The fundamental role of soil in estimating ground and surface water hydrochemistry and quality – Physiographics of Southland

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This work utilises a systems integration approach to explain, 'how' and 'why' we see spatial variability in the hydrochemical and water quality signatures of freshwaters. The rationale for this approach is that the composition of any given surface water sample is diagnostic of its source and the physical, biological and chemical environment through which the water has moved. Classifying these environments should allow for common management approaches to more efficiently drive water quality outcomes. Four key drivers of surface water and shallow groundwater composition have been identified and mapped for the Southland region: (i) precipitation source; (ii) water source and recharge mechanism; (iii) combined soil and geological reduction potential, and; (iv) geomorphic surface age and substrate (rock and sediment) composition. Maps for each driver layer spatially depict driver gradients across the region that influence different aspects of water composition and quality. Each driver layer is a distillation of (multiple) critical characteristics of pre-existing spatial frameworks (e.g. soils maps, Q-Map, REC, DEM, hydrogeology). We demonstrate that: (i) through combination of each of the key spatial drivers it is possible to estimate the steady-state hydrochemical composition of regional surface waters and shallow unconfined groundwaters with a high degree of confidence, and; (ii) that unique assemblages of driver layers can be used as a basis for targeted land use management. We note that of the 3 terrestrial driver layers, soil is the most influential landscape feature determining hydrochemical and water quality signatures.