

Part II

# Maps and Contours

Exercises and Tasks

Carsten Möller-Falschauer, DLR

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# Maps and Contours

The figure illustrates various map projections and contour lines. It includes:

- Orthographic Projection:** A map of Earth showing mean sea level pressure (P<sub>a</sub>) with a color scale from 98000 to 102000.
- Polar Projection:** A map of the Arctic region showing mean sea level pressure (P<sub>a</sub>) with contour lines labeled 135W, 135E, 90W, 45W, 45E, and 0.
- Molleweide Projection:** A map of the world showing mean sea level pressure (P<sub>a</sub>) with contour lines labeled 135W, 135E, 90W, 45W, 45E, and 0.
- Temperature T:** Three contour maps showing temperature (T) for different regions: a global map, a detailed North Atlantic map, and a map of the Indian Ocean region.

Source: Martin Miescher, DLR

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# Map projections

- 18 map projections

Aitoff	Azimuthal Equidistant
Cylindrical Equal Area	Cylindrical Equidistant
Gnomonic	Hammer
Lambert Conformal	Lambert Equal Area
Masked Lambert Conformal	Mercator
Mollweide	Orthographic
Polar Stereographic	Robinson
Rotated Mercator	Satellite
Stereographic	Winkel Tripel

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NCL

# Maps

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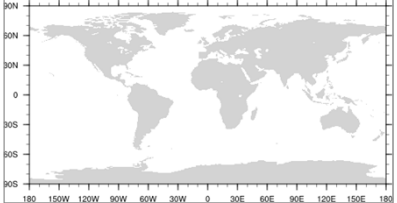
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NCL

## Simple map plot

```
begin
  wks = gsn_open_wks("png", "plot_part_II_simple_map")
  plot = gsn_csm_map(wks, True) ; create the plot
end
```



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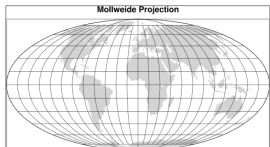
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NCL

## Changing the map projection

```
begin
  wks = gsn_open_wks("png", "plot_part_II_projection_map")
  res = True ; resource object
  res@tiMainString = "Mollweide Projection" ; draw a title
  res@mpProjection = "Mollweide" ; set projection
  res@mpGridAndLimbOn = True ; turn on grid lines
  plot = gsn_csm_map(wks, res) ; create the plot
end
```



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NCL

### Selecting a map sub-region

```

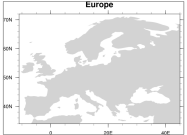
begin
  wks = gsn_open_wks("png", "plot_part_II_subregion_map")

  res = True
  res@tiMainString = "Europe" ; draw a title

  res@mpMinLonF = -11 ; min longitude
  res@mpMaxLonF = 45 ; max longitude
  res@mpMinLatF = 34 ; min latitude
  res@mpMaxLatF = 72 ; max latitude

  plot = gsn_csm_map(wks, res) ; create the plot
end

```



Europe

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NCL

### Change the map resolution / grid lines

```

begin
  wks = gsn_open_wks("png", "plot_part_II_map_resolution")

  res = True
  res@tiMainString = "Ju-H-15V6F35-H-FV-6H3-tland" ;-- draw a title

  res@mpMinLonF = 8 ;-- min longitude
  res@mpMaxLonF = 13 ;-- max longitude
  res@mpMinLatF = 53 ;-- min latitude
  res@mpMaxLatF = 58 ;-- max latitude

  res@mpDataBaseVersion = "MediumRes" ;-- set map resolution
  res@mpOutlineOn = True ;-- draw coastlines

  res@mpGridAndDimOn = True ;-- draw grid lines
  res@mpGridLineColor = "blue" ;-- grid line color
  res@mpGridSpacingF = 1 ;-- grid line spacing
  res@mpGridLineThicknessF = 1 ;-- grid line thickness
  res@mpGridLineDashPattern = 1 ;-- grid line dash pattern

  plot = gsn_csm_map(wks, res) ;-- create the plot
end

```

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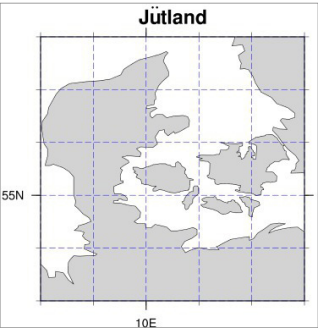
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NCL

### Change the map resolution / grid lines



Jutland

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10E

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NCL

### Change the map resolution / grid lines

```

begin
  wks = gsn_open_wks("png", "plot_part_II_resolution_map")

  res = True
  res@tiMainString = "Ju-H-15V6F35-H-FV-6H3-tland" ;-- Überschrift

  res@mpMinLonF = 8 ;-- Längengrad Minimum
  res@mpMaxLonF = 13 ;-- Längengrad Maximum
  res@mpMinLatF = 53 ;-- Breitengrad Minimum
  res@mpMaxLatF = 58 ;-- Breitengrad Maximum

  res@mpDataBaseVersion = "MediumRes" ;-- Kartenaufösung
  res@mpOutlineOn = True ;-- zeichne Küstenlinien

  res@mpGridAndLimOn = True ;-- Gitterlinien
  res@mpGridLineColor = "blue" ;-- Gitterlinien Farbe
  res@mpGridSpacingF = 1 ;-- grid line spacing
  res@mpGridLineThicknessF = 1 ;-- grid line thickness
  res@mpGridLineDashPattern = 1 ;-- grid line dash pattern

  res@mpGridAndLimDrawOrder = "PreDraw" ;-- first draw grid then map

  plot = gsn_csm_map(wks, res)
end

```

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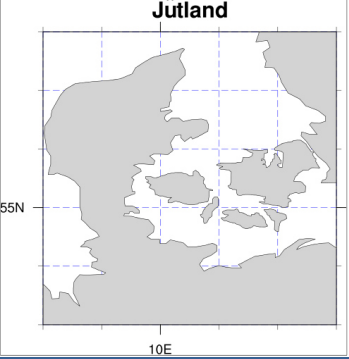
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NCL

### Change the map resolution / grid lines



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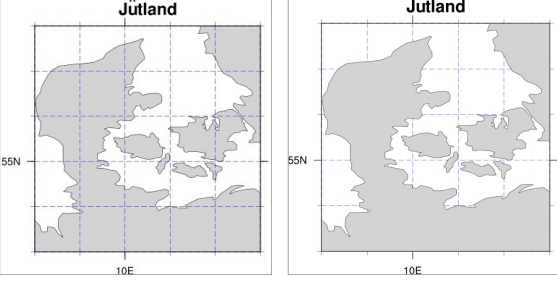
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NCL

### Change the map resolution / grid lines



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NCL

# Contours

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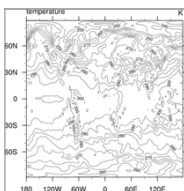
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NCL

## Contour plot using defaults

```
begin
  f = addfile("$NCL_TUT/data/rectilinear_grid_3D.nc", "r")
  t = f->t(0,0,,:)
  wks = gsn_open_wks("png", "plot_part_II_contour_def_map")
  plot = gsn_csm_contour(wks, t, True) ;-- create the plot
end
```



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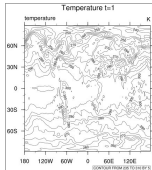
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NCL

## Contour plot with title string

```
begin
  f = addfile("$NCL_TUT/data/rectilinear_grid_3D.nc", "r")
  t = f->t(0,0,,:)
  wks = gsn_open_wks("png", "plot_part_II_contour_def_map")
  res = True ; create resource object
  res@tiMainString = "Temperature t=1" ; draw a title
  plot = gsn_csm_contour(wks, t, res) ; create the plot
end
```



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NCL

### Contour map plot

```

begin

  f = addfile("$NCL_TUT/data/rectilinear_grid_3D.nc","r")
  t = f->t(0,0,,:)

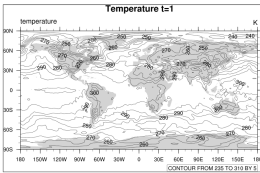
  wks = gsn_open_wks("png", "plot_part_II_contour_def_map")

  res = True
  res@tiMainString = "Temperature t=1"      ;-- draw a title

  plot = gsn_csm_contour_map(wks, t, res)   ;-- create the plot

end

```



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NCL

### Contour map plot with colored lines

```

begin

  f = addfile("$NCL_TUT/data/rectilinear_grid_3D.nc","r")
  t = f->t(0,0,,:)

  wks = gsn_open_wks("png", "plot_part_II_contour_lines_col_map")

  res = True
  res@tiMainString = "Temperature t=1" ; draw a title

  res@cnLineThicknessF = 2 ; make lines thicker
  res@cnMonoLineColor = False ; use multiple line colors
  res@cnLevelSpacingF = 2 ; contour level spacing

  plot = gsn_csm_contour_map(wks, t, res) ; create the plot

end

```

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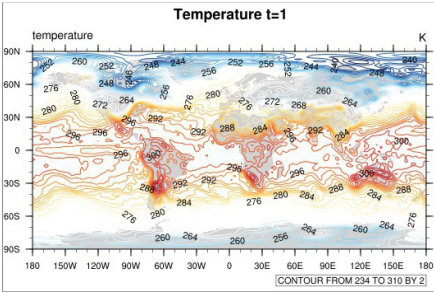
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NCL

### Contour plot with colored lines



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NCL

### Contour map plot with colored lines

```

begin

  f = addfile("../data/rectilinear_grid_3D.nc","r")
  t = f->t(0,0,,:)

  wks = gsn_open_wks("png", "plot_part_II_contour_lines_col_map")

  res = True
  res@tiMainString = "Temperature t=1" ; draw a title

  res@cnLineThicknessF = 2 ; make lines thicker
  res@cnMonoLineColor = False ; use multiple line colors
  res@cnLevelSpacingF = 2 ; contour level spacing
  res@cnLineColors = toint(fspan(2,240,20)) ; define the colors

  plot = gsn_csm_contour_map(wks, t, res) ; create the plot

end

```

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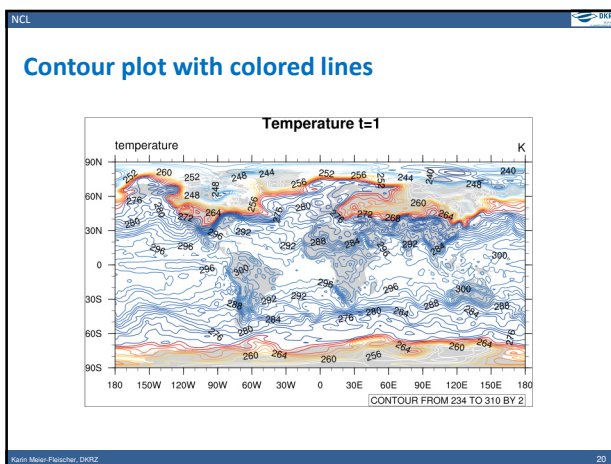
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NCL

### Contour plot with color fill

```

begin

  f = addfile("$NCL_TUT/data/rectilinear_grid_3D.nc","r")
  t = f->t(0,0,,:)

  wks = gsn_open_wks("png", "plot_part_II_contour_fill_map")

  res = True
  res@tiMainString = "Temperature t=1" ; draw a title

  res@cnFillOn = True ; turn color fill on

  plot = gsn_csm_contour_map(wks, t, res) ; create the plot

end

```

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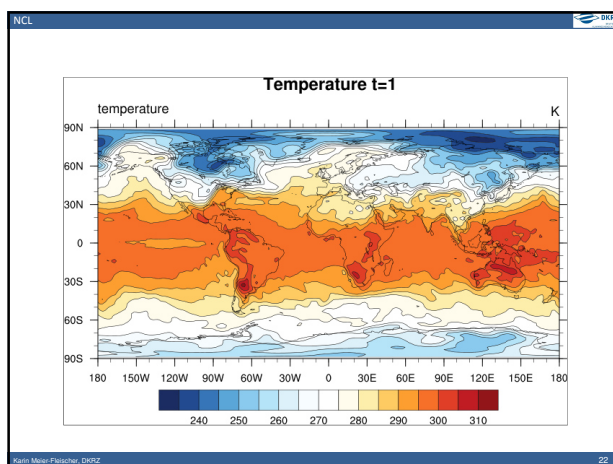
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NCL

### Contour map plot with line settings

```

begin
  f = addfile("$NCL_TUT/data/rectilinear_grid_3D.nc","r")
  t = f->t(0,0,,:)

  wks = gsn_open_wks("png", "plot_part_II_cont_fill_map")

  res = True
  res@tiMainString = "Temperature t=1" ; draw a title

  res@cnFillOn = True ; turn color fill on
  res@cnLinesOn = False ; don't draw contour lines
  res@cnLevelSelectionMode = "ManualLevels" ; set cn levels mode
  res@cnMinLevelValF = 240. ; minimum contour level
  res@cnMaxLevelValF = 310. ; maximum contour level
  res@cnLevelSpacingF = 2. ; contour level spacing

  res@lbLabelStride = 5 ; label every 5th value
  res@lbBoxMinorExtentF = 0.15 ; decrease labelbar height

  plot = gsn_csm_contour_map(wks, t, res) ; create the plot
end

```

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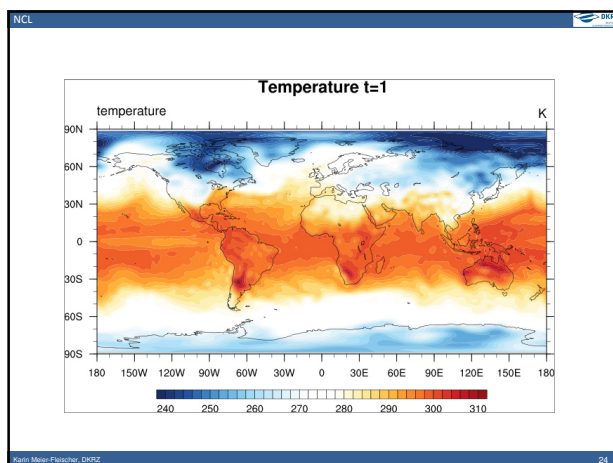
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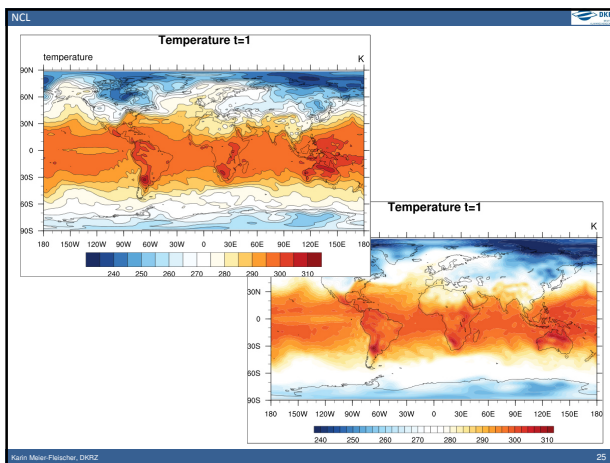
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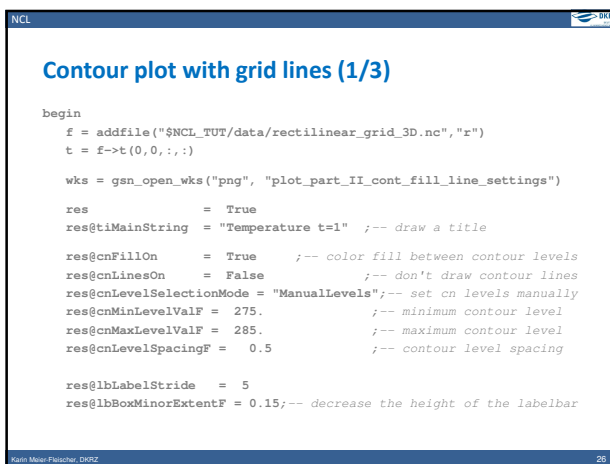
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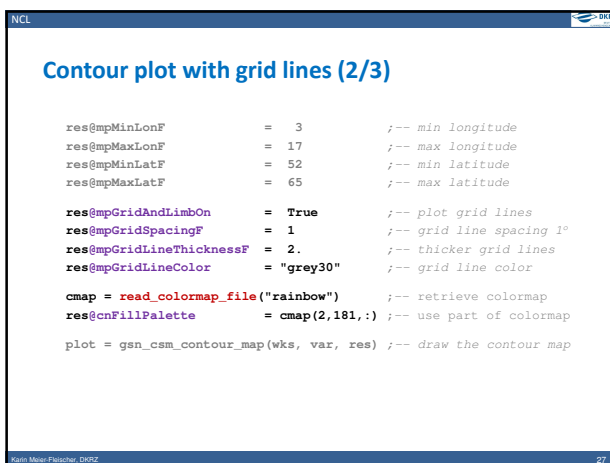
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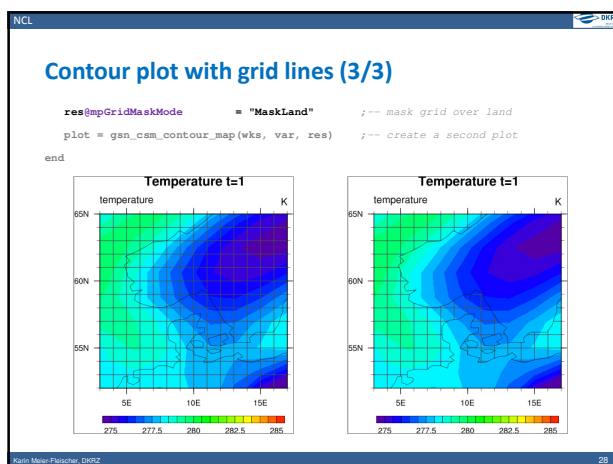
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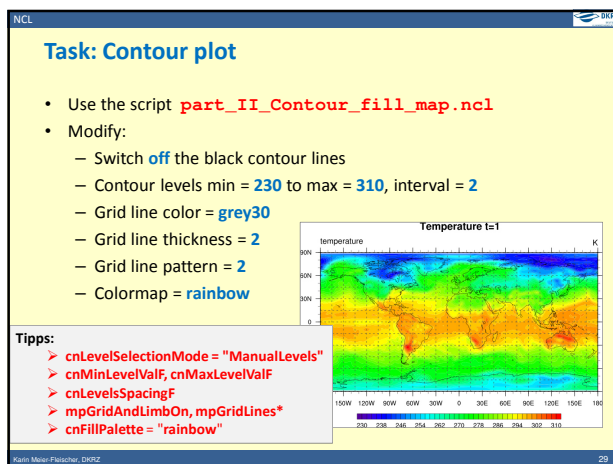
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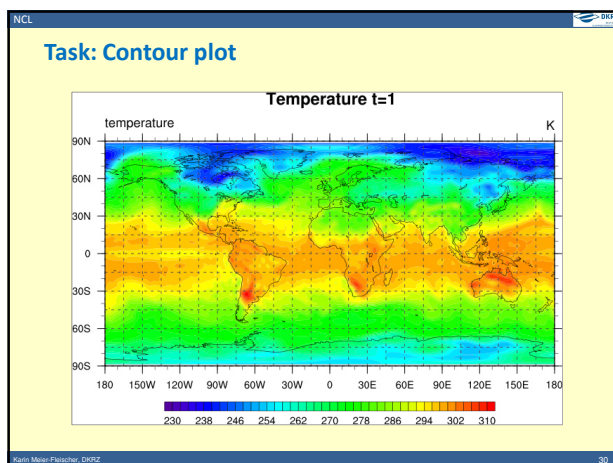
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NCL

### Task: Contour plot (1/2)

```

begin

f = addfile(,"$NCL_TUT/data/rectilinear_grid_3D.nc","r")
t = f->t(0,0,:, :)

wks = gsn_open_wks("png", "task_II_contour_map")

res = True ; create resource object
res@tiMainString = "Temperature t=1" ; title string

res@cnFillOn = True ; turn color fill on
res@cnFillPalette = "rainbow" ; change the colormap
res@cnLinesOn = False ; switch off contour lines
res@cnLevelSelectionMode = "ManualLevels" ; set cn levels
res@cnMinLevelValF = 230. ; minimum contour level
res@cnMaxLevelValF = 310. ; minimum contour level
res@cnLevelSpacingF = 2. ; contour level spacing


```

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NCL

### Task: Contour plot (2/2)

```

res@lbLabelStride = 4 ; labelbar label increment
res@lbBoxMinorExtentF = 0.15 ; decrease labelbar height

res@mpGridAndLimbOn = True ; plot grid lines
res@mpGridLineThicknessF = 2. ; grid line thickness
res@mpGridLineColor = "grey30" ; grid line color
res@mpGridLineDashPattern = 2 ; grid line dash pattern

plot = gsn_csm_contour_map(wks, t, res) ; create the plot

end


```

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