UNIVERSITY OF WISCONSIN-MADISON

Center for Climatic Research
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GrADS Significance Scripts

Go to: Hovmuller and X-Y Plots
Vectors, Contours, Color Fill, Map Projections, Masks, Multiple Plots, GrADS
Scripting Language

These statistical significance scripts calculate the
t-test statistic for a **two-sample difference of
means test** and shade the grid cells that are
significant at a chosen level. There are two
different forms of the test: one in which we
assume the population variances are equal, and
one in we assume the population variances are
unequal. You can determine which form of the
test to use by conducting a F-test that compares
the variances of the two samples. Step-by-step
instructions for running the scripts are listed
below.

In the graphic to the right (click on the map for
a larger-size version), we show the results of a
t-test for for DJF for FOAM GCM data,
comparing model-predicted surface
temperatures from 6K B.P. to current surface
temperatures. The areas that are shaded gray
are signficant at the 99% level.
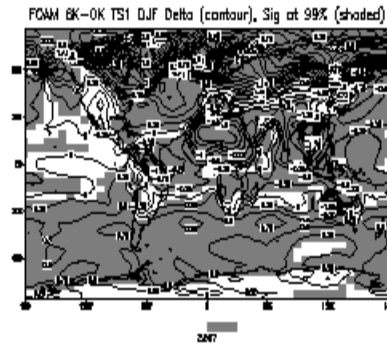
*Click on the map to view larger-size
version.*

Assume Population Variances are Equal

1. Calculate your degrees of freedom: **df = n1 + n2 -2**, where n1 is the size of the
   first sample and n2 is the size of the second sample.
2. Decide on the significance level: .01 (99%), .05 (95%), .10 (90%)
3. **Example**: say we have two samples of sizes **n1=120** and **n2=120**. The
   degrees of freedom = n1+n2-2 = 120+120-2 = 238

4. Say we choose a significance level of **0.01**. When we enter this information
   in the appropriate boxes, we find that our **cutoff t** is **2.597**.

5. Now, we move on to GrADS. The script to use is ttest.equal_variances.gs.
   - Put in open statements for your data files
     (e..g, **sdfopen /grove4/selin/foam_indyr**

/ha.F1.0k.djfi486605.TS1.nc)

- Set **n1** and **n2** to the size of the respective samples.
- In the formulas for **x1, x2, s1,** and **s2,** you must set the time increment for *each* of the formulas according to the sample size. For example, if **n1** is **120**, then set
  x1 = ave(ts1.1,t=1,t=120).
- Set the contour interval equal to the cutoff t you determined from the web page:
  set clevs 2.597
- Now, run the script. Enter GrADS, and type **exec ttest.equal_variances.gs.** The areas that are significant will be shaded gray and the difference between the two means will be contoured.

Assume Population Variances Are Unequal

1. Calculate your degrees of freedom. In this case, **df = min (n1-1, n2-1)**, where n1 is the size of the first sample and n2 is the size of the second sample.
2. Decide on the significance level: .01 (99%), .05 (95%), .10 (90%)
   Example: say we have two samples of sizes **n1=120** and **n2=10** .
   Then **degrees of freedom = min (n1-1, n2-1) = min (120-1, 10-1) = min(119, 9) = 9**
3. This is a conservative estimate of the degrees of freedom. Say we choose a significance level of **0.05**. **cutoff t** is **2.262**.
4. Now, we move on to GrADS. The script to use is ttest.unequal_variances.gs.
   - Put in open statements for your data files. In this example, we used the *xdfopen* option to open our data files because the time indices do not match. Here are the xdfopen files used in this script: xdf6kFixdjf and xdf0kdjf.
   - Set **n1** and **n2** to the size of the respective samples.
   - In the formulas for **x1, x2, s1,** and **s2,** you must set the time increment for *each* of the formulas according to the sample size. For example, if **n1** is **10**, then set
     x1 = ave(ts1.1,t=1,t=10).
   - Set the contour interval equal to the cutoff t you determined from the web page:
     set clevs 2.262
   - Now, run the script. Enter GrADS, and type **exec ttest.equal_variances.gs.** The areas that are significant will be shaded gray and the difference bewteen the two means will be contoured on top.