

THE MOTION OF A WETTING FRONT FOR A GREEN-AMPT MODEL
OF INFILTRATION INTO A CRACKED SOIL

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1. INTRODUCTION

The presence of worm holes, root holes or cracks in soils can have an important effect on the vertical transfer of water from the surface (Bevan and Germann [2]). Here, a two-dimensional homogeneous soil containing regularly spaced vertical cracks which are open to the surface and have length a and spacing $2b$ (Figure 1), is considered. Because of symmetry, we consider only the shaded region bounded by a single crack. Rectangular coordinates (x,z) are chosen with the positive z axis directed downward.

Initially, the moisture content is taken to be uniform. From time $t = 0$ onward, it is assumed that free water is supplied to the surface and that the crack is completely filled with water, the pressure therein being hydrostatic. The front (assumed to be sharp in the Green-Ampt model) separating the wetted from the unwetted region, advances away from the top surface and the crack.

A numerical procedure (similar to that used by Longuet-Higgins and Cokelet [6], and more recently by Davidson [3]) is described which traces the motion of the front by progressively solving an integral equation for the velocity at points on the front at each time step. A detailed account of the modelling assumptions and the physics of the problem is given elsewhere (Davidson [4]).

2. GOVERNING EQUATIONS

In terms of potential ϕ (the sum of the pressure (Ψ) and gravitational potentials), Darcy's law for flow in the wetted region is