

冻结-冻融过程中水分运移机理

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中文摘要:为研究冻结-冻融过程中水分运移机理,在天山北麓平原通过人为控制潜水不同埋深条件下的模拟试验和田间土壤水分运移观测试验,分析了土壤水势分布和土壤含水量分布特征,发现冻结过程不同潜水埋深条件下的土壤水分运移机理、土壤水与潜水之间的相互转化关系有明显差异.在冻结过程中,潜水浅埋条件下,冻结层下界面与潜水面之间土壤水分运移呈上渗型,土壤水向冻结层下界面处运移、积累,同时引起潜水蒸发损耗使潜水位下降,表现出地下水向土壤水转化的基本特征.潜水深埋区,土壤水分运移状态呈上渗-入渗型,同样土壤冻结层下界面处运移、积累,同时潜水得到一定的入渗补给并使潜水位上升,表现为土壤水向地下水转化的特征.冻融过程中对于不同潜水埋深,由原来各自的土壤水分运移状态均逐渐为入渗型,形成潜水入渗补给,表现为土壤水向地下水转化的特征.冻融期是土壤水资源、地下水资源形成的重要时期,对于干旱少雨的西北地区而言,冻融水的形成、运移和入渗补给地具有重要的生态环境意义.

中文关键词:冻结 冻融 土壤水 地下水 水分运移机理

The Mechanism of Water Movement in the Freezing-Thawing Process

Abstract:In order to understand the mechanism of water movement in the freezing-thawing process, the authors conducted simulation test and monitoring work for field soil water transport at different water table depths in the northern piedmont plain of the Tianshan Mountains. An analysis of soil moisture potential and water content distribution shows that there exist different soil water movement mechanisms as well as changeable water transformation relationship between soil water and groundwater in the freezing thawing process. If the water table is shallow, the soil water between the bottom boundary of freezing layer and the water table migrates upward. Water is accumulated around the boundary, resulting in the evaporation and loss of groundwater and the falling of the water table. Thus, the transport of groundwater to soil water is the dominating process in this case. If the water table is deep, however, the soil water movement is of upward-downward character. Although soil water migrates upward to the freezing layer, the water table remains rising due to infiltration recharge to groundwater. In this case, the transport of soil water to groundwater is the dominating process. In the thawing process, soil water movement in both cases gradually changes into the downward infiltration type, causing groundwater infiltration recharge. Snow accumulation and snow melt infiltration following the thawing of the freezing layer are vital for soil water resource and groundwater resource. In the arid region of northwestern China, these factors are very important ecological and environmental protection.