

Exam Geodynamics course (Part II) ; 15-04-2013
Teachers: Spakman & van Hinsbergen.

- Write clearly. If we cannot read it, we cannot judge it!
- You may answer in Dutch or English.
- **Be extensive** in presenting your argumentation using scientific reasoning such that you demonstrate your understanding of the subjects.
- All 4 questions are of equal weight
- There is one **bonus question**. This may only help those that did not score sufficiently on the first 4 questions.

Question 1: Apart from several theoretical approximations, two major subjective choices determine the outcome of the delay-time inverse problem. These are the choice of the data covariance in the forward problem and the application of damping (or regularization) in the inverse problem.

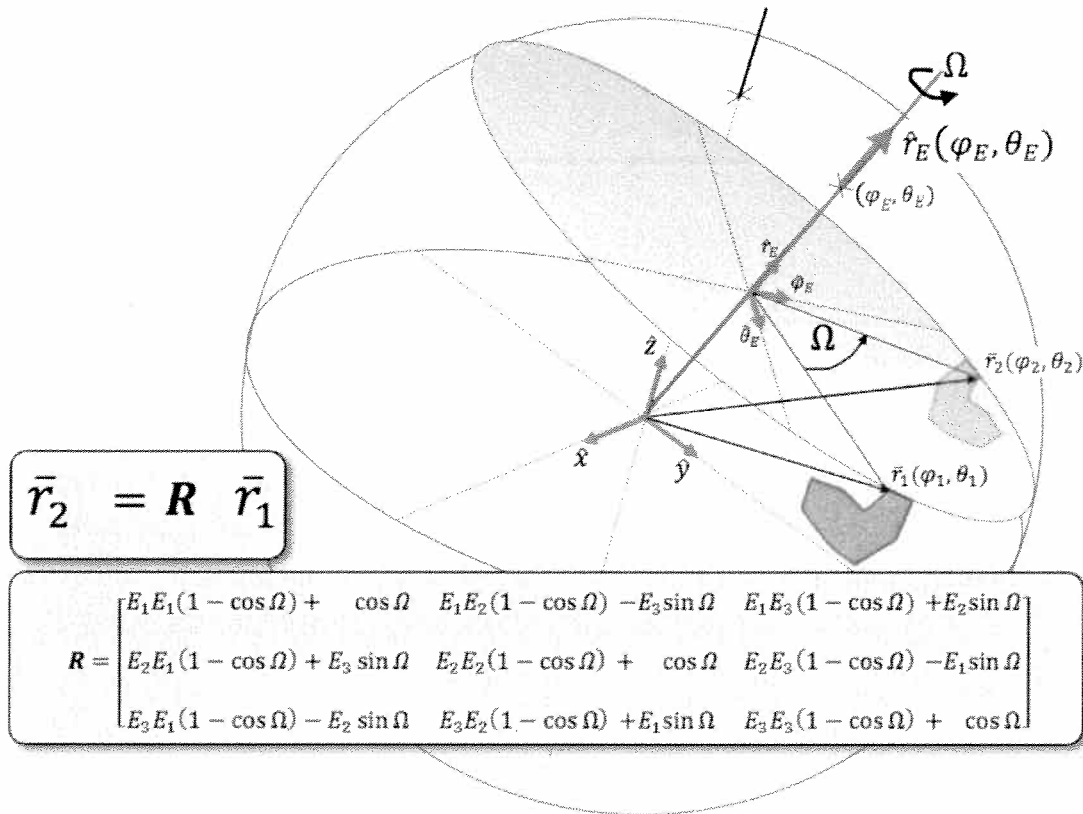
Discuss what necessitates these choices and discuss in a qualitative way in which way these choices affect the tomographic model obtained from inversion (you may use your expertise acquired from the String-Earth tomography experiment).

Question 2: An Arabian seismologist built a tomographic model and identified a large high-velocity body in the lower mantle below southern India. He wonders whether this anomaly may have formed due to subduction of lithosphere that broke off when ophiolites were obducted onto the Arabian margin 70 Myr ago. How could he test whether this is possible if he had global marine magnetic anomaly data and a large set of Mesozoic and Cenozoic paleomagnetic poles from stable continents at his disposal?

Question 3: A plate rotated over 30 degrees clockwise along an Euler pole at the Equator between 50 and 20 Ma. You found a section with multiple lavas, the lower part of which erupted 50 Ma ago, and the upper part 20 Ma ago, from which you have obtained an excellent paleomagnetic dataset. What will that dataset show you if

- a) the rocks you sampled were deposited at that Euler pole;
- b) the Euler pole lies 90° away from your section and coincides with the north pole;
- c) the Euler pole lies 90° due west of your section
- d) the Euler pole lies 90° due east of your section?

Question 4: The figure at the other side of this page shows all the details of uniform Euler pole rotation of a tectonic fragment. Explain all mathematical symbols and equations and describe how we arrive at the rotation matrix R .



Bonus question: Consider the plates below, and the associated velocity diagram. Indicate the nature of the plate contacts. Indicate the different options for subduction polarity. Do all options lead to a stable triple junction ABC

