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Adding value to Groundwater Flow Systems Frameworks for managing dryland salinity in Australia

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Within Australia it is recognised that the management of dryland salinity requires a range of policy responses that are sensitive to hydrogeological and socio-economic conditions, and the types of assets under threat. In most scenarios, management actions need to be targeted to maximize the return on investments. While relatively simple rapid assessment models based on Groundwater Flow System (GFS) frameworks can provide useful assessments of relative broad-scale impacts of land use change on water yields and salinity between catchments at regional and catchment scales, more detailed process-based distributed hydrogeological models (eg CAT3D), that take better account of spatial and temporal variability in GFS components, are required for targeting management actions at sub-catchment scales.

A new approach recognises that GFS frameworks are an important tool for managing dryland salinity in Australia, but that data paucity currently restricts their functionality to supporting catchment and broader scale salinity management. A new methodology for adding value to GFS frameworks has been developed for upland, largely erosional sub-catchments in SE Australia. The methodology utilises a hierarchical, multi-scale, multi-disciplinary mapping approach that incorporates information from national to sub-catchment scales. This nested scale approach provide a framework for identifying the spatial extents of landscapes with similar 3D regolith character, and this in turn enables the design of more detailed farm- and sub-catchment scale hydrogeological investigations to characterise salinity processes.

The approach enables finite research resources to be used in areas most likely to characterise sub-catchments, and permits more rapid and reliable extrapolation of 3D regolith, groundwater and salinity attributes. While the approach maximises the use of existing geoscientific data, limited acquisition of new regolith and hydrogeological data is also involved. This includes stream salinity surveys, and acquisition of new 3D regolith data (from surface mapping and from analysis of existing or new boreholes and limited ground geophysics), and groundwater data. This information is used to provide information on salt stores, and groundwater and salinity dynamics, and has been used to provide more detailed GFS maps, and inputs to hydrogeological and broader decision support models (eg SIF3).

A key outcome of this research is a more detailed characterisation of the regolith landscapes of the SE Murray-Darling Basin that better represents its true complexity. As this regolith layer is the main store for salts, and the groundwaters that mobilise these salts, resolving this regolith architecture is a high priority for calibrating salinity models. Importantly, physiographic region mapping has enabled the boundaries of these changes in landscape complexity to be determined. These boundaries appear to place important constraints on landscape complexity, regolith thickness and potential salt stores. Variations occur at several scales, ranging from hundreds to tens of kilometres. These variations are not recorded on any existing maps, yet this information has the potential to significantly influence the use of GFS and other groundwater and salinity models in Australia. A hierarchical, multi-scale, multi-disciplinary approach is required to map the extent of regolith units with different character and complexity. More detailed products incorporating new regolith, hydrogeological, and salinity data show encouraging results and should provide an improved science basis for salinity management, particularly at sub-catchment scales.