# ELECTRONIC SUPPLEMENTARY MATERIAL (ESM)

## S1. SWAT model calibration

Table S1. Parameters adjusted during SWAT model calibration

| PARAMETER | DEFINITION |
|---|---|
| **Groundwater Group** | |
| GW_DELAY | Groundwater delay (days) |
| GWQMN | Threshold depth of water in the shallow aquifer for return flow to occur (mm) |
| GW_REVAP | Groundwater "revap" coefficient |
| REVAPMN | Threshold depth of water in the shallow aquifer for "revap" to occur (mm) |
| RCHRG_DP | Deep aquifer percolation fraction |
| ALPHA_BF | Baseflow alpha factor (days) |
| **Snow Group** | |
| SFTMP | Snowfall temperature (°C) |
| SMTMP | Snow melt base temperature (°C) |
| SMFMX | Maximum melt rate for snow during year (mm/°C/day) |
| SMFMN | Minimum melt rate for snow during year (mm/°C/day) |
| **Soil and stream channel Group** | |
| SURLAG | Surface runoff lag time (days) |
| CN2 | Initial SCS runoff curve number for moisture condition II |
| SOL_AWC | Available water capacity of the soil layer (mm/mm) |
| SOL_K | Saturated hydraulic conductivity of the soil layer (mm/hr) |
| CH_K1 | Effective hydraulic conductivity in tributary channel alluvium (mm/hr) |
| CH_N1 | Manning's "n" value for the tributary channels |
| CH_K2 | Effective hydraulic conductivity in main channel alluvium (mm/hr) |
| CH_N2 | Manning's "n" value for the main channel |
| OV_N | Default Manning's "n" value for overland flow for land cover/plant |

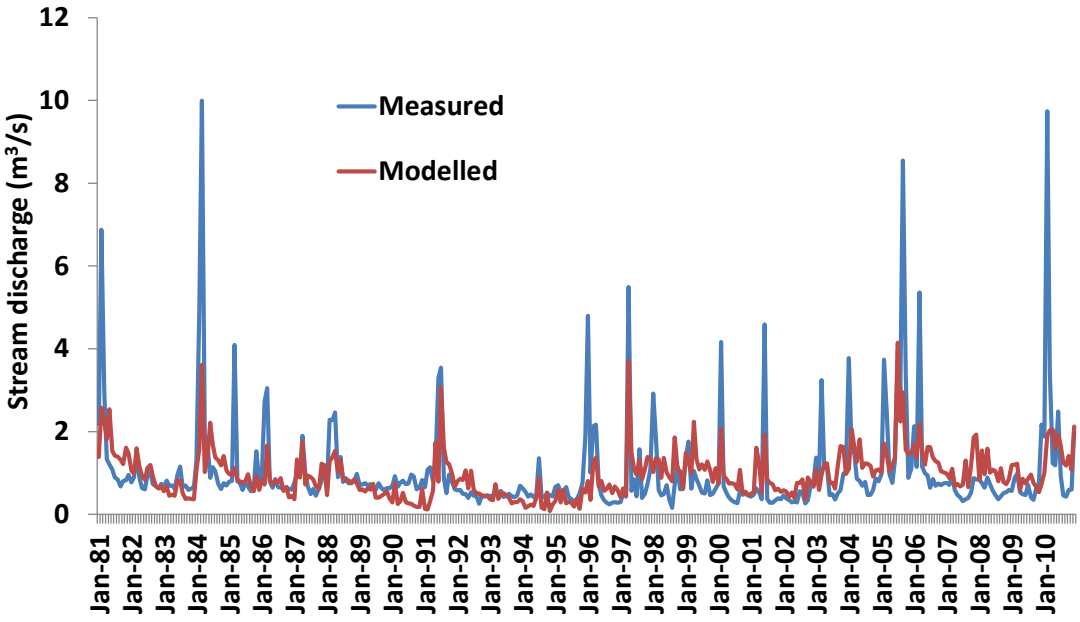


**Figure S1.** Monthly measured and calibrated stream discharge (Moara din Groapa; 1981 – 2010)

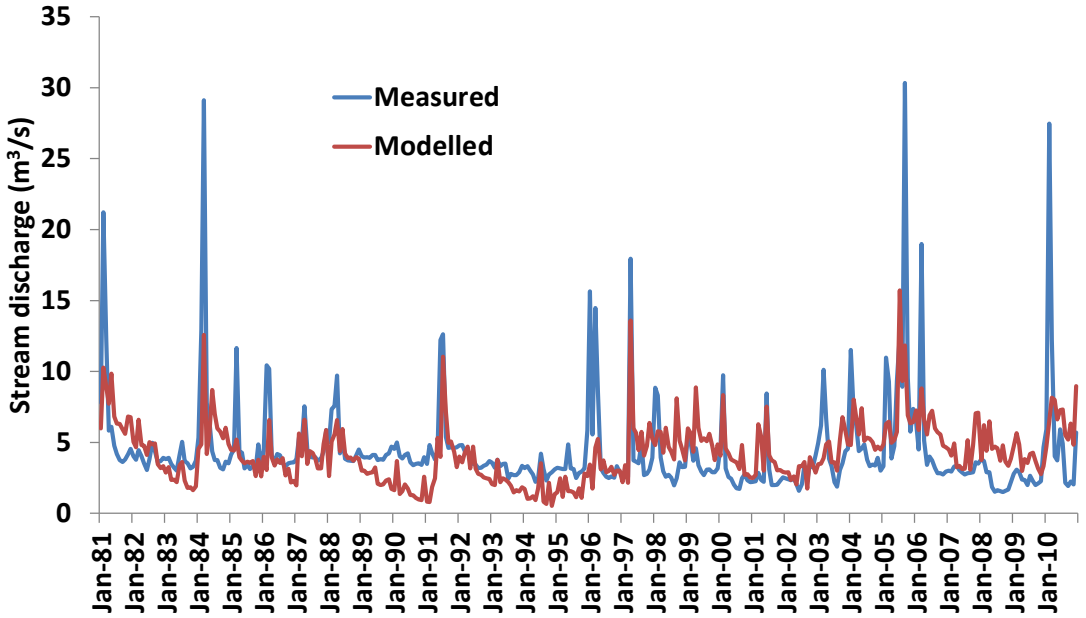


**Figure S2.** Monthly measured and calibrated stream discharge (Vadu Lat; 1981 – 2010)

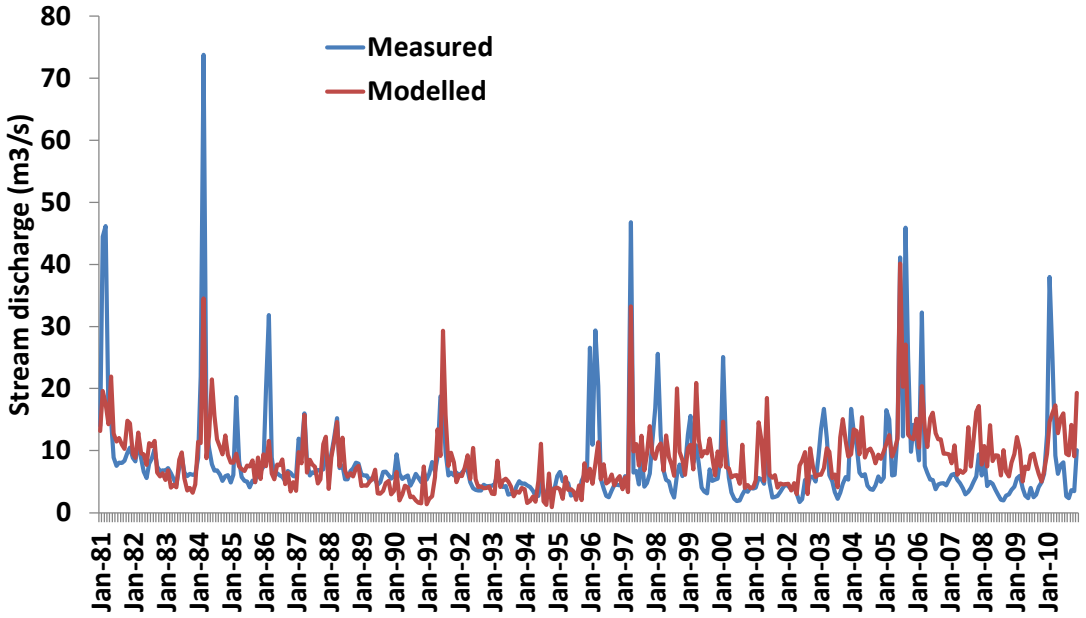


**Figure S3.** Monthly measured and calibrated stream discharge (Calugareni; 1981 – 2010)

## S2. Output from climate models

**Table S2.** Averages for temperature, precipitation and associated climate indicators for each climate model output for the reference, short- and long-term periods

| *Parameter* | *CNRM RCP 4.5* | *CNRM RCP 8.5* | *MPI RCP 4.5* | *MPI RCP 8.5* | *ICHEC RCP 4.5* | *ICHEC RCP 8.5* | *ENS RCP 4.5* | *ENS RCP 8.5* |
|---|---|---|---|---|---|---|---|---|
| | | | | **1981 - 2010 (reference)** | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Precip. (mm /yr) | 576.2 | 594.2 | 526.4 | 533.6 | 536.0 | 553.1 | 546.2 | 560.3 |
| Ave. daily Tave. (ºC) | 9.3 | 9.1 | 12.5 | 12.5 | 10.8 | 10.7 | 10.8 | 10.8 |
| Ave. daily Tmax. (ºC) | 15.0 | 14.8 | 18.2 | 18.1 | 14.8 | 14.8 | 16.0 | 15.9 |
| Ave. daily Tmin. (ºC) | 3.8 | 3.7 | 7.0 | 6.9 | 6.9 | 6.9 | 5.9 | 5.8 |
| Days with T<0ºC (/yr) | 134.0 | 136.1 | 77.0 | 77.0 | 83.5 | 82.9 | 98.2 | 98.7 |
| Days with T>25ºC (/yr) | 81.6 | 79.5 | 108.3 | 106.7 | 64.0 | 63.4 | 84.6 | 83.2 |
| Days with T>35ºC (/yr) | 2.0 | 1.7 | 13.1 | 13.7 | 0.1 | 0.1 | 5.1 | 5.2 |
| Days with precip. (/yr) | 190.1 | 192.6 | 157.5 | 156.6 | 142.8 | 144.8 | 163.5 | 164.6 |
| **2021-2050 (short-term)** | | | | | | | | |
| Precip. (mm /yr) | 633.0 | 618.4 | 534.1 | 520.8 | 494.3 | 546.2 | 553.8 | 561.8 |
| Ave. daily Tave. (ºC) | 10.2 | 10.4 | 13.7 | 13.4 | 12.2 | 12.5 | 12.0 | 12.1 |
| Ave. daily Tmax. (ºC) | 15.8 | 16.0 | 19.4 | 19.1 | 16.2 | 16.6 | 17.2 | 17.2 |
| Ave. daily Tmin. (ºC) | 4.8 | 5.0 | 8.1 | 7.8 | 8.4 | 8.7 | 7.1 | 7.2 |
| Days with T<0ºC (/yr) | 125.8 | 120.5 | 62.0 | 73.0 | 67.9 | 57.8 | 85.2 | 83.7 |
| Days with T>25ºC (/yr) | 93.7 | 92.0 | 120.6 | 122.1 | 89.3 | 86.4 | 101.2 | 100.1 |
| Days with T>35ºC (/yr) | 4.7 | 3.2 | 24.5 | 25.1 | 1.7 | 0.8 | 10.3 | 9.7 |
| Days with precip. (/yr) | 191.6 | 191.2 | 155.0 | 148.7 | 132.9 | 138.9 | 159.8 | 159.6 |
| **2071-2100 (long-term)** | | | | | | | | |
| Precip. (mm /yr) | 641.6 | 663.1 | 454.3 | 465.2 | 522.0 | 525.0 | 539.3 | 551.1 |
| Ave. daily Tave. (ºC) | 12.0 | 13.4 | 14.3 | 16.8 | 12.9 | 14.9 | 13.1 | 15.0 |
| Ave. daily Tmax. (ºC) | 17.7 | 19.1 | 20.1 | 22.7 | 17.0 | 18.9 | 18.3 | 20.2 |
| Ave. daily Tmin. (ºC) | 6.5 | 8.1 | 8.7 | 11.0 | 9.2 | 11.2 | 8.1 | 10.1 |
| Days with T<0ºC (/yr) | 96.3 | 77.5 | 59.0 | 30.7 | 56.3 | 36.4 | 70.6 | 48.2 |
| Days with T>25ºC (/yr) | 105.3 | 116.6 | 129.8 | 151.7 | 93.4 | 119.9 | 109.5 | 129.4 |
| Days with T>35ºC (/yr) | 6.6 | 14.8 | 35.1 | 57.1 | 2.1 | 9.6 | 14.6 | 27.2 |
| Days with precip. (/yr) | 185.9 | 184.9 | 145.0 | 134.6 | 138.5 | 126.4 | 156.5 | 148.7 |

**Table S3.** Monthly values for the temperature and precipitation based climate indicators for the representative year for each climate model ensemble output for the reference, short- and long-term periods (catchment scale)

| **Parameter** | **ENS RCP 4.5** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1981-2010 (reference)** | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Ave. daily Tmax. (ºC) | 2.2 | 4.5 | 10.6 | 17.0 | 21.1 | 25.3 | 28.9 | 28.5 | 23.7 | 16.9 | 9.1 | 4.4 |
| Ave. daily Tmin. (ºC) | -5.1 | -4.2 | 0.1 | 5.5 | 10.0 | 13.9 | 16.7 | 16.4 | 12.4 | 6.5 | 1.1 | -2.6 |
| Days with T<0ºC (/yr) | 25.6 | 21.6 | 13.7 | 3.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 11.5 | 21.4 |
| Days with T>25ºC (/yr) | 0.0 | 0.0 | 0.0 | 1.1 | 4.9 | 15.1 | 26.0 | 24.4 | 11.8 | 1.3 | 0.0 | 0.0 |
| Days with T>35ºC (/yr) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 2.4 | 2.0 | 0.2 | 0.0 | 0.0 | 0.0 |
| Days with precip. (/yr) | 16.9 | 13.3 | 13.4 | 13.6 | 16.9 | 15.8 | 12.8 | 9.8 | 9.3 | 10.3 | 14.3 | 17.2 |
| **2021-2050 (short-term)** | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Ave. daily Tmax. (ºC) | 3.9 | 6.0 | 11.3 | 17.2 | 22.0 | 27.1 | 30.5 | 30.1 | 24.9 | 17.8 | 10.4 | 4.7 |
| Ave. daily Tmin. (ºC) | -3.4 | -2.5 | 1.0 | 6.0 | 10.8 | 15.4 | 18.3 | 17.9 | 13.7 | 7.8 | 2.3 | -2.1 |
| Days with T<0ºC (/yr) | 22.8 | 18.7 | 11.4 | 2.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 8.8 | 20.3 |
| Days with T>25ºC (/yr) | 0.0 | 0.0 | 0.1 | 1.3 | 6.8 | 20.3 | 28.2 | 27.5 | 14.7 | 2.3 | 0.0 | 0.0 |
| Days with T>35ºC (/yr) | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.3 | 4.7 | 3.8 | 0.3 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days with precip. (/yr) | 16.4 | 14.2 | 14.1 | 14.0 | 16.2 | 14.0 | 11.1 | 8.5 | 8.5 | 11.0 | 14.9 | 17.2 |
| **2071-2100 (long-term)** | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Ave. daily Tmax. (ºC) | 5.2 | 7.7 | 13.6 | 18.4 | 23.1 | 27.5 | 31.2 | 30.9 | 25.8 | 18.5 | 11.3 | 6.0 |
| Ave. daily Tmin. (ºC) | -2.3 | -1.4 | 2.8 | 7.2 | 11.9 | 16.1 | 19.1 | 18.8 | 14.5 | 8.7 | 2.9 | -0.9 |
| Days with T<0ºC (/yr) | 21.0 | 16.4 | 7.1 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 7.0 | 17.8 |
| Days with T>25ºC (/yr) | 0.0 | 0.0 | 0.4 | 1.9 | 9.4 | 21.1 | 29.0 | 28.4 | 16.5 | 2.8 | 0.0 | 0.0 |
| Days with T>35ºC (/yr) | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.5 | 6.1 | 5.9 | 0.9 | 0.0 | 0.0 | 0.0 |
| Days with precip. (/yr) | 15.4 | 13.1 | 13.4 | 13.6 | 15.7 | 15.0 | 11.5 | 9.2 | 8.7 | 10.8 | 13.6 | 16.6 |
| **ENS RCP 8.5** | | | | | | | | | | | | |
| **1981-2010 (reference)** | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Ave. daily Tmax. (ºC) | 2.1 | 4.4 | 10.6 | 16.9 | 21.1 | 25.1 | 28.7 | 28.6 | 23.4 | 16.9 | 8.9 | 4.3 |
| Ave. daily Tmin. (ºC) | -5.2 | -4.2 | 0.1 | 5.4 | 10.0 | 13.9 | 16.6 | 16.4 | 12.1 | 6.5 | 0.9 | -2.6 |
| Days with T<0ºC (/yr) | 25.6 | 21.4 | 13.6 | 3.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 12.0 | 21.5 |
| Days with T>25ºC (/yr) | 0.0 | 0.0 | 0.0 | 0.8 | 4.9 | 14.7 | 25.6 | 24.7 | 11.1 | 1.4 | 0.0 | 0.0 |
| Days with T>35ºC (/yr) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 2.2 | 2.3 | 0.2 | 0.0 | 0.0 | 0.0 |
| Days with precip. (/yr) | 16.9 | 13.7 | 13.6 | 13.6 | 17.0 | 16.6 | 13.0 | 9.4 | 9.4 | 10.6 | 13.9 | 17.0 |
| **2021-2050 (short-term)** | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Ave. daily Tmax. (ºC) | 2.8 | 6.7 | 12.0 | 17.7 | 22.3 | 26.7 | 30.1 | 29.7 | 24.9 | 18.5 | 10.6 | 4.8 |
| Ave. daily Tmin. (ºC) | -4.2 | -2.1 | 1.5 | 6.5 | 11.1 | 15.4 | 18.2 | 17.8 | 13.6 | 8.3 | 2.3 | -1.9 |
| Days with T<0ºC (/yr) | 23.9 | 18.0 | 10.6 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 8.6 | 20.3 |
| Days with T>25ºC (/yr) | 0.0 | 0.0 | 0.1 | 1.3 | 7.5 | 18.8 | 27.8 | 27.0 | 14.6 | 2.9 | 0.0 | 0.0 |
| Days with T>35ºC (/yr) | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.4 | 3.8 | 3.8 | 0.6 | 0.0 | 0.0 | 0.0 |
| Days with precip. (/yr) | 16.1 | 13.5 | 13.9 | 14.3 | 15.9 | 15.3 | 12.1 | 8.9 | 8.5 | 10.5 | 14.5 | 16.3 |
| **2071-2100 (long-term)** | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Ave. daily Tmax. (ºC) | 7.5 | 10.6 | 15.3 | 20.1 | 24.5 | 29.7 | 33.4 | 33.0 | 27.6 | 19.9 | 12.8 | 8.5 |
| Ave. daily Tmin. (ºC) | -0.5 | 1.1 | 4.5 | 9.2 | 13.4 | 18.3 | 21.5 | 21.1 | 16.6 | 10.3 | 4.5 | 1.2 |
| Days with T<0ºC (/yr) | 16.0 | 10.9 | 4.6 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 4.2 | 12.1 |
| Days with T>25ºC (/yr) | 0.0 | 0.0 | 0.8 | 4.2 | 13.2 | 25.0 | 30.4 | 29.9 | 21.2 | 4.8 | 0.1 | 0.0 |
| Days with T>35ºC (/yr) | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 4.2 | 9.9 | 9.9 | 2.2 | 0.0 | 0.0 | 0.0 |
| Days with precip. (/yr) | 14.6 | 12.8 | 12.6 | 13.7 | 14.9 | 14.3 | 10.1 | 8.2 | 8.0 | 10.4 | 13.3 | 15.9 |

**Table S4.** Monthly values for main water balance components for the representative year for each climate model ensemble output for the reference, short- and long-term periods (catchment scale)

| | | ENS. RCP 4.5 | | | | | | | ENS. RCP 8.5 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1981 – 2010 (reference) | | | | | | | | | | | | | | | |
| **Month** | **SNMT** | **PET** | **ET** | **SW** | **PERC** | **SURF** | **LAT** | **Q** | **SNMT** | **PET** | **ET** | **SW** | **PERC** | **SURF** | **LAT** | **Q** |
| | mm | mm | mm | mm | mm | mm | mm | $m^3/s$ | mm | mm | mm | mm | mm | mm | mm | $m^3/s$ |
| Jan | 23.7 | 15.6 | 8.6 | 99.3 | 3.6 | 0.2 | 1.9 | 6.7 | 24.5 | 15.8 | 8.6 | 102.3 | 4.1 | 0.2 | 1.8 | 7.3 |
| Feb | 25.2 | 26.3 | 13.5 | 111.0 | 6.1 | 0.3 | 2.2 | 7.7 | 24.3 | 25.9 | 13.4 | 113.5 | 6.2 | 0.4 | 2.0 | 8.2 |
| Mar | 24.9 | 65.6 | 28.6 | 118.4 | 11.3 | 0.7 | 4.4 | 10.3 | 26.3 | 64.5 | 28.2 | 121.2 | 13.4 | 0.7 | 3.1 | 11.1 |
| Apr | 7.9 | 107.0 | 39.2 | 116.2 | 7.2 | 0.9 | 3.3 | 9.5 | 10.1 | 105.1 | 38.9 | 119.1 | 9.2 | 0.9 | 1.8 | 10.5 |
| May | 0.3 | 136.6 | 54.6 | 120.9 | 6.9 | 0.6 | 4.5 | 10.6 | 0.3 | 135.9 | 54.1 | 123.7 | 7.4 | 0.7 | 3.2 | 11.2 |
| Jun | 0.0 | 163.8 | 70.4 | 108.6 | 6.0 | 0.6 | 4.0 | 10.4 | 0.0 | 160.6 | 70.3 | 115.9 | 6.7 | 0.7 | 2.9 | 11.5 |
| Jul | 0.0 | 201.2 | 86.0 | 61.2 | 1.9 | 0.6 | 2.1 | 8.0 | 0.0 | 198.2 | 90.2 | 64.4 | 2.3 | 0.7 | 1.1 | 8.7 |
| Aug | 0.0 | 192.7 | 63.0 | 30.0 | 0.0 | 0.5 | 1.3 | 6.8 | 0.0 | 193.7 | 62.9 | 31.5 | 0.0 | 0.6 | 0.8 | 7.3 |
| Sep | 0.0 | 127.8 | 39.3 | 29.3 | 0.1 | 0.3 | 2.0 | 7.3 | 0.0 | 125.7 | 40.5 | 31.7 | 0.1 | 0.3 | 1.3 | 8.0 |
| Oct | 1.9 | 69.4 | 24.7 | 40.1 | 0.7 | 0.2 | 2.1 | 7.4 | 1.9 | 68.7 | 26.2 | 43.6 | 0.7 | 0.3 | 1.5 | 8.2 |
| Nov | 9.5 | 28.9 | 15.9 | 62.1 | 1.7 | 0.2 | 2.8 | 8.1 | 10.7 | 28.7 | 16.1 | 63.5 | 1.9 | 0.2 | 1.9 | 8.5 |
| Dec | 20.0 | 16.0 | 11.4 | 80.5 | 2.4 | 0.1 | 2.4 | 7.4 | 21.5 | 16.0 | 11.4 | 82.9 | 2.5 | 0.2 | 1.8 | 8.0 |
| ***Ave. full yr.*** | ***113.3*** | **1150.8** | ***455.4*** | ***81.5*** | ***47.9*** | ***5.4*** | ***33.1*** | ***8.3*** | ***119.6*** | **1138.8** | ***460.9*** | ***84.4*** | ***54.5*** | ***5.7*** | ***23.3*** | ***9.0*** |
| ***Ave. gr. seas.*** | **8.2** | **929.1** | **352.7** | **77.7** | **22.1** | **3.6** | **17.3** | **8.8** | **10.4** | **919.2** | **357.0** | **81.0** | **25.7** | **3.8** | **11.1** | **9.5** |
| | 2021-2050 (short-term) | | | | | | | | | | | | | | | |
| **Month** | **SNMT** | **PET** | **ET** | **SW** | **PERC** | **SURF** | **LAT** | **Q** | **SNMT** | **PET** | **ET** | **SW** | **PERC** | **SURF** | **LAT** | **Q** |
| | mm | mm | mm | mm | mm | mm | mm | $m^3/s$ | mm | mm | mm | mm | mm | mm | mm | $m^3/s$ |
| Jan | 24.8 | 17.9 | 9.8 | 111.5 | 4.6 | 0.3 | 2.6 | 8.3 | 25.1 | 18.6 | 9.6 | 105.7 | 4.1 | 0.3 | 1.9 | 7.5 |
| Feb | 25.6 | 30.2 | 15.8 | 122.6 | 7.2 | 0.4 | 2.7 | 9.3 | 23.4 | 32.0 | 16.8 | 118.1 | 8.3 | 0.5 | 2.7 | 9.8 |
| Mar | 21.5 | 68.2 | 30.7 | 128.0 | 12.0 | 0.9 | 4.4 | 11.4 | 17.7 | 70.9 | 31.9 | 123.9 | 10.6 | 0.6 | 3.1 | 10.6 |
| Apr | 10.0 | 107.3 | 41.7 | 128.3 | 11.0 | 0.9 | 4.5 | 12.0 | 7.4 | 107.3 | 43.1 | 126.2 | 9.6 | 0.7 | 2.8 | 11.1 |
| May | 1.6 | 145.0 | 55.0 | 125.1 | 8.8 | 0.8 | 4.4 | 11.5 | 0.0 | 146.9 | 55.7 | 122.8 | 6.1 | 0.6 | 2.3 | 10.2 |
| Jun | 0.0 | 183.7 | 74.0 | 96.5 | 5.2 | 0.8 | 3.1 | 10.5 | 0.0 | 175.7 | 76.7 | 101.4 | 4.8 | 0.5 | 1.8 | 10.1 |
| Jul | 0.0 | 222.9 | 87.2 | 43.8 | 0.9 | 0.9 | 1.6 | 8.5 | 0.0 | 211.3 | 92.1 | 52.5 | 1.1 | 0.5 | 1.3 | 8.2 |

| Aug | 0.0 | 212.9 | 50.0 | 21.4 | 0.2 | 0.7 | 1.3 | 7.9 | 0.0 | 202.4 | 59.5 | 26.5 | 0.4 | 0.4 | 1.2 | 7.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sep | 0.0 | 138.7 | 31.0 | 28.1 | 0.2 | 0.4 | 2.1 | 8.4 | 0.0 | 138.4 | 32.4 | 26.2 | 0.2 | 0.3 | 1.1 | 7.2 |
| Oct | 0.8 | 73.7 | 23.0 | 46.5 | 0.8 | 0.3 | 2.7 | 9.0 | 0.5 | 74.5 | 21.9 | 40.7 | 0.9 | 0.3 | 1.2 | 8.0 |
| Nov | 9.6 | 29.1 | 15.4 | 76.1 | 3.2 | 0.3 | 4.1 | 10.8 | 11.4 | 30.6 | 15.4 | 66.8 | 1.8 | 0.2 | 2.0 | 8.9 |
| Dec | 19.8 | 17.0 | 10.6 | 94.1 | 4.4 | 0.3 | 3.0 | 9.0 | 18.8 | 18.0 | 11.3 | 87.1 | 3.4 | 0.2 | 1.9 | 8.3 |
| ***Ave. full yr.*** | ***113.8*** | **1246.5** | ***444.3*** | ***85.2*** | ***58.4*** | ***6.9*** | ***36.4*** | ***9.7*** | ***104.4*** | **1226.6** | ***466.4*** | ***83.1*** | ***51.3*** | ***5.2*** | ***23.3*** | ***9.0*** |
| ***Ave. gr. seas.*** | **11.6** | **1010.5** | **338.9** | **73.9** | **26.3** | **4.5** | **16.9** | **9.8** | **7.4** | **981.9** | **359.4** | **75.9** | **22.2** | **3.1** | **10.5** | **9.1** |
| | **2071-2100 (long-term)** | | | | | | | | | | | | | | | |
| **Month** | **SNMT** | **PET** | **ET** | **SW** | **PERC** | **SURF** | **LAT** | **Q** | **SNMT** | **PET** | **ET** | **SW** | **PERC** | **SURF** | **LAT** | **Q** |
| | mm | mm | mm | mm | mm | mm | mm | $m^3/s$ | mm | mm | mm | mm | mm | mm | mm | $m^3/s$ |
| Jan | 21.0 | 21.0 | 11.8 | 107.8 | 5.5 | 0.2 | 2.8 | 7.8 | 14.4 | 24.7 | 14.1 | 111.1 | 5.5 | 0.3 | 2.2 | 8.4 |
| Feb | 19.3 | 34.5 | 17.7 | 114.8 | 6.1 | 0.3 | 2.5 | 8.0 | 15.8 | 41.8 | 22.1 | 120.2 | 7.2 | 0.3 | 2.4 | 9.8 |
| Mar | 13.6 | 81.2 | 32.9 | 114.3 | 10.1 | 0.6 | 3.8 | 9.5 | 8.3 | 87.7 | 36.0 | 120.8 | 7.9 | 0.5 | 2.7 | 9.9 |
| Apr | 1.0 | 114.9 | 41.7 | 114.1 | 5.1 | 0.7 | 3.2 | 9.2 | 1.3 | 122.4 | 46.1 | 122.1 | 6.4 | 0.4 | 2.5 | 9.9 |
| May | 0.0 | 151.9 | 55.9 | 111.5 | 6.3 | 0.6 | 4.0 | 10.0 | 0.0 | 165.0 | 63.1 | 111.8 | 6.6 | 0.5 | 2.4 | 10.1 |
| Jun | 0.0 | 184.5 | 80.5 | 85.2 | 4.0 | 0.5 | 3.4 | 9.3 | 0.0 | 199.6 | 91.7 | 73.2 | 4.3 | 0.5 | 1.5 | 9.8 |
| Jul | 0.0 | 224.7 | 84.9 | 39.5 | 1.5 | 0.6 | 2.2 | 7.9 | 0.0 | 244.8 | 77.7 | 27.0 | 0.5 | 0.5 | 0.7 | 7.2 |
| Aug | 0.0 | 213.5 | 47.6 | 20.3 | 0.1 | 0.6 | 1.3 | 6.8 | 0.0 | 229.2 | 37.1 | 16.1 | 0.1 | 0.4 | 0.7 | 6.6 |
| Sep | 0.0 | 144.7 | 29.8 | 28.8 | 0.0 | 0.3 | 2.0 | 7.3 | 0.0 | 155.1 | 21.8 | 31.5 | 1.4 | 0.4 | 1.1 | 8.2 |
| Oct | 0.0 | 75.2 | 21.7 | 47.9 | 0.6 | 0.3 | 2.6 | 7.9 | 0.7 | 82.5 | 19.5 | 57.2 | 2.9 | 0.5 | 1.6 | 9.8 |
| Nov | 7.3 | 31.1 | 13.7 | 72.1 | 3.3 | 0.2 | 3.5 | 8.8 | 4.5 | 34.9 | 13.9 | 77.2 | 3.8 | 0.3 | 1.9 | 9.1 |
| Dec | 18.5 | 18.8 | 10.8 | 93.6 | 4.2 | 0.2 | 3.4 | 8.5 | 14.4 | 22.7 | 11.9 | 98.0 | 5.3 | 0.3 | 2.4 | 9.3 |
| ***Ave. full yr.*** | ***80.7*** | **1296.0** | ***449.0*** | ***79.2*** | ***46.8*** | ***5.0*** | ***34.5*** | ***8.4*** | ***59.5*** | **1410.5** | ***455.0*** | ***80.5*** | ***51.9*** | ***4.9*** | ***22.0*** | ***9.0*** |
| ***Ave. gr. seas.*** | **1.0** | **1034.1** | **340.4** | **66.6** | **17.0** | **3.3** | **16.0** | **8.4** | **1.3** | **1116.1** | **337.5** | **63.6** | **19.3** | **2.7** | **8.9** | **8.6** |

SNMT: snowmelt (mm); PET: potential evapotranspiration (mm); ET: actual evapotranspiration (mm); SW: amount of water in soil (mm); PERC: amount of water percolating out of root zone (mm); SURF: surface runoff (mm); LAT: lateral flow (mm); Q: streamflow (mm)

## S3. Spatial distribution of lateral flow

In a similar fashion to SW, the values for the shallow subsurface flow (LATQ; Figure S4) for the reference period show heterogeneity at catchment scale. LATQ shows significant increase under RCP 4.5 over the short-term period, with the more moderate increase in the lower portion of the catchment, and smaller relative changes over the long-term. For RCP 8.5, the trends are reversed suggesting that the lower half of the catchment will experience reduced LATQ compared to the reference period, while overall the changes in LATQ will be moderate in either direction (i.e., increase or decrease) over the short-term. Over the long-term, all subcatchments will experience a reduction in LATQ, with the most significant reduction occurring in the lower portion of the catchment. As it was the case with SW, during the growing season, LATQ shows a widespread reduction during the growing season, with the magnitude of the change varying in accordance with each RCP and period of analysis (Figure S5).

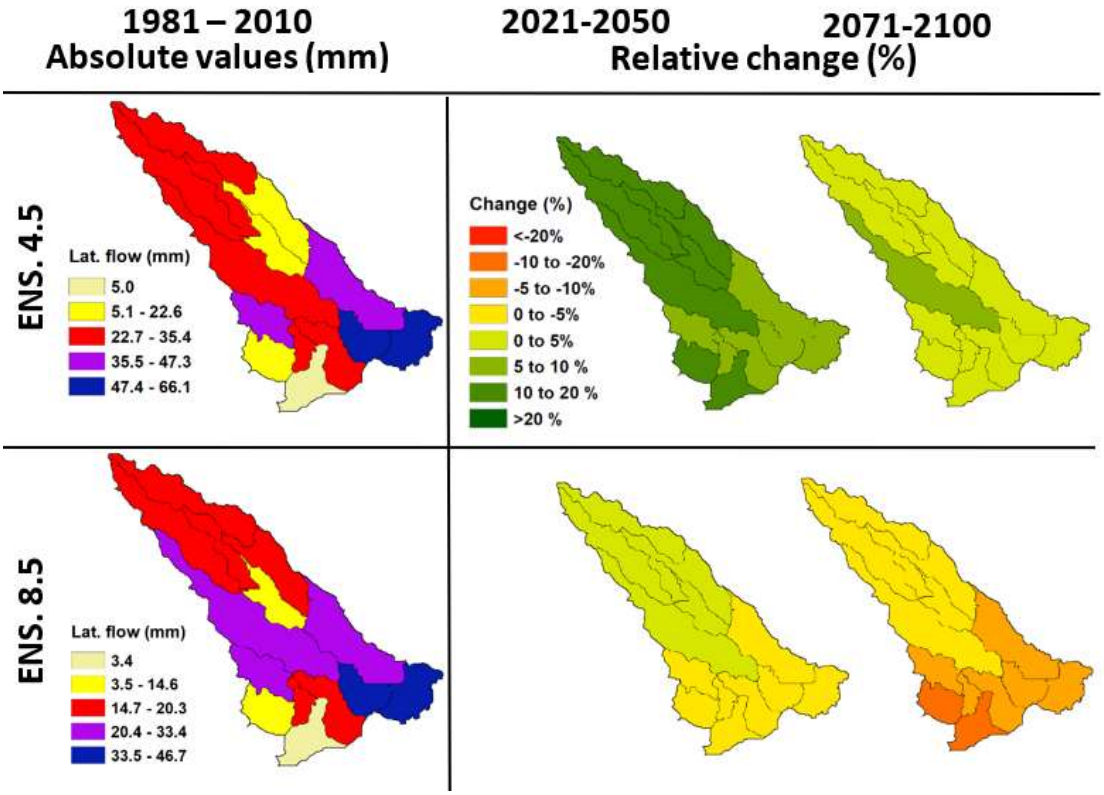


**Figure S4.** Catchment scale distribution of annual average lateral flow for the reference period (mm) and the relative change compared to the reference period (%) for each RCP.

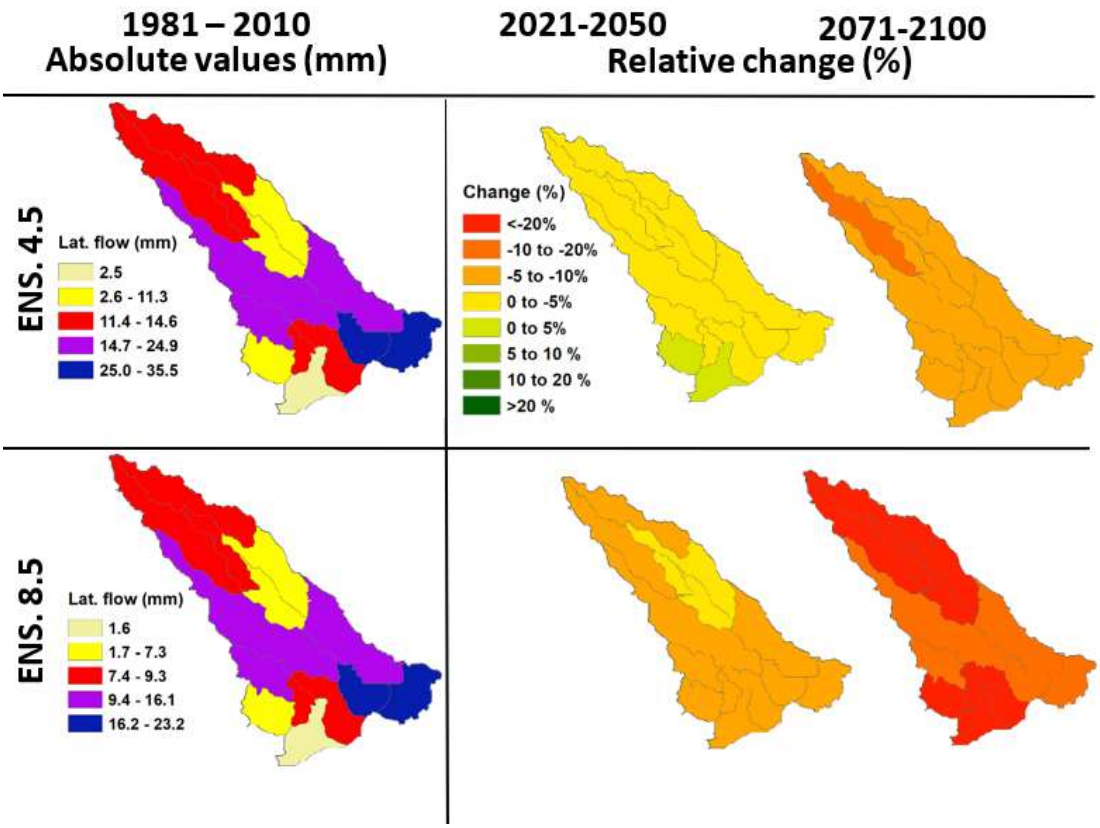


**Figure S5.** Catchment scale distribution of growing season average lateral flow for the reference period (mm) and the relative change compared to the reference period (%) for each RCP.