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Using Dynamically Downscaled Rainfall Data to Investigate Soil Moisture Spatial Patterns Across Eastern Australia and the Impact of Projected Climate Change Trends

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The wetness of the soil in a region plays a major role in hydrological processes and land-surface-atmosphere interactions. For example, the wetness of the soil prior to a rainfall event plays an important role in determining how much rainfall is converted to runoff. This can impact the size and timing of any resulting flood. This study used dynamically downscaled GCM rainfall projections from the New South Wales (NSW) / ACT Regional Climate Modelling (NARCliM) project to simulate soil moisture at 10km resolution across NSW, Australia (approximately 1000km x 1000km). The NARCliM project has produced an ensemble of regional climate projections for south-east Australia, in particular 10 by 10 km resolution hourly rainfall data. 12 different projections of rainfall have been produced for three 20 year time periods; 1990-2009, 2020-2039 and 2060-2079. An hourly time series of soil moisture was simulated from each of the rainfall data sets using the Australian Water Balance Model (AWBM), which in turn had been calibrated to daily data from a HYDRUS model calibrated to field soil moisture from the SASMAS field site. Using the simulated soil moisture timeseries, contour maps of the soil moisture statistics (such as median and 5% soil moisture values) were developed for NSW. We also examined the joint probability of extreme rainfall and antecedent soil moisture prior to extreme rainfall events. Rainfall events of varying durations were considered. For short duration rainfall events, an initial analysis showed that a clear relationship exists between the antecedent soil moisture and extreme rainfall; as the rainfall depth increases so too does the antecedent soil moisture. This will inform procedures for estimating the antecedent soil moisture used in engineering hydrology flood studies. Our results suggest that a normalised antecedent soil moisture relationship we have derived may be geographically regionalisable and robust against changes in governing climate, and so may be applicable outside our study area and suitable for climate change adaptation studies. Results from the 12 rainfall climate change projections and three future time periods will be presented. The impact of climate change on the soil moisture statistics as well as the soil moisture-extreme rainfall relationship will also be presented.