

# Deriving dike-induced aquifer models from high-resolution multi-spectral satellite imagery: a novel groundwater exploration approach for arid regions

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The Main Karoo Basin in South Africa is a typical example of an expanding, arid region dependent on groundwater resources. Dolerite dikes in the region, analogous to dolerite dikes worldwide, are known to influence subsurface groundwater flow and spatially relate to high-yielding boreholes. Here, the effect of dolerite dikes on groundwater flow is remotely assessed using the Modified Soil Adjusted Vegetation Index derived from high-resolution multi-spectral satellite imagery. From imagery collected during the wet and dry seasons of 2018 and 2021, two aquifer models relating to 505 dikes were identified: (1) barrier-controlled aquifers are induced by ~56% of dikes, (2) fractured aquifers are induced by ~35% of dikes. Surficial areas overlying aquifers are also shown to sustain vegetation growth through dry seasons. This research demonstrates the efficacy of vegetation indices to rapidly characterize dike-related aquifer models and their seasonal sustainability, which is critical for effective groundwater exploration and management.