CHclim25 dataset

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Overview

The climatic dataset in this folder provides up-to-date climatic data at a resolution of 25m for Switzerland that are compatible with the 5th assessment report of the IPCC (AR5; reference period 1981-2010).

The dataset is derived from daily MeteoSwiss Grid-Data Products at 1km resolution for 1981-2017 (daily mean/max/min temperatures (TaveD/TminD/TmaxD), daily sum of precipitation (PrecD), daily relative sunshine duration (SrelD)), and monthly potential incoming solar radiations (Srad) calculated at 25m for Switzerland by WSL.

Transient daily time series of gridded climate scenarios of temperature and precipitations between 1981-2099 at 0.02°D (~2.2 km) from the CH2018 initiative used to calculate future climatic layers for 3 GCMs (HADGEM, ECEARTH, MPIESM, and IPSL), 3 time slices (2020-2049, 2045-2074, and 2070-2099) and 2 representative concentration pathways (RCP 4.5 and 8.5).

Each variable and each time period, layers are available either daily and/or monthly and/or yearly according to the table below:

Predictor	description	method	units	Daily layers					Monthly layers					Yearly layers				
				individual years	1981-2010 average	2020-2049 average	2045-2074 average	2070-2099 average	individual years	1981-2010 average	2020-2049 average	2045-2074 average	2070-2099 average	individual years	1981-2010 average	2020-2049 average	2045-2074 average	2070-2099 average
Prec	sum of precipitation	downscaling from 1km to 25m using bilinear interpolation	mm x10	✓	o	o	o	o	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
Srel	duration of daily sunshine	downscaling from 1km to 25m using bilinear interpolation	% x10	✓	✓	✓	✓	✓	✓	✓✓✓	x	x	x	✓	✓✓	x	x	x
Tave	daily average temperature	downscalingfrom 1km to 25m using local regression in moving windows of 5x5km	°C x10	✓	✓	✓	✓	✓	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
Tmax	daily maximum temperature	downscalingfrom 1km to 25m using local regression in moving windows of 5x5km	°C x10	✓	✓	✓	✓	✓	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
Tmin	daily mimimum temperature	downscalingfrom 1km to 25m using local regression in moving windows of 5x5km	°C x10	✓	✓	✓	✓	✓	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
gdd0	sum of growing degree-days above 0°C	calculated from daily Tabs	°C x10	o	o	o	o	o	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
gdd3	sum of growing degree-days above 3°C	calculated from daily Tabs	°C x10	o	o	o	o	o	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
gdd5	sum of growing degree-days above 5°C	calculated from daily Tabs	°C x10	o	o	o	o	o	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
etp	evapotransiration using Turc method	calculated from monthly Tmax, Srel and solar radiation (srad from WSL). Srel 1981-2010 is kept constant in the future. Formula: etp[mm/day] = (0.4/30)*(23.9 * (1-srel)*srad[MJ/day] + 50)* (T[°C]/(T[°C]+15)	mm x10	o	o	o	o	o	✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
biovars	19 bioclim variables from worldclim.org	from www.worldclim.org/data/bioclim.html using monthly Tmax, Tmin and Rhires	various x10	x	x	x	x	x	x	x	x	x	x	✓	✓✓✓	✓✓	✓✓	✓✓
AI	index of aridity from Zomer et al. 2008	etp/Prec. Values > 1 indicate negative water balance	ratio x10	o	o	o	o	o	o	o	o	o	o	✓	✓	✓	✓	✓
GSstart	Growing season start	last day of the year with 6 consecutive days with Tave<5°	days	x	x	x	x	x	x	x	x	x	x	o	✓	o	o	o
GSend	Growing season end	first day of the year with 6 consecutive days with Tave>5°	days	x	x	x	x	x	x	x	x	x	x	o	✓	o	o	o
GSlength	Growing season length	number of days between GSstart and GSlength	days	x	x	x	x	x	x	x	x	x	x	o	✓	o	o	o
maxcdnofrost	maximum consecutive days without frost	maximum number of consecutive days with Tmin>0	days	x	x	x	x	x	x	x	x	x	x	o	✓	o	o	o

x cannot be computed
o not computed
✓ on \\nas\chclim25 (and \\nas\RECHERCHE\FAC\FGSE\IDYST\aguisan\chclim25\D2c\25m)
✓✓ cropped for Rechalp area on \\nas\ecospat\common\50_data\GeoData_RECHALP\Climate\CHclim25
✓✓✓ available online on https://drive.switch.ch/index.php/s/CR26CVP0hmiRkFx

All layer are raster grids saved in .rData format to be loaded directly in R session with function load().

Methods

Daily data

1. **TaveD/TminD/TmaxD**: Based on the relationship between temperature and elevation (T° drops about 0.6 °C every 100m; Seidel & Free 2003) a downscaling based on lapse rate was performed to downscale temperature data from 1km to 25m. This is done here using local linear regressions (using a customized function based on function *focal* of the R package *raster*) with elevation $T_{1km} = a_{1km} + b_{1km}\, x\, Elevation_{1km}$ in a rectangular moving window of 5*5 km. Intercepts a_{1km} and slopes b_{1km} are then disaggregated at 25m (using the *resample* function with argument method="nbg") and smoothed spatially using function *focal* with a conic moving window of 1km where weights are inversely proportional to the distance to the focal pixel (Fig 1). $T_{25m} = a_{25m} + b_{25m}\, x\, Elevation_{25m}$ is then applied.

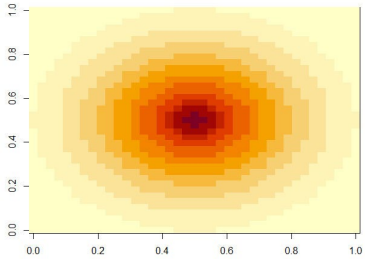

Fig 1 - Conic moving window with weights inversely proportional to the distance to the focal pixel.

2. **PrecD:** grids are first disaggregated from 1km to 25m (using the *resample* function with argument *method="nbg"*). The resulting layer is then smoothed spatially with a conic density kernel of 1km. then a bilinear interpolation is done.
3. **SrelD:** grids are first disaggregated from 1km to 25m, then a bilinear interpolation is done.

Monthly data

1. **TaveM/TminM/TmaxM**
   a. **Individual years**: monthly average of TaveD/TminD/ TmaxD
   b. **1981-2010 average**: average of TaveM/TminM/Tmax individual years between 1981-2010
   c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** monthly anomalies between monthly temperature for 1981-2010 and monthly temperature for the future period at 2.2km are downscaled at 25m using bilinear interpolation (using function *resample*). The anomalies are then added to TaveM/TminM/Tmax for 1981-2010 average.

2. **PrecM**
   a. **Individual years**: monthly sum of PrecD
   b. **1981-2010 average**: average of PrecM for individual years between 1981-2010.
   c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** The same method as temperature.

3. **gdd0M/ gdd3M/ gdd5M**: growing degree days above base temperature of 0°,3° or 5°C
   a. **Individual years**: monthly sum of TaveD above the base temperature
   b. **1981-2010 average**: average of gdd0M/ gdd3M/ gdd5M for individual years between 1981-2010.
   c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** the growing degree days above TaveM for period 1981-2010 + monthly anomalies for future periods

4. **etpM**: potential evapotranspiration following Turc 1961: *etp[mm/day] = (0.4/30)*(23.9 * srad[MJ/day] + 50)* (T[°C]/(T[°C]+15))*
   a. **Individual years**: Turc formula applied to individual years of TaveM and SrelM
   b. **1981-2010 average**: Turc formula applied to 1981-2010 average of TaveM and SrelM
   c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** Turc formula applied to future period averages of TaveM and SrelM.

Yearly data

1. **TaveY/TminY/TmaxY**
    a. **Individual years**: yearly average of TaveM/TminM/TmaxM
    b. **1981-2010 average**: yearly average of TaveY/TminY,TmaxY for individual years between 1981-2010
    c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** yearly averages of TaveM/TminM/TmaxM for future periods
2. **PrecY**
    a. **Individual years**: yearly sum of PrecM
    b. **1981-2010 average**: average of PrecY for individual years between 1981-2010
    c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** yearly sums of PrecM for the future periods
3. **gddY**
    a. Individual years: yearly sum of gddM
    b. **1981-2010 average**: average of gddY for individual years between 1981-2010
    c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** yearly sums of gddM for the future periods
4. **etpY**
    a. Individual years: yearly sum of etpM
    b. **1981-2010 average**: average of etpY for individual years between 1981-2010
    c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** yearly sums of etpM for the future periods
5. **Biovars data.** Bioclimatic variables calculation with function biovars from package dismo. Comparable to worldclim data.
    a. Individual years: calculation based on TminM, TmaxM and PrecM
    b. **1981-2010 average**: average of biovars for individual years between 1981-2010
    c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** calculation applied to future period averages of TminM, TmaxM and PrecM
6. **AI.** Aridity index calculated as in Zomer et al. 2008. Comparable to CGIAR/CSI data
    a. Individual years: ratio of etpY and PrecY
    b. **1981-2010 average**: average of AI for individual years between 1981-2010
    c. **1981-2010, 2020-2049, 2045-2074, 2060-2099 averages:** ratio of averages of etpY and PrecY in future periods
7. **maxcdnofrost.** Maximum consecutive days without frost
    a. **1981-2010 average**: max sum of consecutive days with average TminD>0
8. **Growing Season.** Growing season start, end and length. Based on GSL index from climdex
    a. **1981-2010 average**: based on first and last days of the year with 6 consecutive days with average TaveD<5°