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Seasonal hydrological forecasting skill for Irish catchments using persistence

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This research seeks to examine seasonal hydrological forecasting methods for Ireland's unique hydrology and varied climate, and provide a test-bed for ground-truthing cutting-edge approaches in a challenging hydrological environment. As a first step, and to provide a benchmark for testing more complex methods, we examine the skill of persistence of the previous month's flow as a simple approach for developing monthly river flow forecasts at lead times from one to three months. The analysis is undertaken for 52 catchments with high quality data that represent the range of hydrological conditions on the island. Skill is assessed against a streamflow climatology benchmark and by examining correlations between predicted and observed flows. We find that skill at each station is dependent on lead time, forecast initialisation month and individual catchment characteristics. Greatest skill is found using a one-month lead time, particularly for summer [JJA] initialisation months where 72% of stations show skill relative to the benchmark. Summer skill is attributed to catchment's 'memory' during drier months. Indeed the Base Flow Index, a measure of catchment storage, is strongly correlated with persistence forecast skill (ρ = 0.84). Across the catchment sample, on average; persistence has skill relative to climatology in June, July and August. This skill extends to May in stations with a BFI $>$ 0.4 and extends to September for catchments with BFI $>$ 0.7. Forecast skill is also strongly correlated with annual average rainfall (1961-1990), with drier catchments showing greatest skill (ρ = -0.73). There is a notable spatial distribution of persistence skill across the island with skill predominantly found in the east, midlands and south-east of the island; where there is a lower average rainfall and relatively higher average BFI. Thus this work offers a benchmark for assessing more complex forecasting methods in Ireland; indicating exactly when and where flow persistence is currently the toughest forecasting method to beat.