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Geophysical Research Abstracts
Vol. 18, EGU2016-7977, 2016
EGU General Assembly 2016

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During the 20th century, Sahelian drought episodes like those between 1972 and 1982 showed the vulnerability of the Sahelian agro-ecosystem provoking significant intraregional southward human migrations, to or near the coast. According to the latest IPCC report, the Sahel could become increasingly impacted by climate change during the 21st century because of a lagged and shorter rainfall season having the potential to induce a drastic destabilization of the Sahelian agro-ecosystem and to heavily impact the population. Such effects could be further amplified by a net increase of the Sahelian population. Drastic climate changes over tropical areas also occurred in the past: weakening of the West African Monsoon and megadrought Sahelian episodes have been reported with a close correspondence between the large rainfall decrease and the massive freshwater discharges following ice-sheet melting or iceberg surges.
During the last decades a continuous acceleration of ice-sheet mass loss has been observed and post IPCC-AR5 studies suggest the ice-sheet contribution to future sea-level rise could be revised upward due partly to the lack of an accurate representation of ice-ocean interactions. The release of freshwater discharge in response to ice-sheet instability could have large consequences on the most vulnerable regions, such as the tropical areas. To investigate the impacts of large ice-sheet instability during the 21st century, we first explore the climatic signature of Greenland or Antarctic ice-sheet collapse scenarios corresponding to 0.5 to 1.5 meter of sea-level rise, superimposed to the RCP8.5 scenario. We show that a freshwater discharge coming from Greenland melting induces a significant decrease of summer monsoon rainfall, that may lead to changes in agricultural practices. Combined with increasing demography, this has the potential to induce important human migration flows. Without adaptation measures, we estimate that tens to hundreds million people could be forced to leave the Sahel by the end of the 21st century, not accounting for the direct migratory impact of sea-level rise over coastal areas.