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Climate based risk of pesticide leaching by preferential flow: A regional assessment in the south-west of Western Australia

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Pesticide transport to streams and groundwater occurs episodically driven by rainfall events which trigger fast flow processes such as preferential flow. To evaluate pesticide leaching potential the attenuation factor (AF) is often used as a screening tool. The physical process it represents, however, is not consistent with the episodic and discrete nature of pesticide transport observed in the field. We propose a physically based preferential flow leaching index (PF) based upon the structure of natural rainfall. The PF index describes the proportion of chemical which is partitioned between the soil matrix and preferential flow pathways. We show how the AF and PF compare as a function of sorption capacity and degradation half life. Predictions of pesticide leaching potential with PF are more consistent with observed pesticide loads than the AF. Within the context of the we conducted a climate based regional risk assessment of pesticide leaching for the Wheatbelt region of the south-west of Western Australia. This was done for a suite of pesticides on a single soil type to evaluate the impact of spatial differences in rainfall variability. Moderately sorbing, slowly degrading solutes have a greater regional leaching potential than both strongly and weakly sorbing solutes. The spatial patterns of the mean and the coefficient of variation of annual loads were related to the frequency of preferential flow event triggering which was caused by change in the dominant preferential flow event triggering rainfall from frequent low intensity rainfall along the western and southern coasts to infrequent high intensity events in the east. In between leaching potential is lower despite higher annual rainfall than the east. Peak loads of a suite of chemicals were found to converge to mid-winter, independent of application time indicating periods of high loads of multiple pesticides

may be an unavoidable consequence of the seasonality of storm properties.