



Characterization of microbial 'hot spots' in soils": Where are we, and where are we going?

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Fifty years ago, microbiologists realized that significant progress in our understanding of microbial processes in soils required being able to measure various physical, chemical, and microbial parameters at the scale of microorganisms, i.e. at micrometric or even submicrometric scales, and to identify areas of particularly high microbial activity. Back then, this was only a dream, severely hampered by the crudeness of our measuring instruments. In the intervening years, however, amazing technological progress has transformed that old dream into reality. We are now able to quantify the physical and (bio)chemical environment of soil microorganisms at spatial scales that are commensurate with bacterial cells. In this invited presentation, I will provide an overview of the significant progress achieved in this field over the last few years, and mention a number of further technological advances that are likely to profoundly influence the nature of the research over the next decade. Technology must however remain a means to an end, and therefore it is important to firmly keep in mind that the goal of the research on understanding better how soil processes work at the microscale is to be ultimately in a position to predict the behavior of soils at scales that matter to society at large, for example in terms of food security or global climate change. In that context, part of the research has to focus on how we can upscale information about soil microbial hotspots to macroscopic scales and beyond. I will discuss where we stand on this crucial question, which remains largely open at the moment.