Winter School Talk 29/01/2019, ULiège

Saturated groundwater flow (Chapter 4 - Hydrogeology course)

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Abstract

Groundwater flow in saturated geological porous media is described step by step. The representative elementary volume (REV) concept allows to consider the support scale of each parameter and variable. The effective drainable porosity (specific yield) is distinguished from the total porosity. The Bernoulli potential equation is adapted for porous media and groundwater motion is described by Darcy's law. This law is applied in different contexts of geological heterogeneity and equivalent values for hydraulic conductivity are calculated. Expressing the conservation of groundwater mass, the groundwater flow equations in steady-state and transient conditions are derived in 2D and 3D, for confined and unconfined conditions. The transmissivity is defined by integrating hydraulic conductivity over a layer thickness when the Dupuit assumption of 2D horizontal groundwater flow can be accepted. Similarly, a storage coefficient is found by integrating the specific storage coefficient. In unconfined conditions, the storage coefficient can be represented by the specific yield or effective drainable porosity.

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