



Keynote lecture by Eli Tziperman (Harvard University, US): Warm, Hot ... Freezing! - From past climate variability to future climate change

E. Tziperman

Harvard University, US

The geologic record is a fascinating source for surprising information and useful lessons on the diverse states in which the Earth climate system may be. The Pliocene (2-5 Myr ago) was only slightly warmer than present-day climate, yet was characterized by a permanent El Nino in the equatorial Pacific and by a dramatic warming of mid-latitude ocean upwelling sites. The climate of the Cretaceous and Eocene (146-34 Million years ago) was exceptionally warm. Crocodiles and Palm trees, which cannot survive even a few nights of sub freezing temperatures, could be found in the waters of Greenland and in the middle of present day North America, where current winter temperatures can drop to -40C.

State-of-the-art climate models cannot reproduce nor explain these past warm climates even at high atmospheric CO₂ concentrations. One wonders whether these models are missing some significant feedbacks that may also affect their global warming predictions. We'll discuss possible physical mechanisms for both of these past warm climates and the possible implied lessons.

Further back in time, the complete freezing of the Earth during the Snowball Earth events of the Neoproterozoic Era (1,000 to 542 Myr) pose several interesting and unanswered questions. We'll discuss the possibility that these events were initiated by bacteria in the deep ocean, as well as what the ocean circulation may have been under a kilometer of ice. Even in this case, there may be some surprising lessons for understanding present-day ocean, apart from the relevance to our understanding of the origin of life and its evolution.