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Research Note: Derivation of temperature lapse rates in semi-arid south-eastern Arizona

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Abstract. Ecological and hydrological modelling at the regional scale requires distributed information on weather variables, and temperature is important among these. In an area of basin and range topography with a wide range of elevations, such as south-eastern Arizona, measurements are usually available only at a relatively small number of locations and elevations, and temperatures elsewhere must be estimated from atmospheric lapse rate. This paper derives the lapse rates to estimate maximum, minimum and mean daily temperatures from elevation. Lapse rates were calculated using air temperatures at 2 m collected during 2002 at 18 locations across south-eastern Arizona, with elevations from 779 to 2512 m. The lapse rate predicted for the minimum temperature was lower than the mean environmental lapse rate (MELR), i.e. 6 K km⁻¹, whereas those predicted for the mean and maximum daily temperature were very similar to the MELR. Lapse rates were also derived from radiosonde data at 00 and 12 UTC (5 pm and 5 am local time, respectively). The lapse rates calculated from radiosonde data were greater than those from the 2 m measurements, presumably because the effect of the surface was less. Given temperatures measured at Tucson airport, temperatures at the other sites were predicted using the different estimates of lapse rates. The best predictions of temperatures used the locally predicted lapse rates. In the case of maximum and mean temperature, using the MELR also resulted in accurate predictions.

Keywords: near surface lapse rates, semi-arid climate, mean minimum and maximum temperatures, basin and range topography

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