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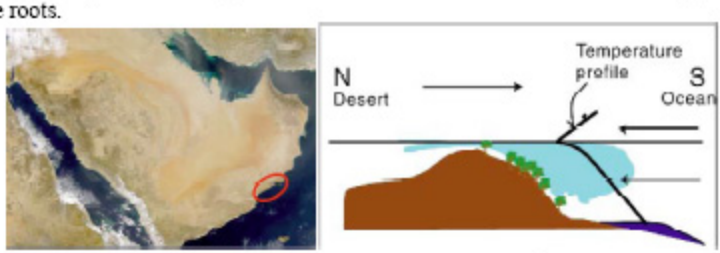
IMPACT OF THE DHOFAR CLOUD FOREST ON SUBSURFACE HYDROLOGICAL FLUXES: MODELLING ON THE SCALE OF A NEAR-ROOT ZONE SOIL CONTINUUM

A slope forest in a semi-arid region of Oman is studied. The peculiarity of this ecosystem is an interception of the liquid (fog and drizzle) by the tree canopy from a monsoon wind during a three-month monsoon period. The intercepted water drips on the soil from the foliage and stem over the area of the projection of the canopy. The moisture accumulates in the soil profile and is used by the tree long after the monsoon. Capillarity and gravity drives moisture to the water table. A modified Green-Ampt model of vertical infiltration is suggested, with a cyclostationary «self-drip-irrigation», vertically non-uniform water uptake by the tree roots and the possibility of stopping of the fronts of a descending water slug owing to non-equal capillary pressures on the imbibition and drainage fronts of the slug.

Key words: *deciduous cloud forest, arid/semi-arid region, hillslope vegetation, orographic rain, root water uptake, infiltration, Darcy law, Green-Ampt model.*

Introduction. In arid and semi-arid climates, which we, following [1], call water-limited environments (WLE), the soil moisture, salinity and temperature stresses determine the performance of plants. In these environments emerge interesting patterns of soil water, which are associated with the spatial distribution of vegetation [2]. In comparison with crops, pastures, grasslands or shrublands, forests are usually considered more water demanding [3]. In WLE higher water consumption of trees or shrubs is often explained by the ability of deep rooted vegetation (such as perennial trees or shrubs) to access water from a deep wet soil and even directly from the water table [4] (other plants with lower water use and with shallower roots can not do this). As a result of a combined water uptake by the roots from the soil, deep vadose zone and aquifer, the experimental data [1] in Kalahari showed that on the scale of 0-60 m from the top soil to the water table the moisture content decreases in the first few meters, then remains almost constant (for approximately 5–25 m from the surface) and then increases again (25–60 m) close to the capillary fringe, with a full saturation on the phreatic surface. This «trough»-shaped moisture profile is attributed to the vertical water-hunting activity of deep tree roots.



a *b*

Fig. 1. Satellite image of the study area (a) and vertical section of the mountain ridge, forest, monsoon and temperature profile (b)