Testing new datasets

2024-01-23

First update `pastclim` to the latest commit in branch `chelsa`. Close RStudio and restart it before trying this out.

A quick check for the new datasets

We now have a lot of new dataset. Let's try a couple of variables to check that they all work

```r
library(pastclim)
```

```
## Loading required package: terra
```

```
## terra 1.7.65
```

```r
list_available_datasets()
```

```
##   [1] "Barreto2023"
##   [2] "Beyer2020"
##   [3] "CHELSA_2.1_0.5m"
##   [4] "CHELSA_2.1_0.5m_vsi"
##   [5] "CHELSA_2.1_GFDL-ESM4_ssp126_0.5m"
##   [6] "CHELSA_2.1_GFDL-ESM4_ssp126_0.5m_vsi"
##   [7] "CHELSA_2.1_GFDL-ESM4_ssp370_0.5m"
##   [8] "CHELSA_2.1_GFDL-ESM4_ssp370_0.5m_vsi"
##   [9] "CHELSA_2.1_GFDL-ESM4_ssp585_0.5m"
##  [10] "CHELSA_2.1_GFDL-ESM4_ssp585_0.5m_vsi"
##  [11] "CHELSA_2.1_IPSL-CM6A-LR_ssp126_0.5m"
##  [12] "CHELSA_2.1_IPSL-CM6A-LR_ssp126_0.5m_vsi"
##  [13] "CHELSA_2.1_IPSL-CM6A-LR_ssp370_0.5m"
##  [14] "CHELSA_2.1_IPSL-CM6A-LR_ssp370_0.5m_vsi"
##  [15] "CHELSA_2.1_IPSL-CM6A-LR_ssp585_0.5m"
##  [16] "CHELSA_2.1_IPSL-CM6A-LR_ssp585_0.5m_vsi"
##  [17] "CHELSA_2.1_MPI-ESM1-2-HR_ssp126_0.5m"
##  [18] "CHELSA_2.1_MPI-ESM1-2-HR_ssp126_0.5m_vsi"
##  [19] "CHELSA_2.1_MPI-ESM1-2-HR_ssp370_0.5m"
##  [20] "CHELSA_2.1_MPI-ESM1-2-HR_ssp370_0.5m_vsi"
##  [21] "CHELSA_2.1_MPI-ESM1-2-HR_ssp585_0.5m"
##  [22] "CHELSA_2.1_MPI-ESM1-2-HR_ssp585_0.5m_vsi"
##  [23] "CHELSA_2.1_MRI-ESM2-0_ssp126_0.5m"
##  [24] "CHELSA_2.1_MRI-ESM2-0_ssp126_0.5m_vsi"
##  [25] "CHELSA_2.1_MRI-ESM2-0_ssp370_0.5m"
##  [26] "CHELSA_2.1_MRI-ESM2-0_ssp370_0.5m_vsi"
##  [27] "CHELSA_2.1_MRI-ESM2-0_ssp585_0.5m"
##  [28] "CHELSA_2.1_MRI-ESM2-0_ssp585_0.5m_vsi"
##  [29] "CHELSA_2.1_UKESM1-0-LL_ssp126_0.5m"
##  [30] "CHELSA_2.1_UKESM1-0-LL_ssp126_0.5m_vsi"
##  [31] "CHELSA_2.1_UKESM1-0-LL_ssp370_0.5m"
##  [32] "CHELSA_2.1_UKESM1-0-LL_ssp370_0.5m_vsi"
```

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## [33] "CHELSA_2.1_UKESM1-0-LL_ssp585_0.5m"
## [34] "CHELSA_2.1_UKESM1-0-LL_ssp585_0.5m_vsi"
## [35] "CHELSA_trace21k_1.0_0.5m_vsi"
## [36] "Example"
## [37] "HYDE_3.3_baseline"
## [38] "Krapp2021"
## [39] "paleoclim_1.0_10m"
## [40] "paleoclim_1.0_2.5m"
## [41] "paleoclim_1.0_5m"
## [42] "WorldClim_2.1_0.5m"
## [43] "WorldClim_2.1_10m"
## [44] "WorldClim_2.1_2.5m"
## [45] "WorldClim_2.1_5m"
## [46] "WorldClim_2.1_ACCESS-CM2_ssp126_0.5m"
## [47] "WorldClim_2.1_ACCESS-CM2_ssp126_10m"
## [48] "WorldClim_2.1_ACCESS-CM2_ssp126_2.5m"
## [49] "WorldClim_2.1_ACCESS-CM2_ssp126_5m"
## [50] "WorldClim_2.1_ACCESS-CM2_ssp245_0.5m"
## [51] "WorldClim_2.1_ACCESS-CM2_ssp245_10m"
## [52] "WorldClim_2.1_ACCESS-CM2_ssp245_2.5m"
## [53] "WorldClim_2.1_ACCESS-CM2_ssp245_5m"
## [54] "WorldClim_2.1_ACCESS-CM2_ssp370_0.5m"
## [55] "WorldClim_2.1_ACCESS-CM2_ssp370_10m"
## [56] "WorldClim_2.1_ACCESS-CM2_ssp370_2.5m"
## [57] "WorldClim_2.1_ACCESS-CM2_ssp370_5m"
## [58] "WorldClim_2.1_ACCESS-CM2_ssp585_0.5m"
## [59] "WorldClim_2.1_ACCESS-CM2_ssp585_10m"
## [60] "WorldClim_2.1_ACCESS-CM2_ssp585_2.5m"
## [61] "WorldClim_2.1_ACCESS-CM2_ssp585_5m"
## [62] "WorldClim_2.1_BCC-CSM2-MR_ssp126_0.5m"
## [63] "WorldClim_2.1_BCC-CSM2-MR_ssp126_10m"
## [64] "WorldClim_2.1_BCC-CSM2-MR_ssp126_2.5m"
## [65] "WorldClim_2.1_BCC-CSM2-MR_ssp126_5m"
## [66] "WorldClim_2.1_BCC-CSM2-MR_ssp245_0.5m"
## [67] "WorldClim_2.1_BCC-CSM2-MR_ssp245_10m"
## [68] "WorldClim_2.1_BCC-CSM2-MR_ssp245_2.5m"
## [69] "WorldClim_2.1_BCC-CSM2-MR_ssp245_5m"
## [70] "WorldClim_2.1_BCC-CSM2-MR_ssp370_0.5m"
## [71] "WorldClim_2.1_BCC-CSM2-MR_ssp370_10m"
## [72] "WorldClim_2.1_BCC-CSM2-MR_ssp370_2.5m"
## [73] "WorldClim_2.1_BCC-CSM2-MR_ssp370_5m"
## [74] "WorldClim_2.1_BCC-CSM2-MR_ssp585_0.5m"
## [75] "WorldClim_2.1_BCC-CSM2-MR_ssp585_10m"
## [76] "WorldClim_2.1_BCC-CSM2-MR_ssp585_2.5m"
## [77] "WorldClim_2.1_BCC-CSM2-MR_ssp585_5m"
## [78] "WorldClim_2.1_CMCC-ESM2_ssp126_0.5m"
## [79] "WorldClim_2.1_CMCC-ESM2_ssp126_10m"
## [80] "WorldClim_2.1_CMCC-ESM2_ssp126_2.5m"
## [81] "WorldClim_2.1_CMCC-ESM2_ssp126_5m"
## [82] "WorldClim_2.1_CMCC-ESM2_ssp245_0.5m"
## [83] "WorldClim_2.1_CMCC-ESM2_ssp245_10m"
## [84] "WorldClim_2.1_CMCC-ESM2_ssp245_2.5m"
## [85] "WorldClim_2.1_CMCC-ESM2_ssp245_5m"
## [86] "WorldClim_2.1_CMCC-ESM2_ssp370_0.5m"
```

```
##  [87] "WorldClim_2.1_CMCC-ESM2_ssp370_10m"
##  [88] "WorldClim_2.1_CMCC-ESM2_ssp370_2.5m"
##  [89] "WorldClim_2.1_CMCC-ESM2_ssp370_5m"
##  [90] "WorldClim_2.1_CMCC-ESM2_ssp585_0.5m"
##  [91] "WorldClim_2.1_CMCC-ESM2_ssp585_10m"
##  [92] "WorldClim_2.1_CMCC-ESM2_ssp585_2.5m"
##  [93] "WorldClim_2.1_CMCC-ESM2_ssp585_5m"
##  [94] "WorldClim_2.1_EC-Earth3-Veg_ssp126_0.5m"
##  [95] "WorldClim_2.1_EC-Earth3-Veg_ssp126_10m"
##  [96] "WorldClim_2.1_EC-Earth3-Veg_ssp126_2.5m"
##  [97] "WorldClim_2.1_EC-Earth3-Veg_ssp126_5m"
##  [98] "WorldClim_2.1_EC-Earth3-Veg_ssp245_0.5m"
##  [99] "WorldClim_2.1_EC-Earth3-Veg_ssp245_10m"
## [100] "WorldClim_2.1_EC-Earth3-Veg_ssp245_2.5m"
## [101] "WorldClim_2.1_EC-Earth3-Veg_ssp245_5m"
## [102] "WorldClim_2.1_EC-Earth3-Veg_ssp370_0.5m"
## [103] "WorldClim_2.1_EC-Earth3-Veg_ssp370_10m"
## [104] "WorldClim_2.1_EC-Earth3-Veg_ssp370_2.5m"
## [105] "WorldClim_2.1_EC-Earth3-Veg_ssp370_5m"
## [106] "WorldClim_2.1_EC-Earth3-Veg_ssp585_0.5m"
## [107] "WorldClim_2.1_EC-Earth3-Veg_ssp585_10m"
## [108] "WorldClim_2.1_EC-Earth3-Veg_ssp585_2.5m"
## [109] "WorldClim_2.1_EC-Earth3-Veg_ssp585_5m"
## [110] "WorldClim_2.1_FIO-ESM-2-0_ssp126_0.5m"
## [111] "WorldClim_2.1_FIO-ESM-2-0_ssp126_10m"
## [112] "WorldClim_2.1_FIO-ESM-2-0_ssp126_2.5m"
## [113] "WorldClim_2.1_FIO-ESM-2-0_ssp126_5m"
## [114] "WorldClim_2.1_FIO-ESM-2-0_ssp245_0.5m"
## [115] "WorldClim_2.1_FIO-ESM-2-0_ssp245_10m"
## [116] "WorldClim_2.1_FIO-ESM-2-0_ssp245_2.5m"
## [117] "WorldClim_2.1_FIO-ESM-2-0_ssp245_5m"
## [118] "WorldClim_2.1_FIO-ESM-2-0_ssp585_0.5m"
## [119] "WorldClim_2.1_FIO-ESM-2-0_ssp585_10m"
## [120] "WorldClim_2.1_FIO-ESM-2-0_ssp585_2.5m"
## [121] "WorldClim_2.1_FIO-ESM-2-0_ssp585_5m"
## [122] "WorldClim_2.1_GFDL-ESM4_ssp126_0.5m"
## [123] "WorldClim_2.1_GFDL-ESM4_ssp126_10m"
## [124] "WorldClim_2.1_GFDL-ESM4_ssp126_2.5m"
## [125] "WorldClim_2.1_GFDL-ESM4_ssp126_5m"
## [126] "WorldClim_2.1_GFDL-ESM4_ssp370_0.5m"
## [127] "WorldClim_2.1_GFDL-ESM4_ssp370_10m"
## [128] "WorldClim_2.1_GFDL-ESM4_ssp370_2.5m"
## [129] "WorldClim_2.1_GFDL-ESM4_ssp370_5m"
## [130] "WorldClim_2.1_GISS-E2-1-G_ssp126_0.5m"
## [131] "WorldClim_2.1_GISS-E2-1-G_ssp126_10m"
## [132] "WorldClim_2.1_GISS-E2-1-G_ssp126_2.5m"
## [133] "WorldClim_2.1_GISS-E2-1-G_ssp126_5m"
## [134] "WorldClim_2.1_GISS-E2-1-G_ssp245_0.5m"
## [135] "WorldClim_2.1_GISS-E2-1-G_ssp245_10m"
## [136] "WorldClim_2.1_GISS-E2-1-G_ssp245_2.5m"
## [137] "WorldClim_2.1_GISS-E2-1-G_ssp245_5m"
## [138] "WorldClim_2.1_GISS-E2-1-G_ssp370_0.5m"
## [139] "WorldClim_2.1_GISS-E2-1-G_ssp370_10m"
## [140] "WorldClim_2.1_GISS-E2-1-G_ssp370_2.5m"
```

```
## [141] "WorldClim_2.1_GISS-E2-1-G_ssp370_5m"
## [142] "WorldClim_2.1_GISS-E2-1-G_ssp585_0.5m"
## [143] "WorldClim_2.1_GISS-E2-1-G_ssp585_10m"
## [144] "WorldClim_2.1_GISS-E2-1-G_ssp585_2.5m"
## [145] "WorldClim_2.1_GISS-E2-1-G_ssp585_5m"
## [146] "WorldClim_2.1_HadGEM3-GC31-LL_ssp126_0.5m"
## [147] "WorldClim_2.1_HadGEM3-GC31-LL_ssp126_10m"
## [148] "WorldClim_2.1_HadGEM3-GC31-LL_ssp126_2.5m"
## [149] "WorldClim_2.1_HadGEM3-GC31-LL_ssp126_5m"
## [150] "WorldClim_2.1_HadGEM3-GC31-LL_ssp245_0.5m"
## [151] "WorldClim_2.1_HadGEM3-GC31-LL_ssp245_10m"
## [152] "WorldClim_2.1_HadGEM3-GC31-LL_ssp245_2.5m"
## [153] "WorldClim_2.1_HadGEM3-GC31-LL_ssp245_5m"
## [154] "WorldClim_2.1_HadGEM3-GC31-LL_ssp585_0.5m"
## [155] "WorldClim_2.1_HadGEM3-GC31-LL_ssp585_10m"
## [156] "WorldClim_2.1_HadGEM3-GC31-LL_ssp585_2.5m"
## [157] "WorldClim_2.1_HadGEM3-GC31-LL_ssp585_5m"
## [158] "WorldClim_2.1_INM-CM5-0_ssp126_0.5m"
## [159] "WorldClim_2.1_INM-CM5-0_ssp126_10m"
## [160] "WorldClim_2.1_INM-CM5-0_ssp126_2.5m"
## [161] "WorldClim_2.1_INM-CM5-0_ssp126_5m"
## [162] "WorldClim_2.1_INM-CM5-0_ssp245_0.5m"
## [163] "WorldClim_2.1_INM-CM5-0_ssp245_10m"
## [164] "WorldClim_2.1_INM-CM5-0_ssp245_2.5m"
## [165] "WorldClim_2.1_INM-CM5-0_ssp245_5m"
## [166] "WorldClim_2.1_INM-CM5-0_ssp370_0.5m"
## [167] "WorldClim_2.1_INM-CM5-0_ssp370_10m"
## [168] "WorldClim_2.1_INM-CM5-0_ssp370_2.5m"
## [169] "WorldClim_2.1_INM-CM5-0_ssp370_5m"
## [170] "WorldClim_2.1_INM-CM5-0_ssp585_0.5m"
## [171] "WorldClim_2.1_INM-CM5-0_ssp585_10m"
## [172] "WorldClim_2.1_INM-CM5-0_ssp585_2.5m"
## [173] "WorldClim_2.1_INM-CM5-0_ssp585_5m"
## [174] "WorldClim_2.1_IPSL-CM6A-LR_ssp126_0.5m"
## [175] "WorldClim_2.1_IPSL-CM6A-LR_ssp126_10m"
## [176] "WorldClim_2.1_IPSL-CM6A-LR_ssp126_2.5m"
## [177] "WorldClim_2.1_IPSL-CM6A-LR_ssp126_5m"
## [178] "WorldClim_2.1_IPSL-CM6A-LR_ssp245_0.5m"
## [179] "WorldClim_2.1_IPSL-CM6A-LR_ssp245_10m"
## [180] "WorldClim_2.1_IPSL-CM6A-LR_ssp245_2.5m"
## [181] "WorldClim_2.1_IPSL-CM6A-LR_ssp245_5m"
## [182] "WorldClim_2.1_IPSL-CM6A-LR_ssp370_0.5m"
## [183] "WorldClim_2.1_IPSL-CM6A-LR_ssp370_10m"
## [184] "WorldClim_2.1_IPSL-CM6A-LR_ssp370_2.5m"
## [185] "WorldClim_2.1_IPSL-CM6A-LR_ssp370_5m"
## [186] "WorldClim_2.1_IPSL-CM6A-LR_ssp585_0.5m"
## [187] "WorldClim_2.1_IPSL-CM6A-LR_ssp585_10m"
## [188] "WorldClim_2.1_IPSL-CM6A-LR_ssp585_2.5m"
## [189] "WorldClim_2.1_IPSL-CM6A-LR_ssp585_5m"
## [190] "WorldClim_2.1_MIROC6_ssp126_0.5m"
## [191] "WorldClim_2.1_MIROC6_ssp126_10m"
## [192] "WorldClim_2.1_MIROC6_ssp126_2.5m"
## [193] "WorldClim_2.1_MIROC6_ssp126_5m"
## [194] "WorldClim_2.1_MIROC6_ssp245_0.5m"
```

```
## [195] "WorldClim_2.1_MIROC6_ssp245_10m"
## [196] "WorldClim_2.1_MIROC6_ssp245_2.5m"
## [197] "WorldClim_2.1_MIROC6_ssp245_5m"
## [198] "WorldClim_2.1_MIROC6_ssp370_0.5m"
## [199] "WorldClim_2.1_MIROC6_ssp370_10m"
## [200] "WorldClim_2.1_MIROC6_ssp370_2.5m"
## [201] "WorldClim_2.1_MIROC6_ssp370_5m"
## [202] "WorldClim_2.1_MIROC6_ssp585_0.5m"
## [203] "WorldClim_2.1_MIROC6_ssp585_10m"
## [204] "WorldClim_2.1_MIROC6_ssp585_2.5m"
## [205] "WorldClim_2.1_MIROC6_ssp585_5m"
## [206] "WorldClim_2.1_MPI-ESM1-2-HR_ssp126_0.5m"
## [207] "WorldClim_2.1_MPI-ESM1-2-HR_ssp126_10m"
## [208] "WorldClim_2.1_MPI-ESM1-2-HR_ssp126_2.5m"
## [209] "WorldClim_2.1_MPI-ESM1-2-HR_ssp126_5m"
## [210] "WorldClim_2.1_MPI-ESM1-2-HR_ssp245_0.5m"
## [211] "WorldClim_2.1_MPI-ESM1-2-HR_ssp245_10m"
## [212] "WorldClim_2.1_MPI-ESM1-2-HR_ssp245_2.5m"
## [213] "WorldClim_2.1_MPI-ESM1-2-HR_ssp245_5m"
## [214] "WorldClim_2.1_MPI-ESM1-2-HR_ssp370_0.5m"
## [215] "WorldClim_2.1_MPI-ESM1-2-HR_ssp370_10m"
## [216] "WorldClim_2.1_MPI-ESM1-2-HR_ssp370_2.5m"
## [217] "WorldClim_2.1_MPI-ESM1-2-HR_ssp370_5m"
## [218] "WorldClim_2.1_MPI-ESM1-2-HR_ssp585_0.5m"
## [219] "WorldClim_2.1_MPI-ESM1-2-HR_ssp585_10m"
## [220] "WorldClim_2.1_MPI-ESM1-2-HR_ssp585_2.5m"
## [221] "WorldClim_2.1_MPI-ESM1-2-HR_ssp585_5m"
## [222] "WorldClim_2.1_MRI-ESM2-0_ssp126_0.5m"
## [223] "WorldClim_2.1_MRI-ESM2-0_ssp126_10m"
## [224] "WorldClim_2.1_MRI-ESM2-0_ssp126_2.5m"
## [225] "WorldClim_2.1_MRI-ESM2-0_ssp126_5m"
## [226] "WorldClim_2.1_MRI-ESM2-0_ssp245_0.5m"
## [227] "WorldClim_2.1_MRI-ESM2-0_ssp245_10m"
## [228] "WorldClim_2.1_MRI-ESM2-0_ssp245_2.5m"
## [229] "WorldClim_2.1_MRI-ESM2-0_ssp245_5m"
## [230] "WorldClim_2.1_MRI-ESM2-0_ssp370_0.5m"
## [231] "WorldClim_2.1_MRI-ESM2-0_ssp370_10m"
## [232] "WorldClim_2.1_MRI-ESM2-0_ssp370_2.5m"
## [233] "WorldClim_2.1_MRI-ESM2-0_ssp370_5m"
## [234] "WorldClim_2.1_MRI-ESM2-0_ssp585_0.5m"
## [235] "WorldClim_2.1_MRI-ESM2-0_ssp585_10m"
## [236] "WorldClim_2.1_MRI-ESM2-0_ssp585_2.5m"
## [237] "WorldClim_2.1_MRI-ESM2-0_ssp585_5m"
## [238] "WorldClim_2.1_UKESM1-0-LL_ssp126_0.5m"
## [239] "WorldClim_2.1_UKESM1-0-LL_ssp126_10m"
## [240] "WorldClim_2.1_UKESM1-0-LL_ssp126_2.5m"
## [241] "WorldClim_2.1_UKESM1-0-LL_ssp126_5m"
## [242] "WorldClim_2.1_UKESM1-0-LL_ssp245_0.5m"
## [243] "WorldClim_2.1_UKESM1-0-LL_ssp245_10m"
## [244] "WorldClim_2.1_UKESM1-0-LL_ssp245_2.5m"
## [245] "WorldClim_2.1_UKESM1-0-LL_ssp245_5m"
## [246] "WorldClim_2.1_UKESM1-0-LL_ssp370_0.5m"
## [247] "WorldClim_2.1_UKESM1-0-LL_ssp370_10m"
## [248] "WorldClim_2.1_UKESM1-0-LL_ssp370_2.5m"
```

```
## [249] "WorldClim_2.1_UKESM1-0-LL_ssp370_5m"
## [250] "WorldClim_2.1_UKESM1-0-LL_ssp585_0.5m"
## [251] "WorldClim_2.1_UKESM1-0-LL_ssp585_10m"
## [252] "WorldClim_2.1_UKESM1-0-LL_ssp585_2.5m"
## [253] "WorldClim_2.1_UKESM1-0-LL_ssp585_5m"
```

CHELSA present

Start with a virtual dataset:

```
bio_vars <- c("bio12","temperature_01")
dataset = "CHELSA_2.1_0.5m_vsi"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

Now use it:

```
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 1  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_0.5m_bio12_v1.0.0_vsi.vrt
## varname     : bio12 (annual precipitation)
## name        :  bio12_1990
## unit        : mm per year
## time (years): 1990
```

```
test_rast$temperature_01
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 1  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_0.5m_temp_01_v1.0.0_vsi.vrt
## varname     : temperature_01 (mean temperature Jan)
## name        : temperature_01_1990
## unit        :     degrees Celsius
## time (years): 1990
```

NOTE: bio12 is precipitation (it should go into the several thousands), whilst temperature_01 is the Jan temp (so range, from -50 to 40 or something along those lines depending on which dataset you are looking at). Ideally, the units should be informative.

Now the real dataset (downloading the files)

```
bio_vars <- c("bio12","temperature_01")
dataset = "CHELSA_2.1_0.5m"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 1  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_0.5m_bio12_v1.0.0.vrt
## varname     : bio12 (annual precipitation)
## name        :  bio12_1990
## unit        : mm per year
## time (years): 1990
```

```r
test_rast$temperature_01
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 1  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_0.5m_temp_01_v1.0.0.vrt
## varname     : temperature_01 (mean temperature Jan)
## name        : temperature_01_1990
## unit        :     degrees Celsius
## time (years): 1990
```

##CHELSA future

Again, a virtual dataset first

```r
bio_vars <- c("bio12","temperature_01")
dataset = "CHELSA_2.1_MPI-ESM1-2-HR_ssp370_0.5m_vsi"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```r
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 3  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_MPI-ESM1-2-HR_ssp370_0.5m_bio12_v1.0.0_vsi.vrt
## varname     : bio12 (annual precipitation)
## names       :  bio12_2025,  bio12_2055,  bio12_2075
## unit        : mm per year, mm per year, mm per year
## time (years): 2025 to 2075
```

```r
test_rast$temperature_01
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 3  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_MPI-ESM1-2-HR_ssp370_0.5m_temp_01_v1.0.0_vsi.vrt
## varname     : temperature_01 (mean temperature Jan)
## names       : temperature_01_2025, temperature_01_2055, temperature_01_2075
```

```
## unit        :     degrees Celsius,     degrees Celsius,     degrees Celsius
## time (years): 2025 to 2075
```

And now the downloading data:

```
bio_vars <- c("bio12","temperature_01")
dataset = "CHELSA_2.1_GFDL-ESM4_ssp126_0.5m"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 3  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_GFDL-ESM4_ssp126_0.5m_bio12_v1.0.0.vrt
## varname     : bio12 (annual precipitation)
## names       :  bio12_2025,  bio12_2055,  bio12_2075
## unit        : mm per year, mm per year, mm per year
## time (years): 2025 to 2075
```

```
test_rast$temperature_01
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 3  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_2.1_GFDL-ESM4_ssp126_0.5m_temp_01_v1.0.0.vrt
## varname     : temperature_01 (mean temperature Jan)
## names       : temperature_01_2025, temperature_01_2055, temperature_01_2075
## unit        :     degrees Celsius,     degrees Celsius,     degrees Celsius
## time (years): 2025 to 2075
```

Paleoclim

```
bio_vars <- c("bio12","bio12")
dataset = "paleoclim_1.0_10m"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 1072, 2160, 8  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180.0001, 179.9999, -90, 88.66667  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : paleoclim_1.0_10m_bio12_v1.0.0.vrt
## varname     : bio12 (annual precipitation)
## names       :     bio12_0, bio12_-2250, bio12_-6250, bio12_-10000, bio12_-12300, bio12_-13800, ...
```

```
## unit        : mm per year, mm per year, mm per year,  mm per year,  mm per year,  mm per year, ...
## time (years): -128050 to 1950
```

```r
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 1072, 2160, 8  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180.0001, 179.9999, -90, 88.66667  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : paleoclim_1.0_10m_bio12_v1.0.0.vrt
## varname     : bio12 (annual precipitation)
## names       :     bio12_0, bio12_-2250, bio12_-6250, bio12_-10000, bio12_-12300, bio12_-13800, ...
## unit        : mm per year, mm per year, mm per year,  mm per year,  mm per year,  mm per year, ...
## time (years): -128050 to 1950
```

WorldClim

```r
bio_vars <- c("bio01","bio12")
dataset = "WorldClim_2.1_10m"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```r
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio01
```

```
## class       : SpatRaster
## dimensions  : 1080, 2160, 1  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180, 180, -90, 90  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : WorldClim_2.1_10m_bio01_v2.0.0.vrt
## varname     : bio01 (annual mean temperature)
## name        :      bio01_1985
## unit        : degrees Celsius
## time (years): 1985
```

```r
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 1080, 2160, 1  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180, 180, -90, 90  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : WorldClim_2.1_10m_bio12_v2.0.0.vrt
## varname     : bio12 (annual precipitation)
## name        :  bio12_1985
## unit        : mm per year
## time (years): 1985
```

```r
bio_vars <- c("temperature_min_03")
dataset = "WorldClim_2.1_10m"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```r
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$temperature_min_03
```

```
## class       : SpatRaster
## dimensions  : 1080, 2160, 1  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180, 180, -90, 90  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : WorldClim_2.1_10m_temperature_min_03_v2.0.0.vrt
## varname     : temperature_min_03 (minimum temperature Mar)
## name        : temperature_min_03_1985
## unit        :         degrees Celsius
## time (years): 1985
```

```r
bio_vars <- c("altitude")
dataset = "WorldClim_2.1_10m"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```r
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$altitude
```

```
## class       : SpatRaster
## dimensions  : 1080, 2160, 1  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180, 180, -90, 90  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : WorldClim_2.1_10m_altitude_v2.0.0.vrt
## varname     : altitude (altitude over the sea level)
## name        : altitude_1985
## unit        :        meters
## time (years): 1985
```

Future projections

```r
bio_vars <- c("bio01","bio12")
dataset = "WorldClim_2.1_MPI-ESM1-2-HR_ssp370_10m"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```r
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio01
```

```
## class       : SpatRaster
## dimensions  : 1080, 2160, 4  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180, 180, -90, 90  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : WorldClim_2.1_MPI-ESM1-2-HR_ssp370_10m_bio01_v2.0.0.vrt
## varname     : bio01 (annual mean temperature)
## names       :      bio01_2030,      bio01_2050,      bio01_2070,      bio01_2090
## min values  :           -53.4,           -52.8,           -51.7,           -50.7
## max values  :            31.7,            32.4,            33.3,            34.1
## unit        : degrees Celsius, degrees Celsius, degrees Celsius, degrees Celsius
## time (years): 2030 to 2090
```

```r
test_rast$bio12
```

```
## class       : SpatRaster
## dimensions  : 1080, 2160, 4  (nrow, ncol, nlyr)
## resolution  : 0.1666667, 0.1666667  (x, y)
## extent      : -180, 180, -90, 90  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : WorldClim_2.1_MPI-ESM1-2-HR_ssp370_10m_bio12_v2.0.0.vrt
## varname     : bio12 (annual precipitation)
## names       :  bio12_2030,  bio12_2050,  bio12_2070,  bio12_2090
## min values  :         0.0,         0.0,         0.0,         0.0
## max values  :      7754.7,      7834.7,      7974.9,      8276.7
## unit        : mm per year, mm per year, mm per year, mm per year
## time (years): 2030 to 2090
```

Chelsa Trace21k

```r
bio_vars <- c("bio06")
dataset = "CHELSA_trace21k_1.0_0.5m_vsi"
download_dataset(dataset=dataset, bio_variables = bio_vars)
```

```
## [1] TRUE
```

```r
test_rast<-region_series(bio_variables = bio_vars, dataset = dataset)
test_rast$bio06
```

```
## class       : SpatRaster
## dimensions  : 20880, 43200, 221  (nrow, ncol, nlyr)
## resolution  : 0.008333333, 0.008333333  (x, y)
## extent      : -180.0001, 179.9999, -90.00014, 83.99986  (xmin, xmax, ymin, ymax)
## coord. ref. : lon/lat WGS 84 (EPSG:4326)
## source      : CHELSA_trace21k_1.0_0.5m_bio06_v1.0.0.vrt
## varname     : bio06 (minimum temperature of coldest month)
## names       :         bio06_0,       bio06_-100,       bio06_-200,       bio06_-300,       bio06_-400,
## unit        : degrees Celsius, degrees Celsius, degrees Celsius, degrees Celsius, degrees Celsius, d
## time (years): -20050 to 1950
```

Don't plot this series, it has over 200 remote time steps, with each time step hundreds of megabytes in size. But you could try etracting climate for a couple of points:

```r
locations <- data.frame(
  name = c("Iho Eleru", "La Riera", "Chalki", "Oronsay", "Atlantis"),
  longitude = c(5, -4, 27, -6, -24), latitude = c(7, 44, 36, 56, 31),
  time_bp = c(-11200, -18738, -10227, -10200, -11600)
)
location_slice(
  x = locations, bio_variables = c("bio06"),
  dataset = "CHELSA_trace21k_1.0_0.5m_vsi", nn_interpol = FALSE
)
```

```
##        name longitude latitude time_bp time_bp_slice  bio06
## 1 Iho Eleru         5        7  -11200        -11200  18.55
## 2  La Riera        -4       44  -18738        -18700   3.35
## 3    Chalki        27       36  -10227        -10200   9.95
## 4   Oronsay        -6       56  -10200        -10200 -14.85
## 5  Atlantis       -24       31  -11600        -11600  15.15
```

Note that, since CHELSA trace21k includes the ocean, we get estimates for every single point!