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Strong constraints on aerosol-cloud interactions from volcanic eruptions

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The climate impact of aerosols is highly uncertain owing primarily to their poorly quantified influence on cloud properties. During 2014-15, a fissure eruption in Holuhraun (Iceland) emitted huge quantities of sulphur dioxide, resulting in significant reductions in liquid cloud droplet size. Using satellite observations and detailed modelling, we estimate a global mean radiative forcing from the resulting aerosol-induced cloud brightening for the time of the eruption of around $-0.2\ W.m^{-2}$. Changes in cloud amount or liquid water path are undetectable, indicating that these aerosol-cloud indirect effects are modest. It supports the idea that cloud systems are well buffered against aerosol changes as only impacts on cloud effective radius appear relevant from a climate perspective, thus providing a strong constraint on aerosol-cloud interactions. This result will reduce uncertainties in future climate projections as we are able to reject the results from climate models with an excessive liquid water path response.