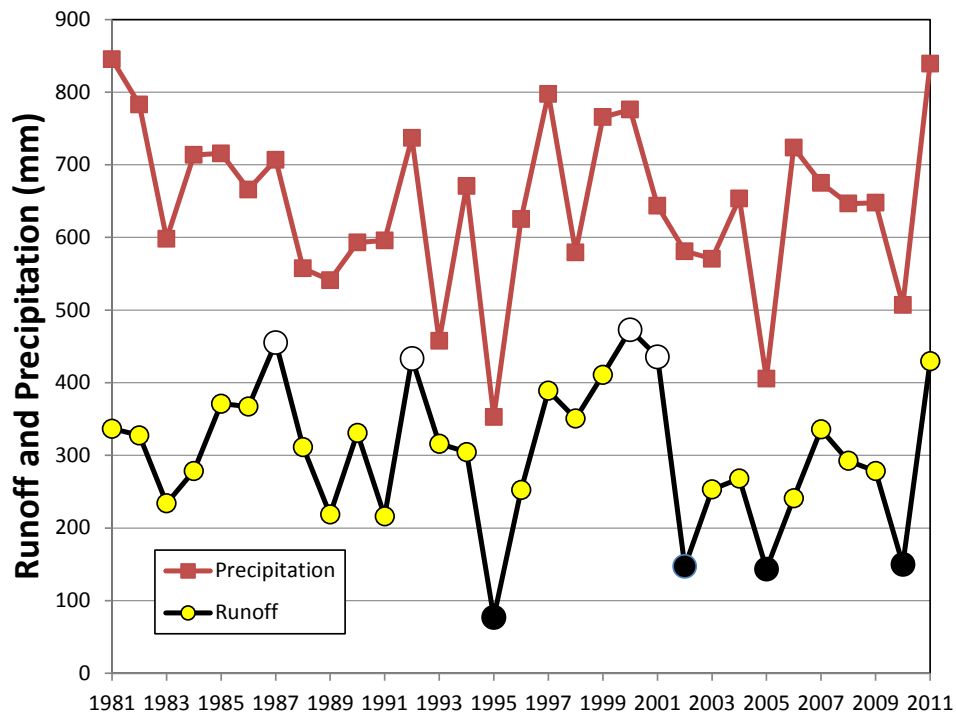
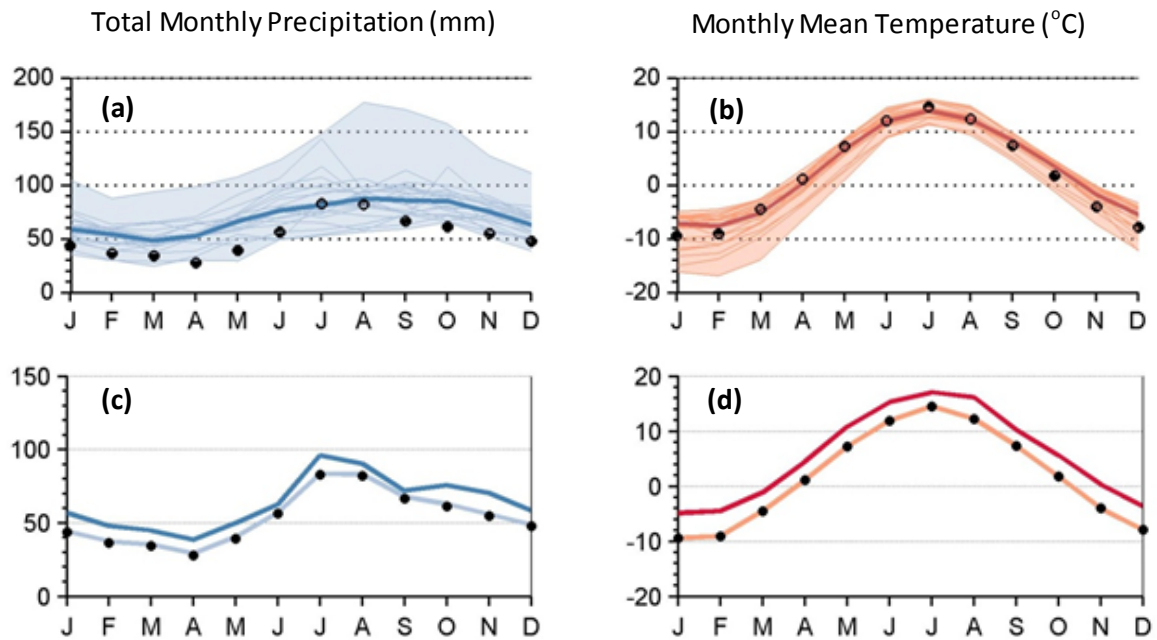
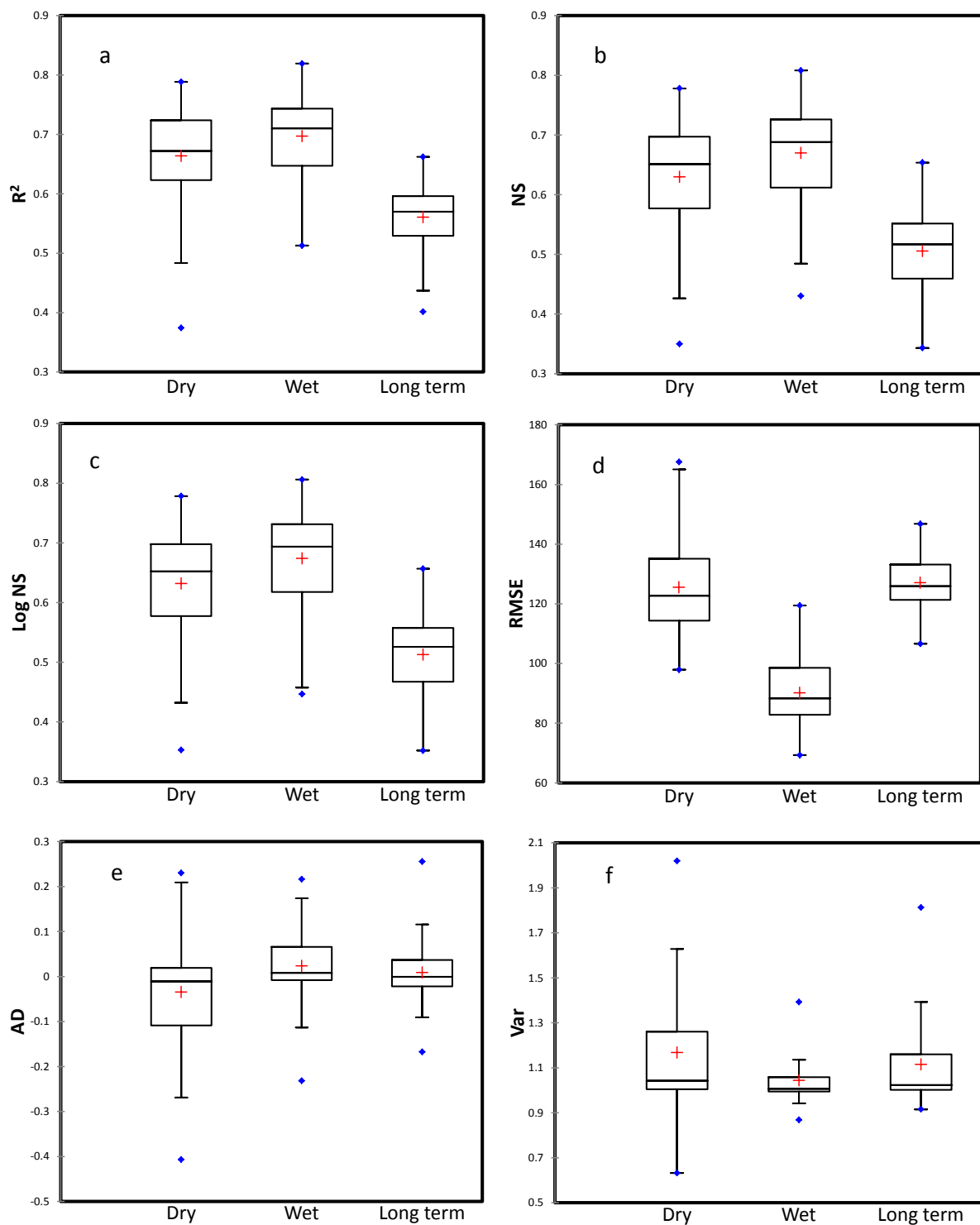
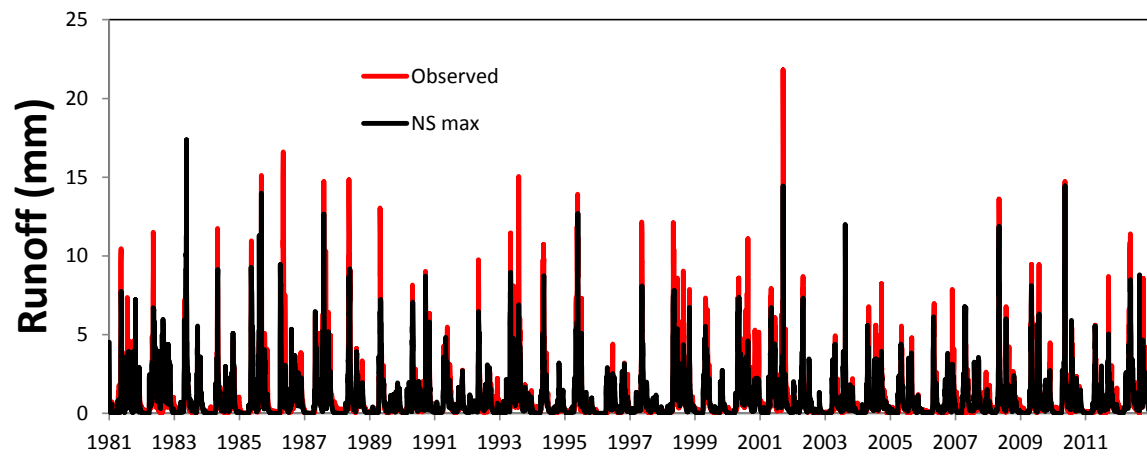
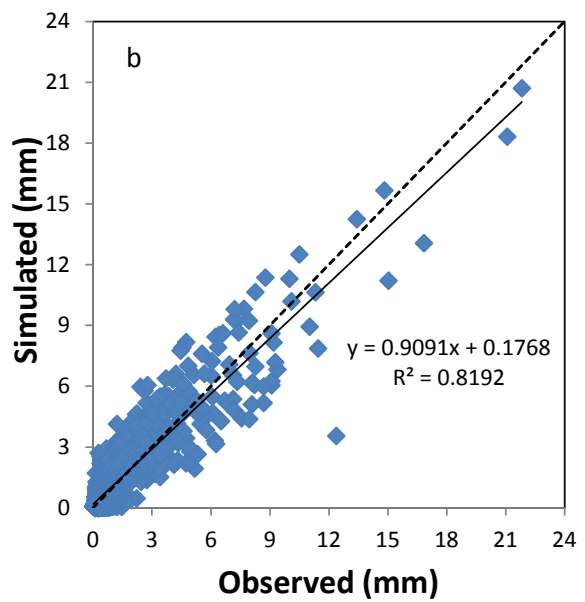
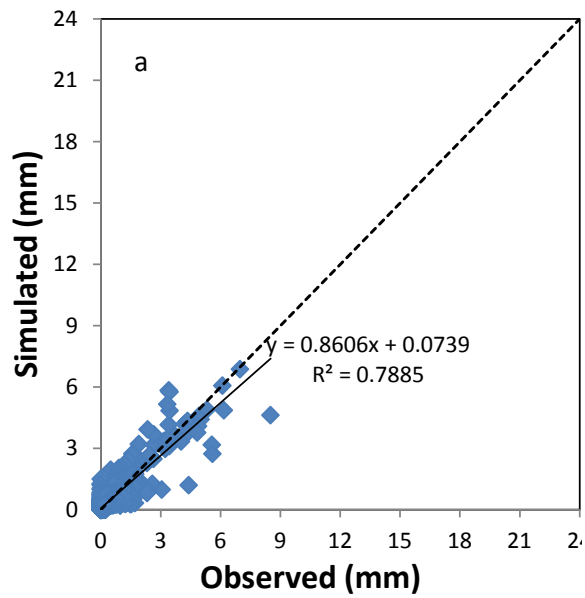
Supplementary 1: Long term patterns of precipitation and runoff records in Svartberget, showing the magnitude of variability in precipitation and runoff from 1981-2011 hydrologic years. White round symbols represent wet years (1987, 1992, 2000 and 2001) while black round symbols signify dry years (1995, 2002, 2005 and 2010). The yellow round symbols denote intermediate years and were not considered in the extreme analysis.

Supplementary 2: Monthly mean precipitation (a) and temperature (b) for the control period 1981–2010 as simulated by 15 individual Regional Climate Models (RCMs) (blue/red thin curves). Observations (black circles) and the RCM-ensemble means (blue/red thick curve) are also displayed. Seasonal changes in precipitation (c) and temperature (d) as projected by the ensemble median of 15 RCMs from the control run 1981-2010 (light blue/red) to the future scenario 2061-2090 (dark blue/red). Observations (1981-2010) are shown as black circles.

Supplementary 3: Multi-criteria calibration objectives used during the MCMC calibration runs in PERSiST: a) is the behavioral parameters based on Nash Sutcliffe statistics, b) is the log Nash Sutcliffe, c) is the coefficient of determination, d) is the root mean square error, e) is the absolute volume difference between the modelled and observed series and f) is the Variance of the modelled flow to the observed series. The whiskers represent 25th and 75th percentiles while the boxex represents the 50th percentile. The red cross represents the mean.

Supplementary 4: Sample PERSiST simulation of historical long term record using best parameter sets based on NS.

Supplementary 5: Model performance in simulating runoff conditions in a) dry and b) wet year regimes using NS best performing parameters.

Supplementary 6: Comparison of runoff ensemble projections in wet and dry year regimes versus the long term record, using minimum and best parameter sets from representative performance metrics. The observed and calibration represent model performances under present day conditions based on NS, R^2 and Var metrics. Best parameter sets based on NS, log NS or R^2 has minimum RMSE and vice versa (not shown). The numbered diamond symbols represent the individual RCMs (Table 1). The clusters of numbered diamonds represent range of runoff projections in dry and wet year regimes (y-axis) versus long term record (x-axis). Ensemble runoff projections were based on downscaled time series shown in SI 2.