天氣學與氣象分析

HW4 - 電腦繪圖

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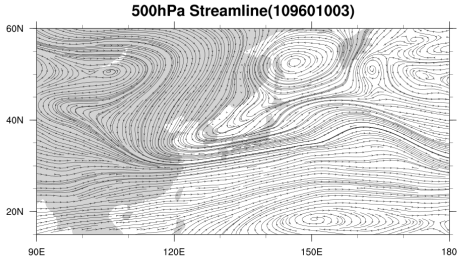
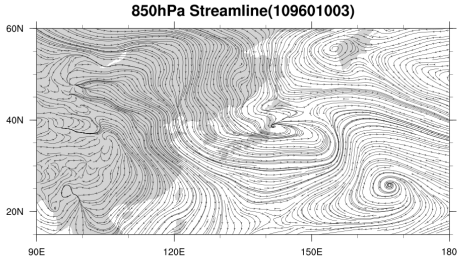
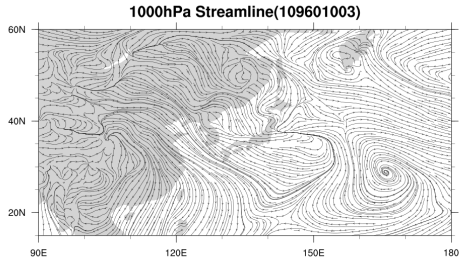
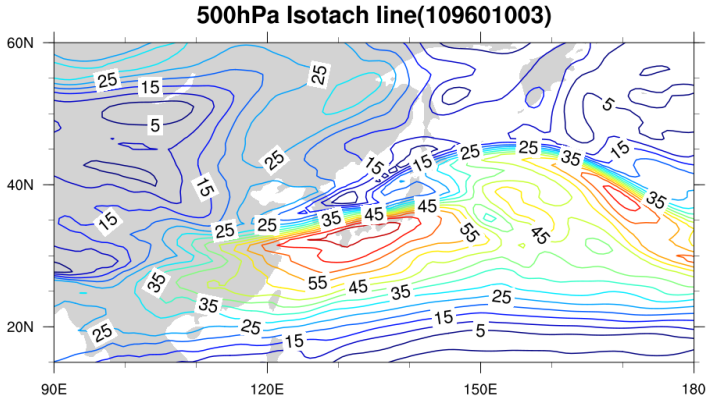
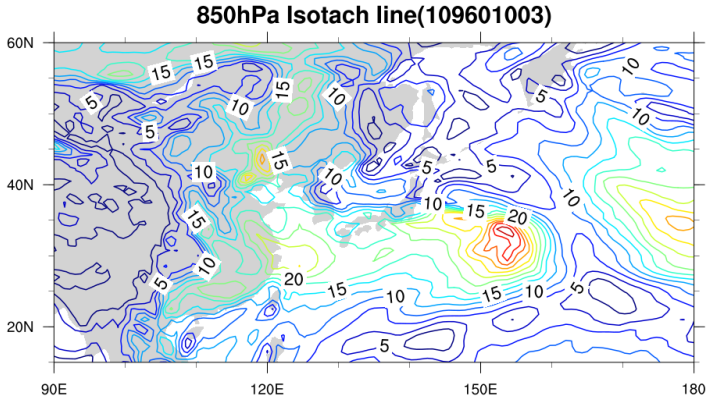
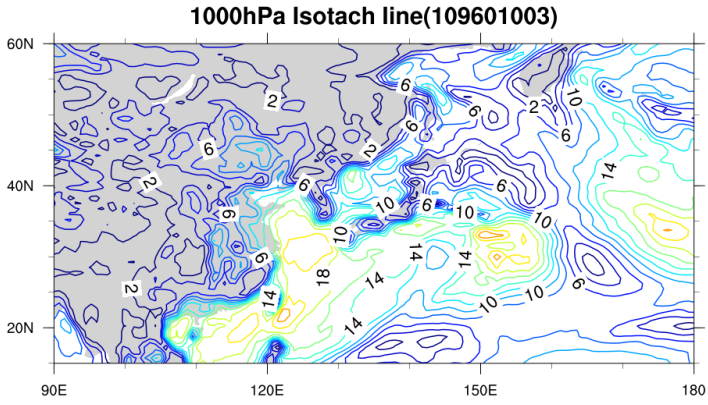
Stream Line

Stream Line	說明	繪圖
500 hPa	根據角動量守恆定律，氣塊移動到極地，緯度增加，旋轉半徑變小，所以氣快角動量會上升，導致西風噴流形成。當冬天時，極地對流層頂與熱帶對流層頂的氣溫溫差變大，更加增強西風帶的速度。	
850 hPa	同 500 hPa	

Stream Line	說明	繪圖
1000 hPa	明顯看出台灣的平流，西伯利亞高壓南下，正影響台灣，台灣此時可能有寒流！	

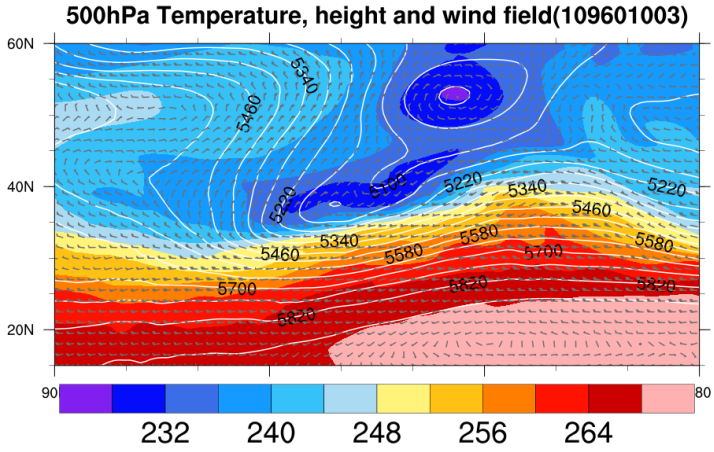
Isotach Line

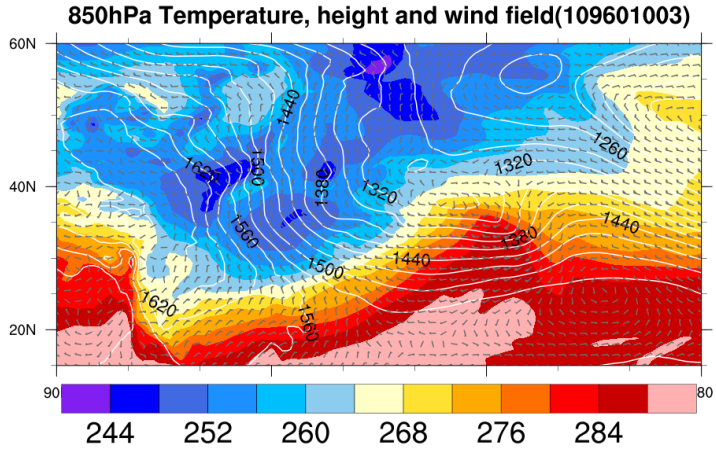
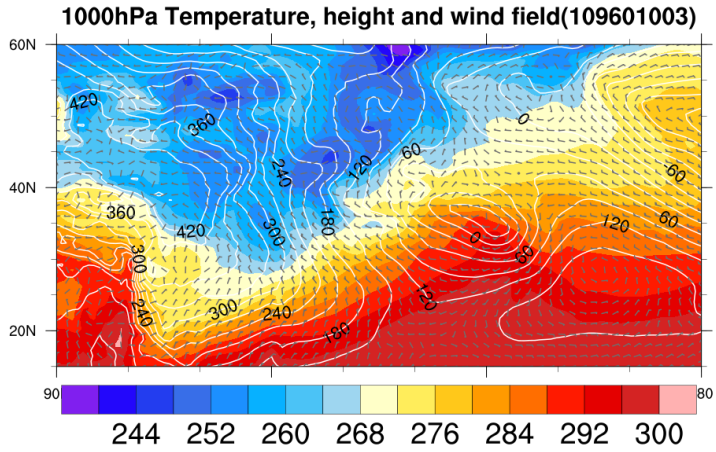
Isotach Line	說明	繪圖
500 hPa	與氣流線差異不大	

Isotach Line	說明	繪圖
850 hPa	與氣流線差異不大	
1000 hPa	海面風速通常較大，因為近地面風速與地形關係較大，海面摩擦力較小。	

Temperature, Height, Wind Field

Temperature, Height, Wind Field	說明	繪圖

Temperature, Height, Wind Field	說明	繪圖
500 hPa	在日本海處可以看到有一個槽線延伸，此高度下重力位高度與溫度大抵上重合，北邊低壓；南邊高壓。	

Temperature, Height, Wind Field	說明	繪圖
850 hPa, 1000 hPa	可以看出有滿強烈的冷瓶留在台灣附近，並且可以看到台灣在清晨六點為本日最低溫，不過目前台灣還是在槽前	 

總分析

從上述的觀察中，感覺冷高壓準備進台灣，並且會連帶台灣溫度下降。

程式碼

```
; Assignment 4
; Name: Hugo ChunHo Lin
; Student Id: 109601003


function setMapsResource(resource: logical)
local localResource
begin
  localResource = resource

  localResource@mpLimitMode = "LatLon"
  localResource@mpMinLatF   =  15.
  localResource@mpMaxLatF   =  60.
  localResource@mpMinLonF   =  90.
  localResource@mpMaxLonF   = 180.

  return localResource
end

function setIsothermalContourResource(resource: logical)
local localResource
begin
  localResource = resource

  localResource@gsnAddCyclic     = False

  localResource@cnFillOn         = True       ; areas between contour
levels are filled with a solid color
  localResource@cnLinesOn        = False      ; turn off contour lines
  ;localResource@cnLineLabelsOn  = False      ; tuen off line labels
  localResource@lbLabelBarOn     = True       ; will draw a panel label
bar

  return localResource
end

function setIsobaricContourResource(resource: logical)
local localResource
begin
  localResource = resource

  localResource@gsnAddCyclic     = False

  localResource@cnLevelSpacingF  = 5
  localResource@tiMainOn         = False         ; turns the Main title
off.
  localResource@cnFillPalette    = "gui_default" ; set color map
  localResource@cnLineLabelBackgroundColor = -1
  localResource@cnInfoLabelOn    = False         ; Robin ask: what is
this?
  localResource@lbLabelBarOn     = False         ; will draw a panel label
bar instead
```

```
  localResource@cnLineColor      = "white"
  localResource@cnLineThicknessF = 3.0

  return localResource
end


function setWindbarVector(resource: logical)
local localResource
begin
  localResource = resource

  localResource@gsnAddCyclic             = False

  localResource@vcGlyphStyle             = "WindBarb"     ; select wind
barbs
  localResource@vcRefLengthF             = 0.008          ; define length
of vec ref
  localResource@vcRefAnnoOn              = False          ; turn off ref
wind barb
  localResource@vcMinDistanceF           = 0.012          ; thin out
windbarbs
  localResource@vcWindBarbLineThicknessF = 3.             ; set the wind
barb thickness
  localResource@trYReverse               = True           ; reverse the Y-
axis
  localResource@vcWindBarbColor          = (/111, 111, 111/) / 255.

  return localResource
end


function setIsotachContourResource(resource: logical)
local localResource
begin

  localResource = resource
  localResource@gsnAddCyclic     = False

  localResource@cnFillOn         = False
  localResource@cnInfoLabelOn    = False         ; Robin ask: what is
this?
  localResource@cnMonoLineColor  = False         ; control the color of
each line individually
  localResource@cnLineColors     = span_color_rgba("NCV_jet",15)   ; 256
colors, span it to get 11 colors
  localResource@cnLineThicknessF = 3.0

  return localResource
end


; Main program strat ----------------------
begin
```

```
path = "./"

; If -1 is given for the dimensions parameter,
; all values in the file will be read into a one-dimensional variable.
lines  = asciiread(path+"012400.txt", -1, "string")

; The dimension size of this variable will be equal to the number of
elements in the file.
nlines = dimsizes(lines)

;;print(nlines)
;;print(lines)

mlon  = 121 ; range: 90~180, step: 0.75
nlat  = 61  ; range: 15~60, step: 0.75
levs  = 5   ; 300, 500, 700, 850, 1000
vars  = 4   ; H, U, V, T

; 'var': Processing the data in 'lines', store 4-dimension data about:
; vars=0: values of Geopotential meters height (H), unit: GPM, in latitude
and longitude grid
; vars=1: values of Meridional wind speed (U), in latitude and longitude
grid
; vars=2: values of Zonal wind speed (V), in latitude and longitude grid
; vars=3: values of Temperature (T), unit: Kelvin, in latitude and
longitude grid
var = new((/vars, levs, nlat, mlon/), float)

pressure_levels = (/300, 500, 700, 850, 1000/)

nl   = 0    ; Count line
nvar = 0    ; Record data types in (H=0, U=1, V=2, T=3)
nlev = 0    ; Record isobaric surfaces in (300hPa=0, 500hPa=1, 700hPa=2,
850hPa=3, 1000hPa-4)
do while(nl .lt. nlines)
;---Read the first character of this line, return substring: (string,
start, end)
  first = str_get_cols(lines(nl), 0, 0)
;---If it's a "%", then increment to next line.
  if(first .eq. "D") then
    nl = nl + 1           ; increment line counter, skip 'DATE=160124
HOUR=00  PLEVEL= ...'
    continue
  else
;---Otherwise, get the number of rows and read the data.

    ; In 012400.txt, every 739 lines contains a complete set of data
    ; of latitude and longitude grid, (121*61 = 739*10-1 = 7381 values).
    nrows = 739

    if(nvar .gt. vars-1)then
       nvar = 0           ; resourceet the type of variable to
Geopotential meters height (H)
       nlev = nlev + 1    ; switch to different isobaric surface, ex: 300,
```

```
500, 700, 850, 1000
    end if
    nl = nl + 1           ; increment line counter, skip '**** ...  ****'
    ;;print("================================================")
    ;;print("Reading " + nrows + " rows of data.")

    ; Clean up the strings so there's only one space between each string,
    ; and no extra space at beginning or end.
    ; This allows us to use str_split_csv to parse this chunk of data.
    ; str_split_csv expects a single character delimiter (a space in this
case).
    lines(nl:nl+nrows-1) = str_sub_str(lines(nl:nl+nrows-1),"    "," ")
    lines(nl:nl+nrows-1) = str_sub_str(lines(nl:nl+nrows-1),"   "," ")
    lines(nl:nl+nrows-1) = str_sub_str(lines(nl:nl+nrows-1),"  "," ")

    ; Returns an array of strings with leading and ending spaces and TABs
removed.
    lines(nl:nl+nrows-1) = str_strip(lines(nl:nl+nrows-1))

    ; Parse the data into a 2D integer array.
    x2D = tofloat(str_split_csv(lines(nl:nl+nrows-1), " ", 0))

    ; Converts a multi-dimensional array to a one-dimensional array.
    x1D =  ndtooned(x2D)
    ;;print(x1D(0:121*61-1))
    ;;print(nvar+" "+nlev)

    ; Reshapes a multi-dimensional array to another multi-dimensional
array.
    var(nvar, nlev, :, :) = reshape(x1D(0:mlon*nlat-1), (/nlat, mlon/))
    ;;print(x1D(0)+"  "+x1D(mlon*nlat-1))

    nl = nl + nrows     ; Jump to next set of data (latitude and longitude
grid).
    nvar = nvar + 1     ; switch to different types of variable, ex: H, U,
V, T
  end if
end do

lat_coor = fspan(15, 60, nlat)
lon_coor = fspan(90, 180, mlon)

H = var(0, :, :, :) ; Geopotential meters height
H!0 = "lev"
H!1 = "lat"
H!2 = "lon"
H&lat = lat_coor
H&lon = lon_coor
H&lat@units = "degrees_north"
H&lon@units = "degrees_east"

U = var(1, :, :, :) ; Meridional wind speed
V = var(2, :, :, :) ; Zonal wind speed
T = var(3, :, :, :) ; Temperature
```

```
; Copies all named dimensions and coordinate variables from one variable
to another.
copy_VarCoords(H, U)
copy_VarCoords(H, V)
copy_VarCoords(H, T)

resource                  = True           ; plot mods desired
resource@gsnDraw          = False          ; don't draw graphics when the
gsn function is called
resource@gsnFrame         = False          ; don't advance frame when the
gsn function is called

do level = 0, levs-1
  wks = gsn_open_wks("png",
"hw4_109601003_total_"+pressure_levels(level)+"hPa")  ; send graphics to
PNG file

  map_resource = setMapsResource(resource)
  map_resource@tiMainString = pressure_levels(level) + "hPa Temperature,
height and wind field(109601003)" ; add titles
  ;print(map_resource)
  map = gsn_csm_map(wks, map_resource)

  temperature_resource = setIsothermalContourResource(resource)
  ;print(temperature_resource)
  isotherm_contour = gsn_csm_contour(wks, T(level, :, :),
temperature_resource)

  gpm_resource = setIsobaricContourResource(resource)
  gpm_resource@cnFillOn               = False
  ;gpm_resource@cnLineLabelPerimOn     = False
  if (pressure_levels(level) .le. 500)then
    gpm_resource@cnLevelSpacingF = 60
  else
    gpm_resource@cnLevelSpacingF = 30
  end if
  ;print(gpm_resource)
  isobaric_contour = gsn_csm_contour(wks, H(level, :, :), gpm_resource)

  vector_resource = setWindbarVector(resource)
  ;print(vector_resource)
  windbars = gsn_csm_vector(wks, U(level, :, :), V(level, :, :),
vector_resource)

  overlay(map, isotherm_contour)
  overlay(map, isobaric_contour)
  overlay(map, windbars)
  draw(map)
  frame(wks)
end do

do level = 0, levs-1
  wks = gsn_open_wks("png",
```

```
"hw4_109601003_streamline_"+pressure_levels(level)+"hPa")

  map_resource = setMapsResource(resource)
  map_resource@tiMainString = pressure_levels(level) + "hPa
Streamline(109601003)" ; add titles
  map = gsn_csm_map(wks, map_resource)

  streamLine = gsn_csm_streamline(wks, U(level, :, :), V(level, :, :),
resource)

  overlay(map, streamLine)
  draw(map)
  frame(wks)
end do

Wind_speed_scalar = new((/levs, nlat, mlon/), float)
; Calculate wind speed scalar
do level = 0, levs-1
  do lat = 0, nlat-1
    do lon = 0, mlon-1
      Wind_speed_scalar(level, lat, lon) = (U(level, lat, lon)^2 +
V(level, lat, lon)^2)^0.5
    end do
  end do
end do
copy_VarCoords(H, Wind_speed_scalar)

do level = 0, levs-1
  wks = gsn_open_wks("png",
"hw4_109601003_isotach_contour"+pressure_levels(level)+"hPa")

  map_resource = setMapsResource(resource)
  map_resource@tiMainString = pressure_levels(level) + "hPa Isotach
line(109601003)" ; add titles
  map = gsn_csm_map(wks, map_resource)

  windspeed_resource = setIsotachContourResource(resource)
  isotach_contour = gsn_csm_contour(wks, Wind_speed_scalar(level, :, :),
windspeed_resource)

  overlay(map, isotach_contour)
  draw(map)
  frame(wks)
end do

end
```