RC 3 with responses

Summary: The focus of the study is to disentangle the role of the external volcanic forcing and of internal climate variability in the cooling surrounding the strong volcanic eruption in of the Huaynaputina eruption 1601. The authors analyse different proxy data sets, including air,temperature, sea-ice extent in the Arctic-North-Atlantic, historical ice break-up dates at several Baltic ports and ensemble of simulations with the Max-Plank-Institute Earth System model.

The conclusions is that the attribution of all aspects of climate change around this date are very difficult to disentangle. Internal climate variability may be large, and although the attribution of the whole temperature evolution around those decades is compatible with the effect of volcanic eruptions, internal processes may play also an important role, even before the eruption.

Recommendation: I enjoyed reading this paper very much, and I like to congratulate the authors at this point. Although, as the authors acknowledge, the study is not conclusive, the authors have tried to use all data sets available to them and have conducted a very thorough, objective and candid analysis. On the other hand, it is very well written, provides an exhaustive background on the physical mechanisms and on the historical evidence, also a proof of a well functioning collaboration between climatologist and historians. Perhaps the significance of this and similar studies goes beyond what the authors let on: this type of events can occur at any time, regardless of whether they are produce only by volcanic forcing or by a combination of volcanic eruption and internal variability. This, it is important to understand these past events.

This manuscript is one of the best that I had a chance to evaluate. My recommendation is to publish it - I have just a few minor comments that the authors may want to consider.

1) My most general comment is directed to the quantification of the magnitude of internal climate variations in this context. The study does compare simulations with and without external volcanic forcing for this period, but here a more general question remains open: what is the largest magnitude of multi-year cooling in a long control simulation in this region? Do large periods of multiyear cooling, comparable to the years following the 1601 eruptions, also appear in simulations without variations in external forcing?

We thank the reviewer for the generous comments on the manuscript. Moreno-Chamarro et al. 2015, “Internally generated decadal cold events in the northern North Atlantic and their possible implications for the demise of the Norse settlements in Greenland,” has previously addressed this question. The largest cooling in the subpolar North Atlantic found in a control simulation with constant forcing simulations and without volcanic forcing is found in those ensembles with an SPG shift, where the has a magnitude of cooling is up to -2˚C for 30-40 years

2) line 34 'The VEI 6 1600 Huaynaputina eruption' I think VEI has not been defined at this point in the manuscript.

We will revise the sentence to define volcanic explosivity index (VEI).

3) line 145 ' Of the 8 total members of the SPG-shift ensemble, 6 had volcanic forcing' . How many simulations with volcanic forcing do not show a SPG-shift ?

There were 10 runs in the VOL ensemble (6 with shift, 4 without) and 10 runs in the NOVOL ensemble (2 with shift, 8 without). We will revise lines 144-145 to include this information.