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Biogeosciences Discussions

Interactive comment on "Microbiology and atmospheric processes: chemical interactions of Primary Biological Aerosols" *by* L. Deguillaume et al.

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This paper provides a summary of the current knowledge about the role of primary biological particles (PBA) in atmospheric chemistry and offers interesting perspectives for future studies. As an atmospheric chemist, I agree with the Authors that the role of biological agents on the heterogeneous reactions in the atmosphere has been underestimated for long, probably because of a systematic lack of a convincing experimental approach for capturing the complex interactions between micro-organisms and the chemical, physical and radiative properties of cloud systems. The Authors provide in section 3 a comprehensive review of the studies dealing with the effects of metabolic reactions driven by bacteria and fungi on the chemistry of dicarboxylic acids and alcohols which are among the most common organic constituents of cloud water. They

also suggest that the biogenically-driven degradation of dicarboxylic acids can be comparable to the abiotic oxidation pathways in cloud conditions. Most interestingly, they point out that the actual biological activity is function not only of physical parameters (UV radiation and of temperature) but also of the concentration of organic matter in cloudwater as well as of pH and oxidant levels. Such mutual interaction between cloud chemistry and airborne bacteria and fungi is described very convincingly in the paper. On the other hand, the other atmospheric effects of PBA, especially as part of the atmospheric aerosol (dry air conditions), are less clearly depicted. Section 2 provides a somewhat confusing description of the contribution of PBA to aerosol chemistry and to aerosol-cloud interactions. The confusion comes from an unclear distinction between A) viable organisms capable of metabolic reactions which can involve atmospheric organic compounds and oxidants, B) biological particles including alive or dead cells and cell fragments, capable of nucleating cloud droplets and ice particles via physical processes, C) any kind of organic substances deriving from biomolecules, and contributing to aerosol mass. This blurry concept of PBA leads to controversial data on the contribution of PBA to aerosol concentration and aerosol processes in the atmosphere. While reading the paper, I sometimes had the impression that micro-organisms are viewed merely as biological agents with little consideration of the implications of their size. For instance, the minimum size of CCN usually varies between 50 and 100 nm in the atmosphere, hence PBA (being larger) are expected to nucleate cloud droplets in any environments. The sentence in Section 5 about how PBA would alter the CCN properties of (small) particles upon contact/collision is obscure to me, because the products of coagulation of any particles with PBA will be good CCN just because of their size. All discussion in section 2 should refocus on the processes for which a specific role of PBA has been proved (e.g., as ice nuclei), as well as on processes less-known but plausible based on some background information. Finally, the two figures included in the manuscript should reflect the current level of knowledge of the various processes taken into account. After addressing these issues, the paper can be considered for publication on Biogeosciences.

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