

This study examined the source contributions to Arctic black carbon (BC) in 2010 using the Flexpart Lagrangian transport model version 10.1 equipped with a new aerosol wet removal scheme. They found that Arctic BC at the surface and high altitudes is sensitive to emissions in high latitude and mid-latitude regions, respectively. About half of Arctic surface BC comes from anthropogenic emissions in Russia and 40% of BC at high altitudes comes from anthropogenic emissions in East Asia. The results can contribute to the Arctic aerosol community and the method with the new wet deposition scheme can improve high latitude aerosol simulation with lagrangian models.

Major comment:

It is good to add more literatures using models in the revised manuscript. However, I still feel the description lacks of details. The authors listed many literatures in lines 79-92, but they did not give their result quantitatively. They stated that 'Although numerous studies have been performed, results regarding regional contributions of BC sources in the Arctic are still inconclusive.' I was expecting to see the differences of BC source contributions between this study and other studies and the possible causes of the differences, but they only showed the similarity between the Flexpart Lagrangian transport model and GEOS-Chem in the last part of the paper. I agree that using the new wet removal scheme can improve the aerosol simulation, but it should not be listed as the new method since that the scheme was introduced in this model in Grythe et al. (2017). The authors need to highlight the unique findings in the manuscript.

Specific comments:

Line 133: The Flexpart lagrangian transport model has some assumptions, like the hydrophilic BC. The uncertainties of the results related to the these assumption should be discussed.

Lines 165-187: These two paragraphs should be in the 'Materials and methods' section.

Line 253: The observations did not show 'a secondary peak in summer', as the authors presented in line 189 'Winter maxima and summer minima were observed'.

Line 276-278: What caused the difference between this study (18%) and Winiget et al. (2019) (39%)? Can the different emissions (2010 vs 2011-2015) lead to the doubled contribution?