Response to Reviewer #1 - attachment

1. Modification to the conductivity model

Correction has been made to ion recombination coefficient now set to α = 1.3E-6 cm3/s, and ion production set to 2.5 s^{-1} cm-3. We want to further simplify the presentation of the model by showing the results of the ion conductivity change in just one table, when the relative proportions of water soluble and soot components vary (a small, constant contribution of insoluble aerosol of 500 cm^{-3} is also assumed). We set the threshold values of soot and water soluble aerosol concentrations at 26000 cm^{-3} and 6000 cm^{-3}, respectively. The first value corresponds to highest average aerosol concentrations in the winter (Fig. 4, Table 2), and the second value refers to the lowest concentrations measured at Świder (~4000 occur too, but they are very rare). Average winter situation may correspond to the ratio of the 10-20% vs 90-80% of water soluble and soot components which give the total CN concentration of 22500-24500 cm^{-3} , since the average observed is ~20900 cm^{-3}, and summer conditions to the ratio of 60-70% vs 40-30%, i.e. 14500-12500 cm^{-3} , since the average observed is ~15300 cm^{-3} is (Table 2, Fig. 4). In the fifth column we give the effective attachment rate β_{eff} = (βN)/N which varies in the range from 1.07 to 3.24 x 10^{-6} cm^3 s^{-1}. Sapkota and Varshneya (1990) mention that Hoppel predicts a range of 0.8 to 3.0 of β_{eff} for the continental aerosol, so these are reasonable values. In the last column we give twice the experimental average value of polar (positive) conductivity calculated from newly digitised 1965-205 data: 4.4 ±0.2 x 10^{-15} S/m 4.4 ±0.2 for winter and 8.0±0.2 x 10^{-15} S/m for summer. While we adjusted q to give the right winter conductivity ~4.32-4.43 x 10^{-15} S/m, the model summer conductivity 4.97-5.13 x 10^{-15} S/m remains too low compared with the observations. It is likely that there are other constituents of the aerosol and dust that cause a larger difference between the winter and summer conductivities. The conductivity value very much depends on both β_{eff} N and q, with β_{eff} depending on the distribution of the sizes of the aerosol particles. In particular, the insoluble component also plays an important part through the high attachment rate. These may also vary between the summer and winter, and in the model they are constant. More analysis, and observational data from Świder are needed to develop a more realistic conductivity model, particularly of the aerosol size distributions.

Water-Sol uble [%]	Soot [%]	Total concentration[cm^{-3}]	βN [10^{-2} s^{-1}]	β_{eff} [10^{-6} cm^3 s^{-1}]	Sigma [10^{-15} S/m]	Average observed conditions and conductivity value* [10^{-15} S/m]
0%	100%	26500	2.85	1.07	4.20	
10%	90%	24000	2.77	1.13	4.32	
20%	80%	22500	2.70	1.20	4.43	WINTER 4.4 ±0.2

30%	70%	20500	2.62	1.28	4.56	
40%	6 0%	18500	2.55	1.38	4.69	
50%	50%	16500	2.48	1.50	4.82	
60%	40%	14500	2.40	1.66	4.97	
70%	30%	12500	2.33	1.86	5.13	SUMMER 8.0±0.2
80%	20%	10500	2.26	2.15	5.29	
90%	10%	8500	2.18	2.57	5.47	
100%	0%	6500	2.11	3.24	5.66	

* The value given equals twice the seasonal average of the positive (polar) conductivity calculated from hourly values reported in the observatory yearbooks (in fair weather conditions).

2. Annual variation of the positive conductivity at Świder.

We can now include the plot of the annual variation of positive conductivity observed at Świder.