

Interactive comment on “The spring 2011 final stratospheric warming above Eureka: anomalous dynamics and chemistry” by C. Adams et al.

Anonymous Referee #2

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This paper uses ground-based measurements above Eureka, supported by satellite observations and model simulations, to characterize the evolution of ozone, N₂O, NO₂ in the stratosphere during the spring 2011. Special attention is devoted to the remarkable frozen-in Arctic anticyclone (FrIAC) observed during that spring and to ozone loss estimations. \hat{A}

I find the paper suitable for publications in ACP, provided that the comments below are addressed.

Major comments

The authors discuss the evolution and the persistence of the FrIAC, in particular the narrowing of the low-latitude intrusion, in relation to the time-theta cross-section of

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equivalent latitude above Eureka (Fig 3b) (p20049, line 17). It is unclear to me that the layer of air with a low-latitude origin near 600K has much to do with the FrIAC. Maps (Fig 5l, for example) indicate that the intrusion originates from a different longitude sector than the intrusion leading to the FrIAC (Fig 6l).

The apparent narrowing of the FrIAC vertical extension, as seen above Eureka, ought also to be related to the vertical tilting of the anticyclone, as discussed for example in Allen et al. (ACP, 2011). From the discussion, it seems that the authors focused on the descent of ozone. These points have to be clarified.

While the authors comment that the FrIAC lasted until the end of May, there is little satellite-based observational or modeling evidence of this in the figures. Some maps of GMI N₂O at the altitude of the FrIAC (850K) into the end of May would have been a strong addition to the paper. Or was the model unable to reproduce the long duration of the FrIAC event?

Sub-sections 3.4 and 3.5 are very short, and are very thin on new science. It seems to me that the material briefly presented there (and in figures 9, 10) does not deserve full sub-sections. The occurrence of an ozone mini-hole or a vortex remnant passing above Eureka could be briefly mentioned somewhere else in the manuscript, with little need of supporting figures.

Minor comments 1) A more precise indication of the lowest equivalent latitudes found in the FrIAC would have been useful: e.g. how close to the equator is the air mass origin? 2) In the conclusions, p20052, it is mentioned “transport over Eureka from mid-latitudes in an anticyclone”. Should it be from low-latitudes? 3) Spell DMPs in the heading of section 2.4

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