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Indicators for the the distribution of flood recharge along ephemeral rivers

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The longitudinal distribution of recharge from floods in ephemeral rivers in semi-arid and arid regions results from complex interactions between runoff-generation processes, transmission losses and storage capacity in the alluvial aquifer. While single event analysis provides data on recharge at specific conditions, data on the characteristic distribution of groundwater recharge along the alluvial aquifer is difficult to obtain. Within the project WADE 'FloodWater Recharge of Alluvial Aquifers in Dryland Environments' (GOCE-CT-2003- 506680-WADE) alluvial aquifers in South Africa (Buffelsrivier/Namaqualand), Namibia (Kuiseb), Spain (Almeria) and Israel (Arava) were investigated. Studies of longitudinal profiles of stable isotopes of water (oxygen-18, deuterium) and of age indicators for recent groundwater recharge (tritium, CFCs, SF6) in ephemeral streams revealed different distribution types. In the lower part of the Kuiseb river in Namibia the isotopic evolution indicates a clear decrease in the stable isotope pattern not accompagnied by a significant change in the age indicators. The longitudinal evolution of the stable isotope composition of groundwater in the alluvium points to a 'chromatographic effect': Larger floods with lighter isotopic fingerprints recharge further downstream, recharge from smaller floods with heavier compositions is more frequent further upstream. Similar longitudinal isotopic profiles could not be found in the alluvial groundwater of the ephemeral streams investigated in South Africa (Buffelsrivier) and southern Spain (Andarax). The isotopic composition in the other basins is characterized by a trend towards heavier values indicating the dominance of inflows from lower parts of the catchment. The combined longitudinal profiles of CFCs, tritium and stable isotopes result from the relative proportion of flood recharge, longitudinal throughflow and lateral subsurface inflow and could serve as proxy-data for long-term recharge patterns and for the connectivity of alluvial aquifer systems.