Atmos. Chem. Phys. Discuss., 9, C3586–C3589, 2009
www.atmos-chem-phys-discuss.net/9/C3586/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Bacteria in the global atmosphere – Part 1: Review and synthesis of literature data for different ecosystems" *by* S. M. Burrows et al.

S. M. Burrows et al.

susannah.burrows@mpic.de

Received and published: 5 August 2009

We thank Ana Sesartic for her comments on our manuscript, and for her positive overall evaluation.

Her individual comments and our responses follow.

I suggest that the authors explain more clearly whether by bacteria they mean any bacteria found in the atmosphere in general, or just those species, which exhibit ice nucleating abilities.

The topic of our manuscript is the total bacteria in the atmosphere. We discuss bacte-

rial ice nucleation briefly in the introduction, as this is indeed one major motivation for the study of bacteria in the air, but this is not the focus of our manuscript, which deals with the concentrations and emissions of atmospheric bacteria in general, and how concentrations depend on meteorological variables and land use types. We hoped that this would be clear from the title and text of the manuscript, but have added a brief note to the introduction to make this explicit.

Page 10778, line 19: cite the source of the claim that "bacteria have a long residence time (of the order of several days)"

We will add a reference for this claim.

Page 10785, line 11: How does the Bowen ratio come into play for bacterial flux measurement? Is it not rather used to measure evapo-transpiration, as it is the ratio of sensible to latent heat fluxes from the Earth's surface up into the air.

In the modified Bowen ratio method to estimate the flux of bacteria, it is assumed that the eddy flux coefficient of a substance emitted into the boundary layer (for instance, bacterial aerosol) is the same as the eddy flux coefficient for heat (e.g. Wesley and Hicks, 2000). The advantage is that the average heat flux can be directly measured using the correlations of deviations in temperature and wind speed, which can be made with much higher precision and finer temporal resolution than measurements of bacterial aerosol.

The literature on such methods cautions that the measurements must be made under very specific conditions (ideally, a long fetch over homogeneous, flat terrain is required), and result in large uncertainties (Businger, 1985; Horst and Weil, 1993; Wesley and Hicks, 2000, and references therein).

The manuscript should have referred to the **modified** Bowen ratio method, but we mistakenly omitted the word "modified", which was perhaps the source of the confusion. We will correct this in the final manuscript.

ACPD

9, C3586–C3589, 2009

Page 10793: In line 19 you state that bacterial concentrations in rural areas are lower than in cities, yet in line 24 you write that "above crops, concentrations may be higher".

I would say that your second statement is correct, as I expect crops (and thus rural areas) to produce higher bacterial emissions than cities.

It is generally true, as we state in the manuscript, that airborne bacteria concentrations are higher in cities than in unsettled environments. Although cities are less biologically active, there are man-made sources of bacteria (such as sewage), and more importantly there are constant mechanical disturbances (traffic, construction, etc.) that cause dust and any microorganisms contained in the dust to enter the air. This was observed as early as 1883 by Miquel.

Agricultural landscapes appear to have higher average emissions and concentrations of bacteria than natural environments, due to the disturbance of plants and land surfaces by agricultural work (see Table B1, Table C1 and references therein). The type of crop and agricultural work performed on the crop are also highly variable in time and space, so there is high variability in the emissions, while the factors driving high emissions from cities are relatively constant over time.

To clarify this, we add "higher than other rural or non-settled regions" to the statement about crops.

Page 10795, lines 1-9: The use of ratios for the coastal and rural sites as rough scaling factors for forest data seems very questionable, though I am aware that no other means of scaling was available.

We appreciate the concern on this point. This scaling appeared to us to be the only reasonable method of obtaining rough estimates for regions such as forests, in the absence of further data. Perhaps some readers will be motivated to fill in the gaps. In this review, however, we believe that this approach is useful in obtaining a rough estimate of the total bacteria.

ACPD

9, C3586–C3589, 2009

Typographical error:

Page 10787, line 26: replace "hiher" with "higher"

Thanks, we will correct this.

1 References

Businger, J. (1986), Evaluation of the accuracy with which dry deposition can be measured with current micrometeorological techniques, J. Appl. Met., 25 (8), 1100–1124.

Horst and Weil (1993), How far is far enough?: The fetch requirements for micrometeorological measurement of surface fluxes, Journal of Atmospheric and Oceanic Technology, 11 (4), 1018–1025.

Miquel, P. (1883), Les Organismes Vivants de L'atmosphere, Gauthier-Villars.

Wesely, M., and B. Hicks (2000), A review of the current status of knowledge on dry deposition, Atmos. Environ., 34 (12-14), 2261–2282.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 10777, 2009.