Shallow Infiltration and Watershed Modeling

RF

May 7, 2001

This volume (IV) of scientific notebook 432 contains work involving shallow infiltration and watershed modeling at Yucca Mountain. David Woolhiser is the primary collaborator (Sci NTbk #362 and #444). Stuart Stothoff and Roger Smith may still contribute on occasion.

The pentium 3 NTbox called bubo is used for ArcView version 3.2 work. Pluto and Io (SGI ONYX) were used for Erdas Imagine version 8.4 manipulation of raster images from IKONOS) Space Imaging.

Detailed Grid of West Flank for Watershed Modeling

Base map was derived from ikonos satellite image and ERDAS Imagine version 8.4 on pluto (SGI).

Created img file with 3 bands derived from subsetted imagery of the detailed Solitario Canyon model area. To create the files:

sol-blu.img
sol-grn.img
sol-red.img
sol-nir.img

I used the 67058 tile 0 image. There is overlap with 67059, but 67059 seemed less distinct/less contrast.

The ImageInterpreter->Utility->LayerStack utility and the ImageInterpreter->SpectralEnhancement->NaturalColor utility. Note also that I determined that the reproject utilities do not give one the flexibility to get the reprojection correctly done for UTM NAD83 to UTM NAD27; this led to a shift of ~70m westward. Instead of using the reproject tool, use the browser in DataPreparation-->Mosaic tool to reproject to UTM, Spheroid=Clarke1866, Datum=NAD27 West Conus

sol-nrg-nad83.img	(UTM NAD83, nir, red, green bands stacked)
sol-nrg-nad27.img	(reprojected to UTM NAD27)
sol-nrg-true-nad27.img	(automatic true color utility applied)
sol-nrg-true-nad27.jpg	(exported to jpeg format)

The last file was copied from the working directory on vulcan (/vscr4/ikonos/Solitario/*) to the directory on bubo: J:\AVData\Solitario\IKONOS-Images\

ArcView 3.2 displays ERDAS Imagine files but does not print or export the any layouts with the *.img format. Apparently this was not a problem with ArcView 3.1, but is a known bug with version 3.2. The geotiff format exported from ERDAS Imagine had similar problems. I had to export a jpeg file, convert the jpeg to a tif file using Illustrator version 8.0 or Corel Photo-Paint version 8.369. Then create a world file with the same base name and the .TFW extension. The world file (has geolocation information) contains the upper left coordinates and the cell size:
0.99999662
0.000000000000
0.000000000000
-0.99999662
546193.12749234
4077311.52565974

Soil Depths for West Flank

This extraction enabled to create and manipulate a soil map to overlay on the grid; otherwise the files became too large to handle. Previously, tecplot was used to (i) contour the soil depth data, (ii) save as a tif, (iii) cut out only the contoured data itself (remove borders and axes), (iv) create a world file, and (v) import into ArcView as an image. However, the soil depth data taxes vulcan's capabilities in tecplot, and photoshop's memory handling on the NT system (takes hours to cut image due to working in swap space). To get around this, I will just extract out the small area of soil depths from Stothoff's soil depth map used in TPA 4.2 and display the data in ArcView as point data with color coded based on soil depth categories.

Work saved in: J:\AVData\Solitario\Soil-Extraction*

The extract.for is a short code (see below) used to extract soil depths out of the Stothoff generated soil map from the TPA code 4.2 infiltration abstraction. This script just extracts data based on the input coordinates file "westflk.txt."

Contents of westflk.txt file:

```
# small watershed west flank coordinates, upper left coord
546192.6 4077312.0
547654.6 4075313.0
```

Contents of extract.for file:

```
c     Last change:  RWF  15 May 2001    11:41 am
        program extract
c bubo: J:\AVData\Solitario\SoilExtraction\extract.f    RFedors May 14, 20001
c to use for extracting soil depths from Stu's DEM for west flank watershed.
c                   |
c       j=y=rows    |
c                   |
c                   |
c                   |_______________
c                      i=x=columns
c
c c23456789 123456789 123456789 123456789 123456789 123456789 123456789 12
      integer ioread, iowrit, mx, mxx, i, j, k
      parameter (mx=1000,mxx=1000000)
      integer nbox,nrecords,nrow,ncol,nrows,ncols,xllcorner,yllcorner
      real*8 box(2,2), soil(mxx)
      character*120 header
      character*6 junk1, junk2
      character*10 junk3, junk4
      character*9 junk5
      character*20 junk6
      real*8 cellsize, xnay, ynay
      LOGICAL  flag

c set input and output unit numbers
      ioread = 7
      iowrit = 9

c Input coordinates file, 1st line comment line, 2nd line # of points;
c modified irregular shape object to just read in upper left and lower right.
      open(unit = ioread, file = 'westflk.txt', form = 'formatted')
      read(ioread,'(a60)') header
      do i = 1, 2
        read(ioread,'(2f10.2)') box(i,1), box(i,2)
      enddo
      close(ioread)

c read in Stothoff DEM of soil depths; row major order from upper right;
c   though Stu gives lower left coordinates of area.
      open(unit=ioread, file='modemnt.dem', form='formatted')
      read(ioread,'(a6,i4)') junk1, nrows
      read(ioread,'(a6,i4)') junk2, ncols
      read(ioread,'(a10,i8)') junk3, xllcorner
      read(ioread,'(a10,i8)') junk4, yllcorner
      read(ioread,'(a9,f8.6)') junk5, cellsize
      read(ioread,'(a20)') junk6
      nrecords = nrows * ncols
      do i = 1, nrecords
          read(ioread,'(f19.5)') soil(i)
      enddo
      close(ioread)

c writing out the array() matrix for digestion in ArcView, which needs 3 columns
c   Note that lower left remains as geolocator (Stothoff convention)
```

```
      open(unit = iowrit, file = 'soilwf.dat', form = 'formatted')
      nrow = int( (box(1,2)-box(2,2)) / cellsize ) + 1
      ncol = int( (box(2,1)-box(1,1)) / cellsize ) + 1
      xnay = float(xllcorner)
      flag =.true.
      do k = 1, ncols
        xnay = xnay + cellsize
        if(xnay.ge.box(1,1)) then
           IF(flag) then
              xupper = xnay
              flag = .false.
           endif
        endif
      enddo

      ynay = float(yllcorner) + float(nrows-1) * cellsize
      flag = .true.
      do k = 1, nrows
        ynay = ynay - cellsize
        if(ynay.le.box(2,2)) then
          IF(flag) then
             yupper = ynay
             flag = .false.
          endif
        endif
      enddo

c Remove these headers for ArcView importing as point data.
c      write(iowrit,'(a1,a6,i4)') '#', junk1, nrow
c      write(iowrit,'(a1,a6,i4)') '#', junk2, ncol
c      write(iowrit,'(a12,f9.1)') '#X-upperLft ', xupper
c      write(iowrit,'(a12,f10.1)') '#Y-upperLft ', yupper
c      write(iowrit,'(a1,a9,f8.6)') '#', junk5, cellsize
c      write(iowrit,'(a1,a60)') '#', header
c For tecplot import only.
c     write(iowrit,'(a7,i5,a4,i5)') 'ZONE I=',ncol,", J=",nrow
c For ArcView only
      WRITE(iowrit,*) 'Easting, Northing, SoilDepth-m'
      xnay = float(xllcorner)
      ynay = float(yllcorner) + float(nrows-1) * cellsize

      ict = 0
      do 20 i = 1, nrows
        do 10 k = 1, ncols
           ict = ict + 1
           xnay = xnay + cellsize
           if(ynay.lt.box(1,2).and.ynay.ge.box(2,2).and.
     &             xnay.ge.box(1,1).and.xnay.lt.box(2,1)) then
      write(iowrit,'(f9.2,a1,f11.2,a1,f9.5)')xnay,',',ynay,',',soil(ict)
c            write(iowrit,'(f9.5)') soil(ict)
           endif
 10      continue
        ynay = ynay - cellsize
        xnay = xllcorner
 20   continue

      close(iowrit)

      stop
      end
```

The file soilwf.dat was created by the program extract.for. The extension *.for forces Lahey to use fortran77 protocols. The output file soilwf.dat copied over to soilwf.txt (ArcView looks for *.txt extension for table imports) for import into ArcView as point data to be plotted as unique colors based on soil depth classes.

The code was checked by visual inspection of output plotted in ArcView to make sure it was consistent with (i) my knowledge of deep versus thin soils on Yucca Mountain, and (ii) previous plots of the entire Stothoff data set (see vulcan: ~/SoilDepthStu/SoilMarch2000/modab.lay layout file for use in tecplot), and Figure IV-1. The tecplot file used to generate the soil map of the entire area is

vulcan: ~/SoilDepthStu/SoilMarch2000/westflk.lay

Various manipulations of the following equation were used to calculate upper left corners, cell sizes of tif image,

$$yllcorner + [(nrow - 1) * cellsize] = yupperleftcorner$$

Figure IV-1. The extracted soil map of west flank watershed model grid overlain on entire soil map to show that extraction retained geolocation of Stothoff soil map. The two soil maps use slightly different color palettes.