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Black carbon, a 'hidden' player in the global C cycle

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During the 2011 alone more than 600 scientific papers about black carbon (BC) were published, half of them dealing with soils (ISI Web of Knowledge, accessed 15/01/2012). If the search is extended to the other terms by which BC is commonly named (i.e. biochar, charcoal, pyrogenic C or soot), the number of 2011 publications increases to >2400, 20% of them also related to soils. These figures confirm BC as a well-known feature in the scientific literature and, thus, in our research community. In fact, there is a wide variety of research topics where BC is currently studied: from its potential as long-term C reservoir in soils (man-made biochar), to its effects on the Earth's radiation balance (soot-BC), including its value as indicator in paleoenvironmental studies (charcoal) or, even surprisingly, its use in suicide attempts. BC is thus relevant to many aspects of our environment, making it a very far-reaching, but also very complex topic.

When focusing 'only' on the role of BC in the global C cycle, numerous questions arise. For example: (i) how much BC is produced by different sources (i.e. vegetation fires, fossil fuel and biofuel combustion); (ii) what are the main BC forms and their respective proportions generated (i.e. proportion of atmospheric BC [BC-soot] and the solid residues [char-BC]); (iii) where does this BC go (i.e. main mobilization pathways and sinks); (iv) how long does BC stay in the different systems (i.e. residence times in soils, sediments, water and atmosphere); (v) which are the BC stocks and its main transformations within and between the different systems (i.e. BC preservation, alteration and mineralization); (vi) what is the interaction of BC with other elements and how does this influence BC half-life (i.e. physical protection, interaction with pollutants, priming effects in other organic materials)?

These questions, and some suggestions about how to tackle these, will be discussed in this contribution. It will focus in particular on the role of black carbon within soil system sciences, but will also consider it from an integrated atmosphere-marine-terrestrial perspective.