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Estimation of the isotopic composition of evaporated water at Loveday Disposal Basin using a constant-volume evaporation pan experiment.

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Executive Summary

A constant-volume evaporation pan experiment was conducted to estimate the isotopic composition of evaporated water (δ_E) at Loveday Disposal Basin. This approach can be used to estimate *m* and *K*, the two exchange parameters required to estimate the specific δ_E for a given water body (Allison and Leaney 1982). A pan set-up was installed at the Loxton Research Centre, approximately 40 km from Loveday Disposal Basin, and was operated from January 23 to February 24, 2007. The pan was set next to an Australian Bureau of Meteorology station, where ancillary meteorological data (temperature, potential evapotranspiration, relative humidity, etc) was collected. Due to logistical constraints, only the $\delta^{18}O$ is analysed in this report.

The $\delta^{18}O$ of the pan took approximately two weeks to reach a pseudo-steady state value of 8.3‰ (the *K* parameter), between February 8 and 19. The pseudo-steady state was broken on February 20 following a small rain event and another steady state had not been reached by the time the experiment was concluded. Using *m* values calculated from relative humidity measurements at Loxton, monthly δ_E for Loveday were estimated for the summer months in 2005-06 and 2006-07. The estimated *K* value for ^{18}O was within the range of annual $\delta^{18}O$ values of Loveday water and similar to summer months values.

There are a few caveats to the estimates of δ_E obtained with the pan experiment. It was noted that daily water temperature variations were greater in the pan than in Loveday, and that on average the pan was slightly cooler. These differences could have induced a bias in the estimation of *m*. However, the mean *m* calculated from either free atmospheric *h* or normalized *h* showed no significant difference, so either method can be used at this location. Due to the short duration of the pan experiment, the *K* and *m* values are probably only applicable to summer months.

A number of improvements to the design of the experiment are proposed to enhance the capability to measure δ_E accurately in Loveday and similar water bodies It is recommended that measures be taken to limit the variability in water temperature between the pan and the targeted water body. The experiment should be repeated on a seasonal basis to provide seasonal estimates of δ_E. Relative humidity should also be measured at the water body itself in case the atmospheric environment is slightly different on floodplains than the nearby upland areas, where meteorological stations tend to be located