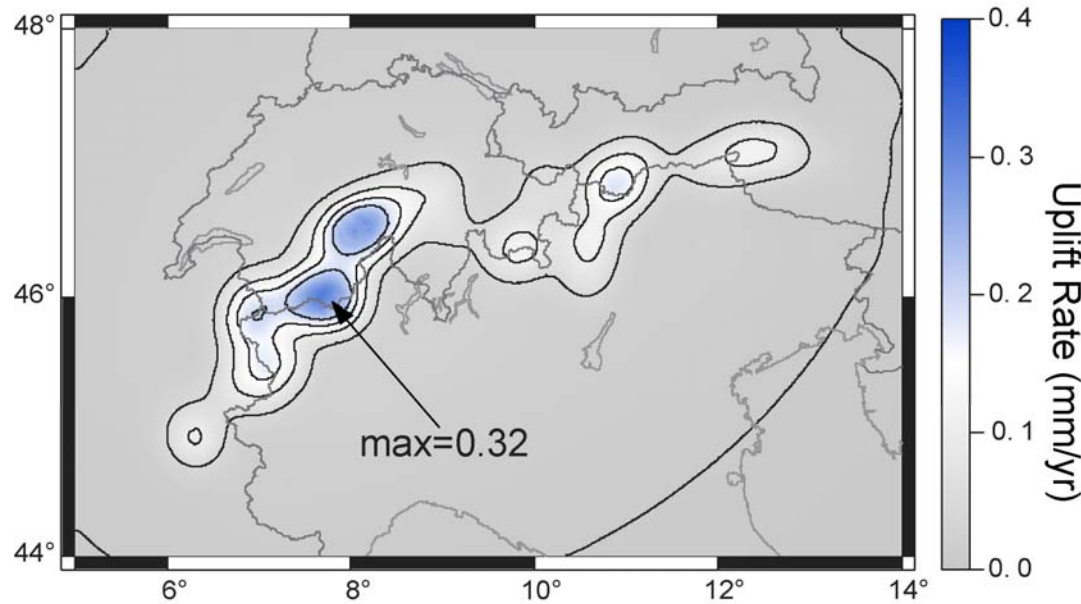
Region	Area Yearly reduction, %	mass balance m/yr, w.e.
Austria	0.63	-0.64
France	0.47	-0.97
Italy	0.47	-1.19
Switzerland	0.84	-0.40
Germany	0.63	-0.64

High resolution Technique



Computed high resolution (elastic response) to ice mass loss. In the inset (corresponding to the the dashed box in main figure), our white contour lines are superimposed to the vertical rates obtained from the new national height system (LHN95) of Switzerland [Schlatter et al., 1999], for comparison.

High resolution Technique



Viscous contribution,
for 155 Km³ of ice
volume loss since
1850 A.D.

	Layer	r in Km	ρ in Kg/m ³	μ in Pa	ν in Pa s
Rheologic structure	1	6371.0	2650.0	2.97×10^{10}	1.00×10^{35}
	2	6352.5	2750.0	5.58×10^{10}	2.15×10^{19}
	3	6341.0	2900.0	6.81×10^{10}	5.00×10^{21}
	4	6331.0	3439.3	7.27×10^{10}	4.64×10^{20}
	5	5951.0	3882.3	1.09×10^{11}	4.64×10^{20}
	6	5701.0	4890.6	2.21×10^{11}	1.000×10^{21}
	7	3480.0	10932.	0.00	0.0