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Locally calibrated rice yield–salinity thresholds for the Guadalquivir River rice-growing district

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Abstract. Rice production in the Guadalquivir River rice-growing area (Spain) relies on flood irrigation and is exposed to high salinity levels in the pumped water. This study aimed to link water-quality monitoring with rice yield response and to enable district-scale assessment of salinity-driven losses by converting available chloride concentration data (Cl^-) to electrical conductivity (EC), calibrating local yield–salinity parameters, and applying the locally calibrated yield function to the district with a circulation water and solute mass-balance model previously developed.

Paired Cl^- and EC measurements from a monitoring network were used to fit a proportional relationship ($Cl^- = a \cdot EC$). Farm-scale yield records were related to salinity expressed as EC using the Maas and Hoffman threshold model: $100 \cdot Y/Ymax = 100 - Bs \cdot (EC - ECu)$, where Y and Ymax are the yield and maximum yield, ECu is the salinity threshold, and Bs is the slope of yield loss beyond the threshold.

Monitoring confirmed a stable proportionality of Cl^- with EC. Yields declined linearly above the threshold and parameters ECu and Bs were fitted. Finally, a yield-loss module was coupled to the existent mass-balance model to quantify production losses driven by salinity and to benchmark differences in yield loss among scenarios.

Keywords: salinity, yield, rice, irrigation.