

Thursday 2 February 2012

Teacher: Prof. Dr. H. Middelkoop

Carefully read the questions and provide complete answers in English or Dutch!

1. Definitions

Briefly explain the meaning of *3 out of the following 6* items:

- a) La Niña
- b) Interstadial
- c) Tephrochronology
- d) Termination
- e) SRES scenario
- f) Agulhas leakage

2. Time control

The ^{14}C method has been widely applied in dating materials containing carbon. Due to various reasons ^{14}C ages must be converted to absolute, calibrated ages.

- a. Explain how to establish a ^{14}C calibration curve; mention at least three types of information that can be used, and indicate the approximate time ranges covered by these methods.
- b. Give at least three methods that can be used for chronological correlation of $\delta^{18}\text{O}$ ice core records from different locations within and between different ice sheets.
- c. Explain what dating methods can be used to date Holocene re-advances of Alpine glaciers. How are these methods applied?

3. Sea level change

Sea level has changed as well during the Quaternary. Relative SLR curves of post-glacial sea level rise show a large spatial variability, with both rising and lowering sea levels, associated with different components and mechanisms controlling these relative SLR curves. Our understanding of all these post-glacial different SLR curves had dramatically improved after the establishment of GIA models, such as the model of Peltier.

- a. Draw a schematic sea level curve that reflects only the eustatic component of the rise. Indicate a few characteristic levels and dates.
- b. Give at least 3 mechanisms that have caused isostatic components of sea level change that have determined the very different types of observed postglacial SLR curves. Draw for each mechanism schematically the resulting relative SLR curve over the past 15 ka.
- c. Explain why SLR in the coming centuries may show considerable spatial variation across the globe. Where would you expect large rise – and why?

4. Climate change and control

The circulation in the Atlantic has been varying considerable during the Quaternary.

- a. Indicate 3 types of variations in Atlantic Ocean circulation that have occurred, during the past 200 ka, and indicate their effect – and where this effect was observed.
- b. At a certain point in time the following trends in orbital parameters are occurring: Obliquity is increasing, Precession is shifting such that the Earth is at the perihelion in June, and Eccentricity is high. What are the consequences of this situation for a) growth or decay of the N-hemisphere ice sheets, and for b) the intensity of monsoons in Africa? Explain your answer.
- c. Draw the shape of the $\delta^{18}\text{O}$ curve (schematically, but with key fluctuations indicated - draw units on the axes!) for the past 150,000 years in the Summit (GISP2/GRIP) ice record from Greenland; indicate (schematically) glacial and interglacial periods, stadials, Younger Dryas, Dansgaard-Oeschger events and Bond cycles.