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Interactive comment on "On the effects of hydrocarbon and sulphur-containing compounds on the CCN activation of combustion particles" *by* A. Petzold et al.

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First of all, we would like to thank the four reviewers for their detailed and helpful comments on the manuscript which helped to overcome some serious deficiencies in the presentation of the material. We will briefly address the most important remarks and suggestions by the reviewers.

The experimental data presented in the manuscript originate from a study on particle emissions from aircraft engines. However, the manuscript does not focus on the aviation aspects of the CCN activation of combustion particles, but wants to draw more general conclusions on the different processes which influence the CCN activation potential of combustion particles. It was correctly mentioned by all reviewers that the CCN activation of combustion particles emitted from aircraft engines is of no relevance with respect to aerosol-climate interactions, since aviation-related particle emissions occur mostly at altitudes where ice nuclei activation is the pre-dominant process for the aerosol-cloud interaction. The focus of the paper is sharpened in the introduction section.

Part of the confusion arose from the fact that in the manuscript water cloud activation and contrail formation processes were discussed. In order to avoid confusion, we concentrate now exclusively on the presentation and discussion of data which are linked to the CCN activation of combustion particles. All references to specific cloud types are replaced by the respective saturation ratio with respect to water without any further interpretation. In the presented data analysis, the gas turbine combustor was simply treated as a very efficient particle generator for studies on the interaction of carbonaceous combustion particles and sulphur-containing species during CCN activation. The unique features of this type of aerosol generator are still the simultaneous production of high-temperature-generated carbonaceous combustion particles and gaseous precursors for subsequent particle nucleation processes for the investigation of particle aging processes in an exhaust plume, but discussed without any preference of this type of particle generator against laboratory burners or other combustion particle sources. The more focused approach of the study is explicitly outlined in the introduction section. Furthermore, the key results of the entire PartEmis experiment which were published elsewhere are summarised in the introduction, so that the reader gets a clearer impression of what is new in this study.

The identification of test conditions for different analyses during the PartEmis experiment was not properly done in the former manuscript. The selected aerosol parameters for the data analysis like the choice of particles of sizes > 20 nm for representing the combustion particle mode, and the different methods for the determination of CCN activation diameters are more extensively described. The measurement cycles par-

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ticularly of the Tandem DMNA systems are also more explicitly described in Section 2.2 because they are essential for the entire data analysis. Operation conditions and test points which refer to presented data are now explicitly mentioned in the text, in the figure captions and particularly in Tables 3 and 5.

Another point of criticism aimed at the limited statistical qualification of the results. Uncertainty ranges of the used methods and resulting error bars are defined and added wherever possible. This lack of confidence in the statistical accuracy holds particularly for the data on the chemical composition of the investigated particles. Some reviewers requested a more detailed description of the carbon-specific methods which were applied in PartEmis, because the analyses of elemental and organic carbon components are essential for this study. The revised section on the off-line chemical analytical methods contains detailed information on the applied methods, including a discussion of measurement uncertainties and systematic deviations between elemental carbon-specific methods. This section should now enable the reader to follow the analytical approaches used in PartEmis. In order to concentrate on the presentation and discussion of statistically sound data we skipped the short section on average mass density and surface area of the combustion particles, because the uncertainties introduced by an unknown particle shape make a quantitative interpretation impossible. Also the discussion of the partitioning of sulphur-containing compounds is restricted to statistically significant observations.

One reviewer raised the serious question whether the reduction in hygroscopic growth and the increase in non-volatile OC for particles sampled at edge positions could be a coincidence due to the anomalous sampling position, instead of a correlation. In order to answer this question, a paragraph was added to Section 3.5 where we discuss the possibility of a reduced coating at the edge positions compared to the ensemble, which may result in a reduced hygroscopic growth of these particles. However, we argue against this hypothesis because neither the availability of gaseous sulphuric acid per combustion particle nor the particle volatile fraction shows any dependence on the

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sampling probe position.

It is stated in the conclusions section that the data presented here are far from being quantitative, particularly concerning the effect of the organic compounds on the CCN activation potential. In order to better reflect the nature of the drawn conclusions, the title of the manuscript was modified and the statements in the abstract were softened. However, we believe that the presented data give clear experimental evidence for the reported effects of particle nucleation/coagulation processes in the exhaust plume and of organic matter components of the combustion particles on the CCN activation potential.

All minor comments and suggestions by the reviewers were considered in the manuscript revision.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 2599, 2005.