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Optimizing forecast-based actions for extreme rainfall in Peru

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Natural disaster management has recently seen a major innovation through the advent of standardized forecast-based action and financing protocols. Given a forecast with adequate skill and lead time, relief actions can be taken before, rather than after, a disaster, saving lives and property while also transferring some ex-post risk to ex-ante risk for the relief agency. Multi-stage actions, in which forecasts with longer leads allow for preparation while short-term forecasts trigger direct actions, may be particularly effective at reducing risk. Multi-stage protocols, however, have not been explicitly optimized, either through trigger mechanisms or forecast tailoring. This study considers a multi-stage early action protocol developed by the Peruvian Red Cross for El Niño-induced extreme rainfall in coastal Peru. A sensitivity analysis of trigger thresholds, forecast methods, and levels of risk aversion is conducted to recommend optimal actions. Results demonstrate the relative importance of benefit-cost ratios at different lead times; forecast technology and risk aversion play a lesser but still valuable role. Moreover, the optimization framework can be utilized without post-disaster monitoring and evaluation, enabling the proliferation of effective plans in other disaster-prone regions.