Appendix 1. CRU TS 4.04

This appendix shows how to generate the input files for the climate reconstructions, based on the CRU TS 4.04 dataset (Harris et al., 2020).

The target output files are:

"cru\_ts4.04.1901.2019.cld.dat-clim-1961-1990-int.nc"  
"cru\_ts4.04.1901.2019.pre.dat-clim-1961-1990-int.nc"  
"cru\_ts4.04-clim-1961-1990-daily.tmp.nc"

## Raw data

Download the following files directly from the CEDA Archive (<https://catalogue.ceda.ac.uk/uuid/89e1e34ec3554dc98594a5732622bce9>)

ncfiles\_raw <- c("cru\_ts4.04.1901.2019.cld.dat.nc",  
 "cru\_ts4.04.1901.2019.pre.dat.nc",  
 "cru\_ts4.04.1901.2019.tmn.dat.nc",  
 "cru\_ts4.04.1901.2019.tmx.dat.nc",  
 "cru\_ts4.04.1901.2019.vap.dat.nc")  
ncfiles\_var <- c("cld", "pre", "tmn", "tmx", "vap")  
path <- "/path/to/CRU/4.04/"

## Convert precipitation from [mm/month] to [mm/day]

codos:::convert\_units.m2d(  
 filename = file.path(path, "cru\_ts4.04.1901.2019.pre.dat.nc"),  
 varid = "pre",  
 output\_filename =  
 file.path(output\_path, "cru\_ts4.04.1901.2019.pre.dat-new.nc")  
)

##### Output file

"cru\_ts4.04.1901.2019.pre.dat-new.nc"

## Create monthly climatologies: 1961-1990

ncfiles\_clim <- c("cru\_ts4.04.1901.2019.cld.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.pre.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.tmn.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.tmx.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.vap.dat-clim-1961-1990.nc")  
  
message("###### Create monthly climatologies: 1961-1990 ######")  
for (i in seq\_along(ncfiles\_raw)) {  
 message("Processing: ", ncfiles\_var[i], "...")  
 codos::monthly\_clim(  
 filename = file.path(path, ncfiles\_raw[i]),  
 varid = ncfiles\_var[i],  
 s\_year = 1961,  
 e\_year = 1990,  
 output\_filename = file.path(output\_path, ncfiles\_clim[i])  
 )  
}

##### Output files

"cru\_ts4.04.1901.2019.cld.dat-clim-1961-1990.nc"  
"cru\_ts4.04.1901.2019.pre.dat-clim-1961-1990.nc"  
"cru\_ts4.04.1901.2019.tmn.dat-clim-1961-1990.nc"  
"cru\_ts4.04.1901.2019.tmx.dat-clim-1961-1990.nc"  
"cru\_ts4.04.1901.2019.vap.dat-clim-1961-1990.nc"

## Interpolate monthly data to daily

ncfiles\_clim <- c("cru\_ts4.04.1901.2019.cld.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.pre.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.tmn.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.tmx.dat-clim-1961-1990.nc",  
 "cru\_ts4.04.1901.2019.vap.dat-clim-1961-1990.nc")  
ncfiles\_var <- c("cld", "pre", "tmn", "tmx", "vap")  
ncfiles\_clim\_int <- c("cru\_ts4.04.1901.2019.cld.dat-clim-1961-1990-int.nc",  
 "cru\_ts4.04.1901.2019.pre.dat-clim-1961-1990-int.nc",  
 "cru\_ts4.04.1901.2019.tmn.dat-clim-1961-1990-int.nc",  
 "cru\_ts4.04.1901.2019.tmx.dat-clim-1961-1990-int.nc",  
 "cru\_ts4.04.1901.2019.vap.dat-clim-1961-1990-int.nc")  
  
message("###### Interpolate monthly data to daily ######")  
for (i in seq\_along(ncfiles\_raw)) {  
 message("Processing: ", ncfiles\_var[i], "...")  
 codos:::nc\_int(  
 filename = file.path(output\_path, ncfiles\_clim[i]),  
 varid = ncfiles\_var[i],  
 s\_year = 1961,  
 cpus = 20,  
 output\_filename = file.path(output\_path, ncfiles\_clim\_int[i])  
 )  
}

##### Output files

"cru\_ts4.04.1901.2019.cld.dat-clim-1961-1990-int.nc"  
"cru\_ts4.04.1901.2019.pre.dat-clim-1961-1990-int.nc"  
"cru\_ts4.04.1901.2019.tmn.dat-clim-1961-1990-int.nc"  
"cru\_ts4.04.1901.2019.tmx.dat-clim-1961-1990-int.nc"  
"cru\_ts4.04.1901.2019.vap.dat-clim-1961-1990-int.nc"

## Calculate daily temperature

tmin <- file.path(path, "cru\_ts4.04.1901.2019.tmn.dat-clim-1961-1990-int.nc")  
tmax <- file.path(path, "cru\_ts4.04.1901.2019.tmx.dat-clim-1961-1990-int.nc")  
output\_filename <- file.path(path, "cru\_ts4.04-clim-1961-1990-daily.tmp.nc")  
codos::daily\_temp(tmin = list(filename = tmin, id = "tmn"),  
 tmax = list(filename = tmax, id = "tmx"),  
 output\_filename = output\_filename)

##### Output file

"cru\_ts4.04-clim-1961-1990-daily.tmp.nc"

## References

Harris, I., Osborn, T.J., Jones, P., Lister, D., 2020. Version 4 of the CRU TS monthly high-resolution gridded multivariate climate dataset. Sci Data 7, 109. https://doi.org/10.1038/s41597-020-0453-3