

Interactive comment on “Diminished greenhouse warming from Archean methane due to solar absorption lines” by B. Byrne and C. Goldblatt

J. Kasting (Referee)

jfk4@psu.edu

Received and published: 15 December 2014

This is a careful study of the greenhouse warming that might have been provided by CH₄ in a CO₂-rich Archean atmosphere. The general conclusion is that CH₄ is less effective as a greenhouse gas than estimated by previous authors (specifically, Haqq-Misra et al., *Astrobiology*, 2008), largely because of increased absorption of incident solar radiation by CH₄ when calculated using the up-to-date HITRAN2012 database. This is a useful and possibly important result.

One should note, however, that the earlier study by Haqq-Misra et al. also included greenhouse warming by ethane (C₂H₆), the concentration of which was calculated self-consistently using a photochemical model. The ethane in that study contributed several degrees of greenhouse warming, although its effect was largely masked at high C2095

CH₄ concentrations by anti-greenhouse cooling provided by organic haze. Hence, the two studies (Haqq-Misra et al. and the present paper) are not directly comparable. When the effects of ethane are included, however, it seems likely that the general story of a methane greenhouse during the Archean remains valid. And that is significant, as the simplest explanation for the Paleoproterozoic glaciations that happened at the end of this eon is that the CH₄ greenhouse was diminished or wiped out by the rise of atmospheric O₂.

Interactive comment on *Clim. Past Discuss.*, 10, 4229, 2014.