

地球科学学院大气科学系《诊断分析与绘图实验》报告

实验十 相关分析

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一、目的：

掌握相关分析的基本方法；能对相关分析的结果进行显著性检验；了解其他数据分析函数的使用方法。

二、方法：（见实验指导书）

三、回答习题（可逐题回答，也可以把执行的命令或脚本一次写完，把要说明的内容加成注释或在最后说明）：

根据文献《南海夏季风变化及其与全球大气和海温的关系》，使用实验9中计算出的1950-1999年南海夏季风指数（SCSSMI），计算其与同期850hPa经向风或纬向风的相关系数，并检验；结果的图形输出参考文献图2。

```
begin
f = addfile("nc/0518/ssta5099.nc", "r")
fu = addfile("nc/0518/uwnd.mon.mean4803.nc", "r")
fv = addfile("nc/0518/vwnd.mon.mean4807.nc", "r")
```

```
; level = fv->level
; print(level);850hPa is 2
;time = fv->time
;printVarSummary(time)
;tim1 = cd_calendar(time, 4)
;print(tim1)
```

```
;;;;;;;;vwnd;;;;;;;;
vwnd1 = fv->vwnd
;printVarSummary(vwnd1)
vwnd2 = 0.01*vwnd1+202.65
copy_VarCoords(vwnd1,vwnd2);not metedata
vwnd = vwnd2(24:623,2,:,:)
;printVarSummary(vwnd)
```

```
vclm = clmMonTLL(vwnd)
;printVarSummary(vclm)
v1m = vclm(0,:,:)
;v1m_ex = conform(vwnd1, v1m, )
v17m = vclm((/0,6/),:,:)
;print(v17m)
v = dim_avg_n(v17m, 0)
;copy_VarCoords(vwnd(0,:,:), v)
;printVarSummary(v)
```

```

v_ep = conform(vwnd, v, (/1,2/))
;printVarSummary(v_rs_ep)
v1m_ep = conform(vwnd,v1m,(/1,2/))

;;;;;;;;;uwnd;;;;;;;;;
uwnd1 = fu->uwnd
;printVarSummary(uwnd1)
uwnd2 = 0.01*uwnd1+202.65
copy_VarCoords(uwnd1,uwnd2);not metedata
uwnd = uwnd2(24:623,2,,:)

uclm = clmMonTLL(uwnd)
u1m = uclm(0,,:,:)
u17m = uclm((/0,6/),,:,:)
u = dim_avg_n(u17m, 0)

u_ep = conform(uwnd, u, (/1,2/))
u1m_ep = conform(uwnd,u1m,(/1,2/))
;print(u_rs_ep)
;;;;;;;;;
v_t = sqrt(v_ep^2 + u_ep^2)
; wind = sqrt(vwnd_rs^2 + uwnd_rs^2)
;printVarSummary(v1m_t)

v_fenzi = (v1m_ep - vwnd)
u_fenzi = (u1m_ep - uwnd)
fenzi = sqrt(v_fenzi^2 + u_fenzi^2)

delta = fenzi/v_t - 2
copy_VarCoords(uwnd,delta)

```

读取数据并计算 SCSSMI 指数。

```

delta_c = delta(lat|:,lon|:,time|:)
uwnd_c = uwnd(lat|:,lon|:,time|:)

corc = escorc(delta_c, uwnd_c)
copy_VarCoords(delta_c,corc)
;printVarSummary(corc)
prob = rtest(corc, 48, 0)
print(prob)

```

计算相关系数并检验。

```

; pwks = "x11";这里的设置是对画布的， 但是不是我想要的效果
; pwks@wkWidth = 800
; pwks@wkHeight = 800
wks = gsn_open_wks("png", "ehh")

res = True

res@mpShapeMode = "FreeAspect";if plot map, have to write this to change

```

```

picture size
res@vpHeightF = 0.7
res@vpWidthF = 0.7;这几句是设置绘图大小的，因为画成长方形跟论文不太一样，实验 9 没改，这里还是改了 😊
res@tmXBLabelFontHeightF = 0.013
res@tmYLLabelFontHeightF = 0.013

res@cnInfoLabelOn = False
res@pmTickMarkDisplayMode = "Always"
;res@tmXBTickSpacingF = 60

res@cnLevelSelectionMode = "Explicitlevels"
res@cnLevels = (/ -0.6, -0.4, -0.2, 0, 0.2, 0.4, 0.6 /)
res@cnExplicitLineLabelsOn = True
res@cnLineLabelStrings = (/ "-0.6", "-0.4", "-0.2", "0", "0.2", "0.4", "0.6" /)

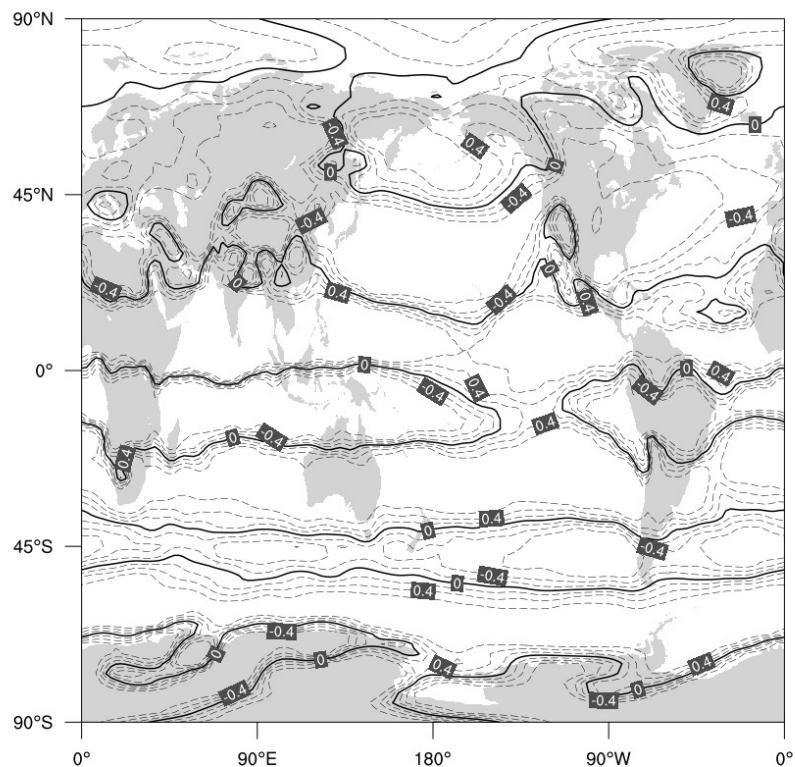
res@gsnContourZeroLineThicknessF=3
res@gsnContourPosLineDashPattern=5
res@gsnContourNegLineDashPattern=5
res@cnLabelMasking=True
res@cnLineLabelBackgroundColor="gray30"
res@cnLineLabelFontColor = "white"
res@cnLineLabelFontHeightF = 0.009
res@mpCenterLonF = 180
res@cnLineLabelDensityF = 0.7

plot = gsn_csm_contour_map_ce(wks, corc, res)

end

```

设置相关属性并绘图，这里没加标题啥的，主要是想尽可能复现论文图像。



设置不同的置信水平，在图中显示 **95%**和 **99%**置信水平的相关显著区域。

;这里 **SCSSMI** 指数的计算和上题一样，， 代码便不再放，从改动地方开始。

```

::::::::::::q2::::::::::::
prob = rtest(corc, 48, 0);n = 50-2
copy_VarCoords(delta_c,prob)
prob95=rtest(0.273,48,0)
prob99=rtest(0.354,48,0)
;print(prob)
::::::::::::q2::::::::::::

wks = gsn_open_wks("x11", "ehh")

res = True
res@mpFillOn = False
res@mpCountyLineThicknessF = 0.5
res@mpShapeMode = "FreeAspect"
res@vpHeightF = 0.7
res@vpWidthF = 0.7
res@tmXBLLabelFontHeightF = 0.013
res@tmYLLLabelFontHeightF = 0.013

res@cnInfoLabelOn = False

```

```

res@pmTickMarkDisplayMode = "Always"

res@cnLevelSelectionMode = "Explicitlevels"
res@cnLevels = (/ -0.8, -0.6, -0.4, -0.2, 0, 0.2, 0.4, 0.6, 0.8 /)
res@cnExplicitLineLabelsOn = True
res@cnLineLabelStrings = (/ "-0.8", "-0.6", "-0.4", "-0.2", "0", "0.2", "0.4", "0.6", "0.8" /)

res@gsnContourZeroLineThicknessF=3
res@cnLineThicknessF = 2
res@gsnContourPosLineDashPattern=5
res@gsnContourNegLineDashPattern=5
res@cnLabelMasking=True
res@cnLineLabelBackgroundColor="gray30"
res@cnLineLabelFontColor = "white"
res@cnLineLabelFontHeightF = 0.009
res@mpCenterLonF = 180
res@cnLineLabelDensityF = 0.7
res@cnLabelDrawOrder = "PostDraw"
res@cnLineDrawOrder = "PostDraw"

```

```

plot = gsn_csm_contour_map_ce(wks, corc, res)

```

还是先画相关系数的等值线图，下一步再叠加检验的图。

```

pres = True
pres@vpHeightF = 0.7
pres@vpWidthF = 0.7
pres@tmXBLLabelFontHeightF = 0.013
pres@tmYLLLabelFontHeightF = 0.013
pres@cnInfoLabelOn = False
pres@pmTickMarkDisplayMode = "Always"
pres@cnLineLabelsOn = False
pres@cnLinesOn = False
pres@cnLevelSelectionMode = "Explicitlevels"
pres@cnLevels = (/ -0.05, -0.01, 0.01, 0.05 /)

```

```

plot1 = gsn_csm_contour(wks, prob, pres)
plot2 = gsn_csm_contour(wks, prob, pres)

```

```

opt = True
opt@gsnShadeFillType = "color" ; color is the default
opt@gsnShadeLow = "gray70"
;opt@gsnShadeHigh = "gray70"
;opt@gsnShadeMid = "gray70"
plot1 = gsn_contour_shade(plot1, 0.05, 0.05, opt)
;plot1 = gsn_contour_shade(plot1, 0, 0.273, opt)
;plot1 = gsn_contour_shade(plot1, -0.05, 0.05, opt)

```

```

opt1 = True
opt1@gsnShadeFillType = "color"
opt1@gsnShadeLow = "gray50"

```

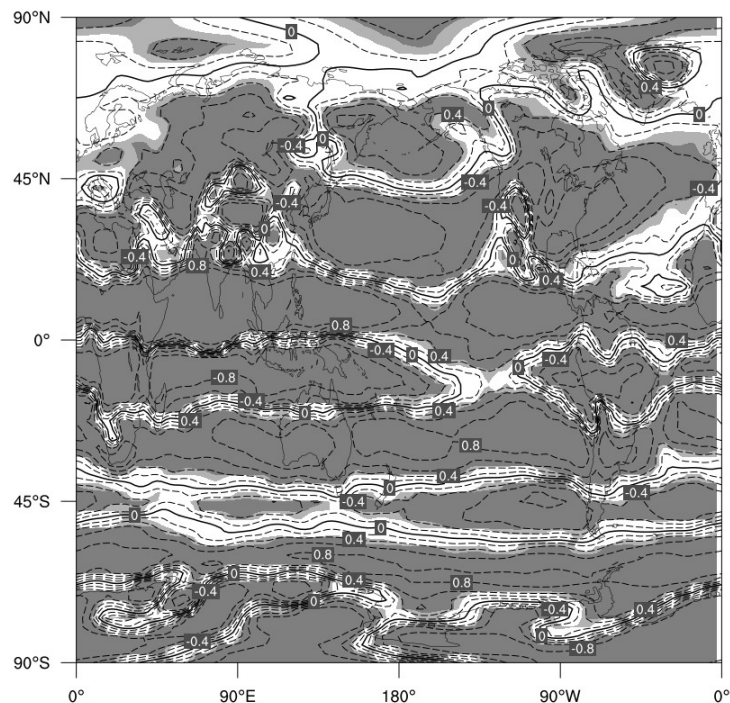
```

;opt1@gsnShadeHigh = "blue"
;opt1@gsnShadeMid = "gray50"
plot2 = gsn_contour_shade(plot2,0.01,0.01,opt1)
;plot2 = gsn_contour_shade(plot2,0,0.354,opt1)
;plot2 = gsn_contour_shade(plot2,-0.01,0.01,opt1)

overlay(plot, plot1)
overlay(plot, plot2)
draw(plot)
frame(wks)

end

```



浅灰色为 95%置信，深灰色为 99%置信

嗯…我是打算像论文图像那样(最后发现论文的阴影颜色好像是区分的正相关和负相关，我就不改了)直接叠两个不同亮度的灰色在一张图来同时体现 95%和 99%置信区间的，仔细观察是发现 99%的区域更小一些比较符合常理，不过这张图阴影范围占比好大，对比原论文发现原论文设置了陆地掩膜，只有海洋区域有（不过我的图还是更多）——（看错啦）——最后发现了原因是…我读取的是 1-12 月的数据…所以本实验的两道题全都是 1-12 月的…肯定和原文不一样…

```

m3 = ispan(5, 593, 12)
m4 = ispan(6, 594, 12)
m5 = ispan(7, 595, 12)
m6 = ispan(8, 596, 12)
uwnd_ch = new(/50,73,144/), "float")

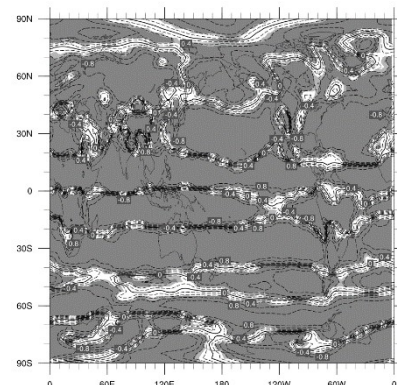
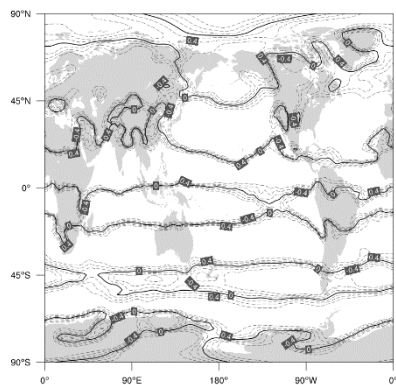
```

```

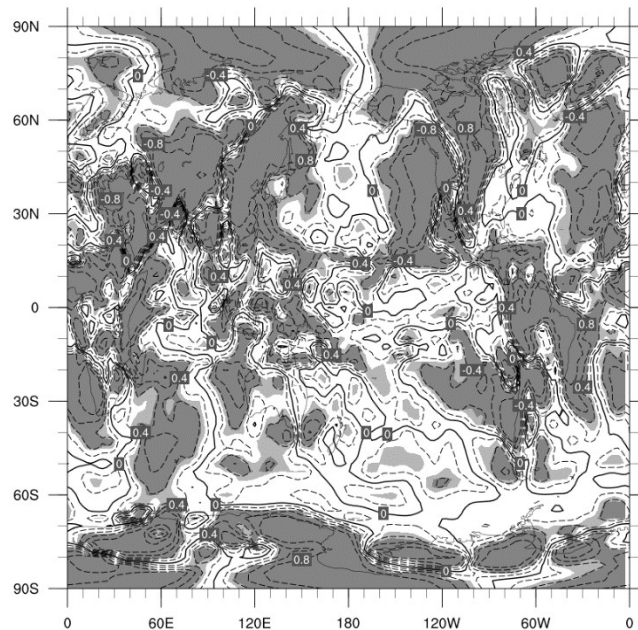
uwnd_ch(0:49, :, :) = (uwnd(m3, :, :) + uwnd(m4, :, :) + uwnd(m5, :, :) + uwnd(m6, :, :))/4.0
vwnd_ch(0:49, :, :) = (vwnd(m3, :, :) + vwnd(m4, :, :) + vwnd(m5, :, :) + vwnd(m6, :, :))/4.0
print(uwnd_ch)
; uwnd_ch(0:49, :, :) = uwnd(m3, :, :)
; uwnd_ch(50:99, :, :) = uwnd(m4, :, :)
; uwnd_ch(100:149, :, :) = uwnd(m5, :, :)
; uwnd_ch(150:199, :, :) = uwnd(m6, :, :)
delta_ch = new((/50,73,144/), "float")
delta_ch(0:49, :, :) = (delta(m3, :, :) + delta(m4, :, :) + delta(m5, :, :) + delta(m6, :, :))/4.0
copy_VarCoords(delta(m3, :, :), delta_ch)
copy_VarCoords(delta(m3, :, :), uwnd_ch)

printVarSummary(delta_ch)
=====
delta_c = delta_ch(lat|:, lon|:, time|:)
uwnd_c = uwnd_ch(lat|:, lon|:, time|:)

```



还是得改，改到 **6-9** 月，确实有变化但变化不大…这 **SCSSMI** 和 **u** 风场的相关性太好了吧…和原文也不太一样，还是阴影面积好大，于是我顺手看了下和 **v** 风场的…噫



…正常多了..

所以这样看起来，只能说 **SCSSMI** 指数和 **u** 风场的相关性更普遍显著了吧 😊

四、实验小结（本次实验收获的经验、教训、感受等）：

破大防了，最要吐槽的是 `gsn_contour_shade()` 与之配套的 `gsnShadeHigh`, `gsnShadeLow` 和 `gsnShadeMid`，开始寻思直接用 `Mid` 取中间范围方便，但总是报错，而且我有两个 `shade` 函数，还只有第二个报错，并且应该是原 `gsn` 程序的错，超出 `x` 维度范围啥的…改来改去…

```
fatal:conform: the third argument contains a dimension that is out-of-range of the dimensions of x
fatal:["Execute.c":8637]:Execute: Error occurred at or near line 12866 in file /home/xlaoma/anaconda3/envs/ncl/lib/ncarg/nclscripts/csm/gsn_code.ncl
```

最后我改用 `Low` 或者 `High` 就好了…绷不住了