```
#!/bin/tcsh
# shell script: data : CMIP5 multi-model precipitation, RCP scenarios
#               purpose: calculate SPI(drought index)
#              method: create NCL script with SPI calculation funciton


set exp = rcp26
set realm = atmos
set cmor_table = Amon
set runtype = r1i1p1

set var = pr

set dir = "/raid60/cmip5/data/${exp}/${realm}/mon/${cmor_table}/${var}"
set current = "/home/yjang/1.Drought/SPI/spi/cmip5"

# 43+6 = 49 models
 set ins = (CSIRO-BOM CSIRO-BOM \
         CCCma \
           NCAR \
           NSF-DOE-NCAR NSF-DOE-NCAR NSF-DOE-NCAR NSF-DOE-NCAR\
           CMCC CMCC CMCC\
           CNRM-CERFACS CNRM-CERFACS \
         CSIRO-QCCCE \
         NOAA-GFDL NOAA-GFDL NOAA-GFDL \
         NASA-GISS NASA-GISS NASA-GISS NASA-GISS \
         MOHC MOHC \
         INM \
         IPSL IPSL IPSL \
           MIROC MIROC \
           MIROC \
         MPI-M MPI-M MPI-M\
           MRI \
         NCC NCC\
         BCC BCC \
         BNU \
         ICHEC \
         LASG-CESS \
         MIROC \
         LASG-IAP \
           CCCma \
         NOAA-GFDL \
         MOHC \
         NIMR-KMA \
         MRI \
           FIO)

 set models = (ACCESS1-0 ACCESS1-3\
            CanESM2 \
              CCSM4 \
              CESM1-BGC CESM1-CAM5 CESM1-FASTCHEM CESM1-WACCM \
              CMCC-CESM CMCC-CM CMCC-CMS \
              CNRM-CM5 CNRM-CM5-2\
              CSIRO-Mk3-6-0 \
            GFDL-CM3 GFDL-ESM2G GFDL-ESM2M \
            GISS-E2-H GISS-E2-H-CC GISS-E2-R GISS-E2-R-CC\
            HadGEM2-CC HadGEM2-ES \
            inmcm4 \
            IPSL-CM5A-LR IPSL-CM5A-MR IPSL-CM5B-LR \
```

```
              MIROC-ESM MIROC-ESM-CHEM \
             MIROC5 \
               MPI-ESM-MR MPI-ESM-LR MPI-ESM-P \
               MRI-CGCM3 \
             NorESM1-M NorESM1-ME\
               bcc-csm1-1-m bcc-csm1-1 \
             BNU-ESM \
             EC-EARTH \
             FGOALS-g2 \
             MIROC4h \
             FGOALS-S2 \
               CanCM4 \
             GFDL-CM2p1 \
             HadCM3 \
             HadGEM2-AO \
             MRI-ESM1 \
               FIO-ESM)

## step 1. go to model directory and check if it exists!!


set ii = 1
while( $ii <= 41)
 set dirmodel = ${dir}/$ins[$ii].$models[$ii]/${runtype}

 cd ${dir}
 set tmp = `ls `
 set num = $#tmp

 set iexist = 1
while ( $iexist <= $num )
##  echo $iexist ":" $tmp[$iexist] ":" $ins[$ii].$models[$ii]
 if( $tmp[$iexist] =~ *$ins[$ii].$models[$ii]/ ) then

 echo $ii "..................."$tmp[$iexist]


 cd $dirmodel
 echo `pwd`
 set tmp1 = `ls`
 set num1 = $#tmp1
## echo $tmp1

 if($num1 == 1) then
 echo "------------ Single file"
 else
 echo "------------ Multiple files"

 cd $current
##================================================
##================================================
##================================================
if( -e spi_$models[$ii].ncl) then
rm spi_$models[$ii].ncl
endif
 echo "NCL files...."
cat >> spi_$models[$ii].ncl << EOF
;----------------------------------------------------------------------
; spi_2.ncl
```

```
;
; Concepts illustrated:
;   - Computing the Standardized Precipitation Index (SPI)
;   - Reading data from the GPCP (Global Precipitation Climatology Project)
;----------------------------------------------------------------------

load "/opt/ncl_ncarg-6.1.2/lib/ncarg/nclscripts/csm/gsn_code.ncl"
load "/opt/ncl_ncarg-6.1.2/lib/ncarg/nclscripts/csm/gsn_csm.ncl"
load "/opt/ncl_ncarg-6.1.2/lib/ncarg/nclscripts/csm/contributed.ncl"


begin



 model = "$models[$ii]"

 fils = systemfunc ("ls /raid60/cmip5/data/${exp}/${realm}/mon/${cmor_table}/$
{var}/$ins[$ii].$models[$ii]/r1i1p1/${var}_${cmor_table}_$models[$ii]_$
{exp}_r1i1p1_*.nc")


 diro = "${exp}/org/"
 filo = "spi12_$models[$ii]_${exp}_2006-2100.nc"


; ================================================================
; Open the file: Read only the user specified period
; ================================================================

 f     = addfiles(fils, "r")




 prc = addfiles_GetVar(f,fils,"pr")

 printVarSummary(prc)


 pmsg = prc@_FillValue







; precipitaiton flux(kgm-2s-1) to mm/day
 prc = prc*86400
 runlen = (/12, 24/)
 nrun   = dimsizes(runlen)

 land_only = prc


;  do nr = 0,nrun-1
```

```
   spi = dim_spi_n(land_only,runlen(0),False,0)
;  end do
  spi@long_name = "SPI 12 month"
  spi!0 = "time"
  spi!1 = "lat"
  spi!2 = "lon"

  lon = prc&lon
  lat = prc&lat
  time = prc&time

;  print(time)


  spi&lon = lon
  spi&lat = lat
  spi&time = time

  printVarSummary(spi)

  system("rm " + filo)
  fout = addfile(diro+filo,"c")

  ;---------------

 ntim = dimsizes(time)
 nlat = dimsizes(lat)
 nlon = dimsizes(lon)

 fileAtt = True
 fileAtt@title = "$models[$ii] SPI 12 month"
 fileAtt@Conventions = "none"
 fileAtt@creation_date = systemfunc("date")
 fileattdef(fout,fileAtt)

 dimNames = (/"time","lat","lon"/)
 dimSizes = (/ntim,nlat,nlon/)
 dimUnlim = (/False,False,False/)


 filedimdef(fout,dimNames,dimSizes,dimUnlim)


 filevardef(fout,"time",typeof(time),"time")
 filevardef(fout,"lat",typeof(lat),"lat")
 filevardef(fout,"lon",typeof(lon),"lon")
 filevardef(fout,"spi",typeof(spi),getvardims(spi) )


 filevarattdef(fout,"time",time)
 filevarattdef(fout,"lat",lat)
 filevarattdef(fout,"lon",lon)
 filevarattdef(fout,"spi",spi)
 setfileoption(fout,"DefineMode",False)


 fout->time = (/time/)
 fout->lat = (/lat/)
 fout->lon = (/lon/)
```

```
 fout->spi = (/spi/)



  end


EOF
##================================================
##================================================
##================================================
ncl < spi_$models[$ii].ncl
rm -rf spi_$models[$ii].ncl

cd ${current}
set file = spi12_$models[$ii]_${exp}_2006-2100
echo $file
if( -e ${file}.xtl ) then
rm ${file}.xtl
endif

cat >> ${file}.xtl << --
dset ^${file}.nc
tdef time 1140 linear jan2006 1mo
--

mv ${file}.xtl ${exp}/org
 endif

 endif




@ iexist = $iexist + 1
end

@ ii = $ii + 1
end
```