

This manuscript estimated the aerosol indirect effect over the Baltic Sea region by using MODIS L3 dataset. Over high latitude regions, such studies are very limited previously because the available dataset are often unreliable. By making use of twelve years of aerosol and cloud properties from MODIS product, the authors investigated the response of the cloud properties to change of aerosol loading based on statistical analysis, and presented some interesting findings over the region. Overall, this manuscript is well written and useful to improve our understanding on aerosol-cloud interaction. The disadvantage is lacking of the detailed explanations and discussions on the results presented (see my specific comments below).

Specific comments:

P2, Line 26-27: you raised a question here, but we don't see a clear answer finally.

P4, line 19-24, Fig.2: Area 3 AOD is much larger than AI, why?

P5, line 2-3: "Indicating the dominance of fine particles, high values of the AE are found over the entire Area 1, ...", Area 1 should be dominated by sea salt, why the fine particles dominate here?

Line 18-19: 'Over the Norwegian coast the high values of the COT and the 19 CF can be explained by high hygroscopicity of sea spray aerosols,

which makes these particles very efficient'. It seems true, but why we don't see the same thing over the coast of Area 1?

Line 25, should be Fig.4e-h.

Line 26-27: Does MODIS provide cloud top height directly?

Line 32: why the CF is not affected by aerosol? any explanations?

Line 40-42: "The cloud droplet size in Area 1 (the Baltic Sea) and Area 2 (Fennoscandia) shows a strong negative correlation with the AI, while a weak correlation is observed over Area 3 (Central-Eastern Europe)", this is contradictory to our understanding.

Line 42-43: 'Area 1 has no results for the high LWP bins: clouds over the Baltic Sea are most likely stratiform clouds which are characterized by a lower LWP than for convective continental clouds', any references to present that stratiform clouds hold a lower LWP than convective clouds?

P5, line 49-p6, line 1: ' $\Delta CF$  (Fig. 6a) presents only positive values suggesting that the CF is always significantly larger in the polluted atmospheric conditions'.  $\Delta CF$  is always negative as I can see.

Line 1-3: 'The positive values of  $\Delta CTP$  (Fig. 6d) over Area 2 (Fennoscandia) and Area 3 (Central-Eastern Europe) agree with the idea of the vertical development of clouds for higher aerosol loadings (Fig. 4)'. Higher aerosol loadings cause the vertical development of clouds, and then  $\Delta CTP$  should be negative, correct?

Line 6-8: 'Over land  $\Delta CER$  is predominantly negative: although small (<

2  $\mu\text{m}$ ), negative values of the  $\Delta\text{CER}$  indicate that the CER is larger over areas with higher aerosol loadings than over cleaner areas. This result is in contradiction with the theory of the AIEs”, is there any explanations for this? From Fig. 3, it seems that higher CER correspond to lower aerosol loading, why the contradictory result is shown in Fig. 6?

Line 15-16: ‘The LWP and CER are negatively correlated with aerosol parameters, showing a stronger response to the AOD than to the AI’, CER is negatively correlated with aerosol, but LWP is NOT negatively correlated with aerosol from Fig. 7a.

Line 29-30: ‘...0.06 to a maximum of 0.16...’, what is unit? Please keep consistent with the figure. The ACI values for Area 1 are positive, indicating a positive correlation of CER and aerosol loading, right? but why the correlation coefficients are negative?

Line 37-38: does this result means that high aerosol loading correspond to larger cloud effective radius for Area 3? Can you give some explanations?