Afternoon ANU Theatre 2 Sessions – Caves/Groundwater Recharge/Climate

Characterising Groundwater Recharge from Cave Terrestrial Lidar and Drip Water Analysis

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Limestone aeolianites constitute karstic aquifers covering much of the western and southern Australian coastal fringe. They are a key groundwater resource for a range of industries such as winery and tourism, and provide important ecosystem services such as habitat for stygofauna. Caves offer a natural inception point to observe both the long term groundwater recharge and the preferential movement of water through the unsaturated zone of such limestone. With the availability of automated drip rate logging systems and remote sensing techniques, it is now possible to deploy the combination of these methods for larger scale studies of infiltration processes within a cave. In this study we present the largest spatial and temporal survey of automated cave drip rate monitoring published to date in two large chambers of the Golgotha Cave, South-West Western Australia, with the aim of better understanding infiltration water hydrogeology and the relationship between infiltration, stalactite morphology and groundwater recharge. By applying morphological analysis of ceiling features from Terrestrial Lidar data, coupled with long-term drip time series and climate data, we demonstrate the nature of the relationships between infiltration through fractures in the limestone and groundwater recharge. Similarity between drip rate time series can be interpreted in terms of flow patterns, cave chamber morphology and lithology. Moreover, we develop a new technique to estimate groundwater recharge even in large scale caves, which is important for understanding the water cycle, for contaminant transport and for water management. The drip loggers do not demonstrate a single discharge response to effective precipitation, instead displaying an apparently diverse range of drip rates, with varying statistical properties. This new technique can be applied to other cave sites to identify highly focused areas of groundwater recharge and can help better estimate the total recharge volume.