

Interactive comment on “Re-evaluating the link between the Laacher See volcanic eruption and the Younger Dryas” by James U. L. Baldini et al.

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The manuscript “Re-evaluating the link between the Laacher See volcanic eruption and the Younger Dryas” by Baldini et al proposed Laacher See Eruption (LSE) as a potential trigger of the YD cold interval during the last deglaciation. The manuscript is good written and easy to follow. The authors argued that radiative effect of the LSE could lead to a cooling over the Northern Hemisphere, which eventually triggered the YD due to the existence of “sweet spot” of millennial-scale variability during glacial periods and positive feedbacks. I do see the potential of this mechanism, which enables an improvement of our understanding of YD dynamics. However, I’m a bit suspicious of its reliability. Some points are summarized in the following: 1) Responses of ocean circulation (AMOC) to a Northern Hemisphere volcano eruption is not that supportive

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of authors’ argument. According to Pausata et al 2015 (PNAS), eruption’s effect on AMOC is positive (strengthening) rather negative (weakening) at the first 20 years after the eruption, contrast to the weakening AMOC during YD. 2) Effect of southward ITCZ shift will lead to an increase of salinity in the North Atlantic subtropics, which will also act as a negative feedback to a potential weakening AMOC (Schmidt et al 2006 Nature). 3) Although the ice volume during YD is beneficial to the occurrence of millennial-scale variability (Zhang et al 2014 Nature), the high CO₂ level (~250 ppm) will shift the “sweet spot” to a lower level of global ice volume (Zhang et al 2017 Nature Geo). This will weaken the arguments proposed by the authors. Nevertheless, I do see a potential of LSE (or northern hemisphere volcanic eruption) as a trigger to YD —Muschiello et al (2017 Nature Comm, also cited by the authors) recently proposed that the volcanic eruptions can effectively influence the mass balance of ice sheet via altering its surface albedo. This will promote the ice-sheet melting, leading to freshwater input to the North Atlantic and weakening the AMOC. I’m not an expert on data and climate response to the volcanic eruptions. But I think if the author can well improve the robustness of their arguments (probably by rephrasing the mechanisms), this will be a nice manuscript for Clim Past.

Line 145: Citation “Pasauta et al 2015 Tellus B” is not proper here. It should be Pausata et al 2015 PNAS.

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