ON THE RECENT DEVELOPMENTS IN CONCEPTUAL/SEMI-ANALYTICAL INFILTRATION MODELING

C. Corradini\textsuperscript{1}, R. Morbidelli\textsuperscript{1}, C. Saltalippi\textsuperscript{1}, A. Flammini\textsuperscript{1}

\textsuperscript{1}Department of Civil and Environmental Engineering, University of Perugia - Perugia, Italy, corrado.corradini@unipg.it

A review of rainfall infiltration modeling at different spatial scales and based on conceptual/semi-analytical approaches referred to horizontal surfaces is presented. Representations of infiltration into vertically homogeneous and two-layered soils with top soil more or less permeable than the underlying soil are considered. The review defines the terms of the problem mainly through the advanced contributions proposed in the last 20 years in the following topics: local infiltration models for vertically homogeneous soils and complex rainfall patterns including period with rainfall hiatus; local infiltration models for bare soils with crust and for vertical profile with upper layer more permeable as for example in the specific case of grassland; field-scale infiltration models under conditions of random spatial variability of soil saturated hydraulic conductivity, soil moisture content and rainfall rate as well as for combinations of these quantities.

Synthetic descriptions of basic elements of the main models together with an analysis of their interactions are given. The link between the local scale modeling recently set up and the Green-Ampt approximation is also discussed, because the latter has been frequently adopted in the extension of modeling from local to field scale on the basis of the simple analytical form which simplify the integration on the spatial scale. Particular emphasis is given to the accuracy of the different models generally investigated using the Richards equation as a benchmark for the local scale and Monte-Carlo simulations at the field-scale. Laboratory investigations of particular interest, addressed to model validation for local infiltration, are also examined. Furthermore, in the context of the spatial variability of hydraulic soil properties, infiltration of overland flow running over pervious downstream areas (run-on process) in addition to rainfall infiltration is extensively examined even though its theoretical representation as well as the experimental investigation are still rather limited.