

## Climate variability across scales – from the butterfly’s wings to the age of the Earth – an online seminar series from Nov 2020 to March 2021 –

### Climate variability on time scales of $10^8$ years: stabilisation through the carbonate silicate cycle

Mario Trieloff (mario.trieloff@geow.uni-heidelberg.de)

2021-03-05, 11:00 CET

#### Abstract:

Volatile elements are enriched in our sun, as well as the gas and ice giants of the outer solar system, but heavily depleted on the terrestrial planets and our Earth. While the depletion of hydrogen and helium can be understood in terms of atmospheric escape, the depletion of carbon needs local heating processes in the solar nebula to be combusted and lost as CO during accretion. The Earth remained hot during the first 100 Ma with a protoatmosphere dissolved partly in a magma ocean. Only after the moon forming Theia impact, temperature decreased until water oceans formed, leaving a CO<sub>2</sub> dominated atmosphere. Most of CO<sub>2</sub> became bound as carbonate during operation of the carbonate-silicate-cycle: CO<sub>2</sub> and H<sub>2</sub>O cause weathering of silicate rocks, particularly at higher temperatures, leading to an increase of Ca<sup>++</sup> and HCO<sub>3</sub><sup>-</sup> ions in the oceans and precipitation of carbonates. Decreasing average temperature lead to less efficient CO<sub>2</sub> removal, and CO<sub>2</sub> accumulation by ongoing volcanic activity. Long term stabilisation can be achieved, e.g. the faint young sun problem can be explained by a higher partial pressure of CO<sub>2</sub> in the ancient atmosphere, and long term albedo changes (e.g. by continental drift) can be compensated as well (however, not on short time scales). Long term climate variations are rather due to changes in CO<sub>2</sub> sources, e.g., by intensified carbonate metamorphism due to increased spreading rates and/or volcanic activity at continental margins) and CO<sub>2</sub> sinks, e.g., increased weatherability due to uplift of the Himalayan plateau.

#### The speaker:

#### More information:

#### Dates and speakers

1. **Jürg Schmidli** – IAU Frankfurt, Germany “**Variability at sub-daily time scales – from seconds to hours**”. Tuesday **10.11.2020** 16:00-17:00 (*video on youtube, link below*)
2. **Christian Grams** – IMK-TRO/KIT, Germany “**Synoptic to sub-seasonal surface climate variability in the Atlantic-European region: the role of weather regimes.**”. Thursday **26.11.2020** 16:00-17:00 (*video on youtube*)
3. **Tine Nilsen** – UIT, Norway “**Decadal variability and the scaling paradigm**”. **3.12.2020** 16:00-17:00 (*video on youtube*)
4. **Michel Crucifix** – UC Louvain, Belgium “**The challenge of centennial climate variability**”. Friday **18.12.2020** 11:00-12:00 (*video on youtube*)
5. **Heather Andres** – MUN, Canada “**Millennial climate variability and Dansgaard-Oeschger events**”. **21 Jan 2021** 16:00-17:00 (*video on youtube*)
6. **Julie Schindlbeck-Belo** – GEOMAR Kiel, Germany “**The links between volcanism and climate**”. **20.1.2021** 16:00-17:00 (*video available on request*)
7. **Oliver Friedrich** – GEOW HD, Germany “**Glacial/Interglacial climate variability ( $10^5$ - $10^7$  years)**”. **27.1.2021** 11:00-12:00 (*video on youtube*)
8. **Valerio Lucarini** – Reading, UK “**Heatwaves and Cold Spells and Assessing Their Response to Climate Change**”. Wednesday **10.2.2021** 11:00-12:00 (*video on youtube*)
9. **Mario Trieloff**, GEOW Heidelberg, “**Climate variability on time scales of  $10^8$  years: stabilisation through the carbonate silicate cycle**”. Friday **5.3.2021** 11:00-12:00
10. **Shaun Lovejoy**, McGill University/Canada – “**Linking Climate Variability Across Scales**” – **18.3.2021** 16:00-17:00 (*date/time tbc*)

All times stated are CET (Berlin). Past lectures are available via the PAGES youtube channel:

[https://www.youtube.com/playlist?list=PLSaCdvM4wMLH\\_QfoKHyc5n4d-0\\_KBHDL](https://www.youtube.com/playlist?list=PLSaCdvM4wMLH_QfoKHyc5n4d-0_KBHDL)

**Registration:** The link to the online meeting (Zoom) will be sent a day before the seminar to the first 75 registered participants. For technical questions and registration, please send an email to [paleodyn@iup.uni-heidelberg.de](mailto:paleodyn@iup.uni-heidelberg.de) with the mail header “CVAS lecture series”. **Contact:** Kira Rehfeld ([krehfeld@iup.uni-heidelberg.de](mailto:krehfeld@iup.uni-heidelberg.de))

