

ARC/INFO Macro to calculate projection statistics

```
/* true75.aml
/*
/* 7.5 minute quadrangles, estimates their areas, and figures errors
/* for a map projection.

/* Arguments: Southwest lat/long, Northeast lat/long, projection file

/* Example: &r true75 -117 44 -103 49 geoalb.prj

/* This AML creates a coverage called geocov that has all of the 7.5
minute
/* quadrangles in the indicated region. The coverage AAT will have an
/* item called TLENGTH that gives the true length of the lines in
meters.
/* The coverage PAT will have an item called TAREA that gives the
estimated
/* true area of the polygons in square meters.
/* It projects GEOCOV using the projection file specified in the
arguments
/* and calculates items in the PAT and AAT called PCTERR to equal the
percent
/* difference between the length of lines or areas of polygons in the
/* coverage and their true lengths.

/* If you want to know the error in a projection whose units are not
meters,
/* you must change the axis of the ellipse below so that it is measured
in the
/* units of the desired projection. If you want to use NAD83 instead
of NAD27,
/* comment out the NAD27 lines below and un-comment the NAD83 lines.
If you
/* want the quadrangles to be some size other than 7.5 minutes, you
must
/* change the "8" in "[calc %raddeg% / 8]" to the subdivision of a
degree
/* that you want to use, and change all occurrences of "0.125",
"0.0625",
/* and "0.0725" to a fraction that matches your desired subdivision.
(For
/* whole-degree quads, these would be "[calc %raddeg% / 1]", "1.0",
"0.5",
/* and "0.51").

/* Notes: The lengths along meridians and parallels are calculated
/* according to equations 4-19 and 4-21 on page 25 of:
/* Snyder, John P., Map Projections, a Working Manual
/* U.S. Geological Survey professional paper 1395, 1987.
/* The areas of the quadrangles are estimated by assuming that
/* they are plane trapezoids, using the lengths of the sides
/* from Snyder's formulas.
/*
/* From:
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/* Gerry Daumiller
/* Montana State Library
/* (406) 444-5358
/* gerry@nris.msl.mt.gov
/* http://nris.msl.mt.gov/gis/gerry/gerry.html
/* Gerry Daumiller 1/17/93 - 5/14/96
/*
/* Figures the "true" length of all the sides of an area's

&args name prjfile xmin ymin xmax ymax
&do namenull &list %name% %prjfile%

&if [EXISTS %prjfile% -file] &then
    &call user_routine
&else
    &call proj
&return

&if ^ [null %namenull%] &then
    &call user_routine
&else
    &call usage
&return

/*-----
&routine USER_ROUTINE
/*-----

/* Set constants
&s pi 3.14159265
&s raddeg [calc %pi% / 180] /* # of radians in a degree
&s div [calc %raddeg% / 8] /* # of radians in 7.5 minutes
/*&s a 6378206 /* NAD27 ellipsoid major radius
(meters)
    &s a 6378137 /* NAD83
/*&s e 0.006768658 /* NAD27 ellipsoid eccentricity squared
    &s e 0.006694380 /* NAD83
    &s newcov nc_%name%

&if [exists %newcov% -cover] &then
&do
&type %newcov% exists
/*rename %newcov% %newcov%bu
kill %newcov% all
&end

&mess &off
&if [exists geocov -cover] &then &goto decov
&do namenull &list %xmin% %ymin% %xmax% %ymax%
&if [null %namenull%] &then &call usage

&if [show program] ne ARCEDIT and [show program] ne ARC &then &do
    &type \Leaving [show program]; quit
&end
&if [show program] ne ARCEDIT &then &do
    &type \Starting ARCEDIT; arcedit
&end

```

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drawe arc; sds 2

/* Set constants
&s pi 3.14159265
&s raddeg [calc %pi% / 180] /* # of radians in a degree
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/*&s a 6378206 /* NAD27 ellipsoid major radius
(meters)
&s a 6378137 /* NAD83
/*&s e 0.006768658 /* NAD27 ellipsoid eccentricity squared
&s e 0.006694380 /* NAD83

/* Create the coverage
mapextent %xmin% %ymin% %xmax% %ymax%; coordinate keyboard
create geocov; 1,%xmin%,%ymin%; 2,%xmin%,%ymax%
3,%xmax%,%ymax%; 4,%xmax%,%ymin%; 0; %xmin%,%ymin%; %xmax%,%ymax%
editfeature arc; createattributes
additem tlength 4 7 f 1; additem pterr 4 7 f 4

&type \Creating the parallels and figuring their lengths.
&do y = %ymin% &to %ymax% &by 0.125
&s sin [sin [angrad %y%]]
&s sin [calc %sin% * %sin%]
&s p1 [calc 1 - [calc %e% * %sin%]]
&s numer [calc %a% * [cos [angrad %y%]]]
&s width [calc %numer% / [sqrt %p1%]]
&s width [calc %width% * %div%]
add
&do x = %xmin% &to [calc %xmax% - 0.125] &by 0.125
2,%x%,%y%;2,[calc %x% + 0.125],%y%
&end
9
calc tlength = %width%
&end

&type \Creating the meridians and figuring their lengths.
&do y = %ymin% &to [calc %ymax% - 0.125] &by 0.125
&s sin [sin [angrad [calc %y% + 0.0625]]]
&s sin [calc %sin% * %sin%]
&s p1 [calc 1 - [calc %e% * %sin%]]
&s numer [calc %a% * [calc 1 - %e%]]
&s denom [calc %p1% * [calc %p1% * %p1%]]
&s denom [sqrt %denom%]
&s height [calc %numer% / %denom%]
&s height [calc %height% * %div%]
add
&do x = %xmin% &to %xmax% &by 0.125
2,%x%,%y%;2,%x%, [calc %y% + 0.125]
&end
9
calc tlength = %height%
&end
&type \Leaving ARCEDIT
quit yes

&type \Building coverage
build geocov poly

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```

createlabels geocov
additem geocov.pat geocov.pat tarea 4 7 f 1
additem geocov.pat geocov.pat pcterr 4 7 f 4
&type \Starting ARCPLOT

arcplot
&type \Estimating areas of quadrangles
&do y = [calc %ymin% + 0.0625] &to %ymax% &by 0.125
  clearselect
  reselect geocov poly box %xmin% [calc %y% - .01] %xmax% [calc %y% +
.01]
  &if [extract 1 [show select geocov poly]] gt 0 &then &do
    reselect geocov arc box %xmin% [calc %y% - .01] %xmax% [calc %y% +
.01]
    &s c [show select geocov arc 1 item tlength]
    aselect geocov arc
    reselect geocov arc box ~
      %xmin% [calc %y% - .0725] %xmax% [calc %y% - .0625] within
    &s a [show select geocov arc 1 item tlength]
    aselect geocov arc
    reselect geocov arc box ~
      %xmin% [calc %y% + .0625] %xmax% [calc %y% + .0725] within
    &s b [show select geocov arc 1 item tlength]
    &s p1 [calc [calc %a% - %b%] / 2]
    &s h [sqrt [calc [calc %c% * %c%] - [calc %p1% * %p1%]]]
    &s area [calc [calc %p1% * %h%] + [calc %b% * %h%]]
    calc geocov poly tarea = %area%
  &end
&end
clearselect
&type \Leaving ARCPLOT
quit

&label decov

&type \Projecting and re-building coverage
project cover geocov %newcov% %prjfile%
build %newcov% poly

&type \Calculating errors

/* loop for feet
&if %name% in
{'olz','ol9','orl','lmo','sps','n27','spn','laz','lmf','lic'} &then
&do
tables
  additem %newcov%.pat marea 8 12 f 3
  additem %newcov%.aat mlength 8 12 f 3
  sel %newcov%.pat
  cal marea = area * .09290304
  resel tarea gt 0
  calc pcterr = ( ( marea - tarea ) / tarea ) * 100
  calc pcterr = pcterr * pcterr /* square
  calc pcterr = pcterr ** .5 /* square root
  sel %newcov%.aat
  cal mlength = length * .3048
  calc pcterr = ( ( mlength - tlength ) / tlength ) * 100

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    calc pcterr = pcterr * pcterr /* square
    calc pcterr = pcterr ** .5    /* square root
quit
&goto nofeet
&end

/* loop for meters
tables
  sel %newcov%.pat
  resel tarea gt 0
  calc pcterr = ( ( area - tarea ) / tarea ) * 100
  calc pcterr = pcterr * pcterr /* square
  calc pcterr = pcterr ** .5    /* square root
  sel %newcov%.aat
  calc pcterr = ( ( length - tlength ) / tlength ) * 100
  calc pcterr = pcterr * pcterr /* square
  calc pcterr = pcterr ** .5    /* square root
  quit

&label nofeet
statistics %newcov%.pat %newcov%.pst
min pcterr
max pcterr
mean pcterr
end
statistics %newcov%.aat %newcov%.ast
min pcterr
max pcterr
mean pcterr
end
&mess &on
&type \%name% Polygon statistics:
list %newcov%.pst
&type \%name% Length statistics:
list %newcov%.ast
&type \Done!\
&return

/*-----
&routine USAGE
/*-----
&type '\Usage: true75 {minx} {miny} {maxx} {maxy}\'
&type '\ie. &r true75 lam geolam.prj -125 42 -116 46.25\'
&return &inform

/*-----
&routine PROJ
/*-----
&type '\Project file does not exist.\'
&type '\Usage: true75 {minx} {miny} {maxx} {maxy}\'
&type '\ie. &r true75 lam geolam.prj -125 42 -116 46.25\'
&return &inform

/*-----
&routine EXIT
/*-----

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&dv .true75$*
&if [show &thread &exists tool$true75] &then
  &thread &delete tool$true75
&mess &on
&return

&routine BAILOUT
/*-----
&if %ver% = 6.1.1 &then
&do
&type \Error:&return;q;&return &error
&end
&return;&return &error \Last error: %aml$message%\Line: %AML$LINE% of
%AML$FILE%
/*
/*
/*  _
*****
/*  \  \__-__/      \  Emmor H. Nile           tel#: 503-
945-7418  *
/*    \              ) GIS Project Coordinator   FAX#: 503-
945-7314  *
/*    | + Salem    /  Oregon Department of Forestry
www.odf.state.or.us *
/*    |              /  2600 State Street
*
/*    /  O R E G O N |  Salem, OREGON 97310  USA
*
/*    (              |  EMAIL:Emmor.H.NILE@state.or.us
*
/*    \_____ |
*****
/*

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