

Séminaire du LGGE

Mercredi 22 janvier 2014, 14h

Salle L. Lliboutry, LGGE

“The co-evolution of the Earth System and human civilizations over the preindustrial Holocene”

Jed O. Kaplan

ARVE Group

Institute for Environmental Sciences

Université de Genève

jed.kaplan@unige.ch

Abstract:

Human activities during the preindustrial Holocene are increasingly seen to have had the potential to influence the chemical composition of the atmosphere. In the preindustrial world, humans practiced deforestation to prepare agricultural land, domestication of livestock, application and management of fire, irrigation, wetland drainage, and other water management activities, and “industrial” activities such as charcoal production and metallurgy, all of which could influence atmospheric CO₂ and methane concentrations. Possibly even more important than concentrations is the influence that anthropogenic activities had on the isotopic composition of these trace gases, as even small redistributions of sources could have a measurable impact on isotope ratios. Thus, anthropogenic activities during the preindustrial Holocene have implications for the interpretation of ice core records, particularly as new high-precision, high-resolution data are collected. Here I show, using a combination of historical, archaeological, and paleoecological data synthesis and state-of-the-art land use and vegetation models, how humanity may have affected the isotope ratios of CO₂ and methane over the preindustrial Holocene. For methane, the largest effects come from the widespread and increasing human application of fire, which has a distinct ¹³CH₄ signature. Increases in populations of domesticated ruminants and draining of wetland also affect methane isotopes. For CO₂, the increasing biosphere-atmosphere carbon flux, particularly as a result of widespread deforestation starting in the Iron Age from about 3 ka, has the potential impact to influence atmospheric ¹³CO₂. My results demonstrate that, when interpreting the ice core record of CO₂ and methane isotopes, it is essential to consider the potential impact of human activities on the global environment over the preindustrial Holocene.