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Aggregate stability as an indicator of soil erodibility and soil physical quality: review and perspectives

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Aggregate breakdown due to water and rain action may cause surface crusting, slumping, a reduction of infiltration and interrill erosion. Aggregate stability determines the capacity of aggregates to resist the effects of water and rainfall. In this paper, we evaluated and reviewed the relevance of an aggregate stability measurement to characterize soil physical properties as well as to analyse the processes involved in these properties. Stability measurement assesses the sensitivity of soil aggregates to various basic disaggregation mechanisms such as slaking, differential swelling, dispersion and mechanical breakdown. It has been showed that aggregate size distributions of structural stability tests matched the size distributions of eroded aggregates under rainfall simulations and that erosion amount was well predicted using aggregate stability indexes. It means stability tests could be used to estimate both the erodibility and the size fractions that are available for crust formation and erosion processes.
Several studies showed that organic matter was one of the main soil properties affecting soil stability. However, it has also been showed that aggregate stability of a given soil could vary within a year or between years. The factors controlling such changes have still to be specified. Aggregate stability appears therefore as a complex property, depending both on permanent soil characteristics and on dynamic factors such as the crusting stage, the climate and the biological activity. Despite, and may be, because of this complexity, aggregate stability seems an integrative and powerful indicator of soil physical quality. Future research efforts should look at the causes of short-term changes of structural stability, in order to fully understand all its aspects.