EGU2020-20914
https://doi.org/10.5194/egusphere-egu2020-20914
EGU General Assembly 2020

Simulations of large climate transition occurring at high and low latitudes during the late Pliocene (3.3 Ma) and the Plio/Pleistocene (3-2.5 Ma) boundary

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The late Pliocene corresponds to a large cooling over Northern Hemisphere associated with sporadic occurrences of glaciations. The most important event occurred during the marine isotope stage M2 (MIS M2, 3.312–3.264 Ma) when a large glaciation took place with a sea level drop from 20 to 60 m, but its duration is short and the summer insolation forcing change at 65°N is weak. De Schepper et al (2013) invoked to explain the onset and termination of this glaciation with the opening and closing of the Central American Seaway (shallow CAS). Based on their hypothesis, we have intensively studied the onset mechanism of MIS M2 through a series of sensitivity experiments using the IPSL AOGCM and the asynchronous coupling with an Ice sheet model (GRISLI). Our results demonstrate that the shallow CAS helps to precondition the low-latitude oceanic circulation and affects the related northward energy transport, but cannot alone explain the onset of the M2 glaciation, the most important contribution on MIS M2 are from the large change of pCO_2 as well as the internal feedbacks of vegetation and ice sheet. Moreover, we have also investigated the period from the late Pliocene to the early Pleistocene (3-2.5 Ma) through a transient-like simulation using the same AOGCM and ISM. This enables to simulate the Greenland Ice Sheet (GRIS) onset and development using the pCO_2 reconstructions from different proxies. All these simulations were analyzed with emphasis on cryosphere and focused on the Northern Hemisphere (mid-to-high latitudes). Here we used the same modeling simulations but with a focus over the tropical Africa. We first depict the large changes of temperatures and hydrological cycle produced over this area during these two periods and compare our data to reconstructions. Moreover, by prescribing our climate results as inputs for the vegetation model (Biome4), we compare more directly the simulated plant functional types (PFTs) with that constructed by the pollen data. In addition, we further quantify the respective impact of various driving factors on these PFTs variations.