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Groundwater Vulnerability: A Less DRASTIC Approach

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Traditionally, the vulnerability of a groundwater resource was associated with the resources potential for anthropogenic contamination. Quantifying groundwater vulnerability typically used the DRASTIC approach, which takes into account various factors that directly control pollutant transport potential at catchment or smaller scales. These factors would then be compiled into a multi-criteria evaluation (MCE) where each factor was weighted differently. Although this method is clearly applicable to the protection of groundwater from localised point source pollutants, groundwater vulnerability on a regional scale can be impacted by a wider variety of factors than that considered in the DRASTIC approach. In particular, groundwater resources that are not directly impacted by anthropogenic forcing may still be vulnerable to regional climate change and ecological adaptations. A more robust method for evaluating both current and future regional groundwater vulnerability therefore requires the incorporation of several indices into one holistic vulnerability calculation. The question then becomes what these regional indices on groundwater vulnerability should be. A shift towards greater human dependence on groundwater, driven by population growth, the global trend towards urbanisation and widespread land use change, suggests that these are important indices that should be accommodated within assessments of regional groundwater vulnerability. As an example of this method, we show how datasets that incorporate groundwater properties, climate variables as well as socio-economic factors are necessary to evaluate regional groundwater vulnerability. We explain the role and significance of each dataset, assign each a weighting, and perform a MCE to output the distribution of groundwater vulnerability on a national scale. Subsequently, climatic forcings are adjusted according to global circulation models (GCMs) into new predictive spatial datasets that represent the evolution of these groundwater vulnerabilities over time. This shift in the way we think of groundwater vulnerability is critical at the current point in time when severe drought conditions affecting large parts of the world are driving even greater dependence onto groundwater.