Three-dimensional visualization of model results
or
Does the Matrix have you?

ftp://ftpext.usgs.gov/pub/cr/ar/little.rock/clark/3D/

U.S. Department of the Interior
U.S. Geological Survey

Brian R. Clark
10/14/09

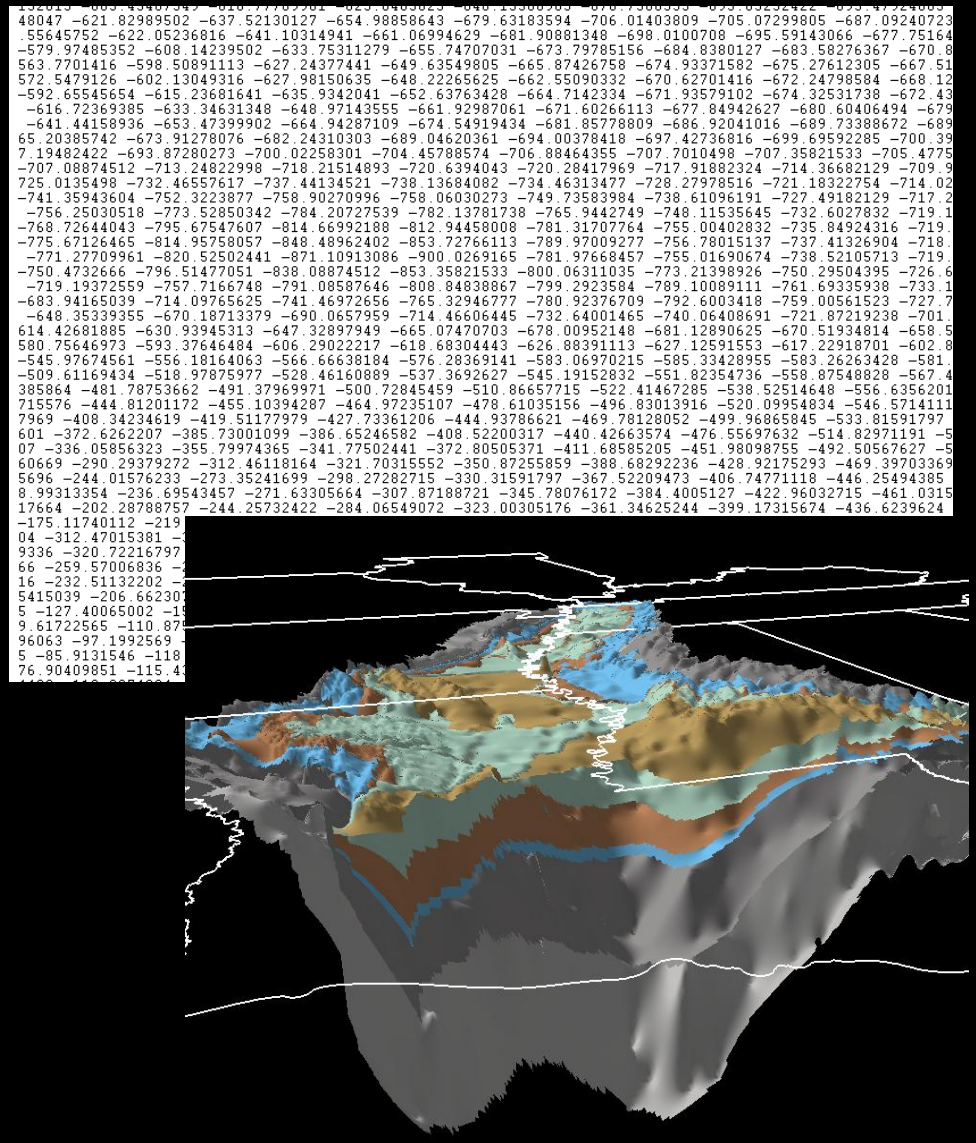
Why 3D?

1. Matrices?

2. Error checking

3. Comprehension

4. It’s cool



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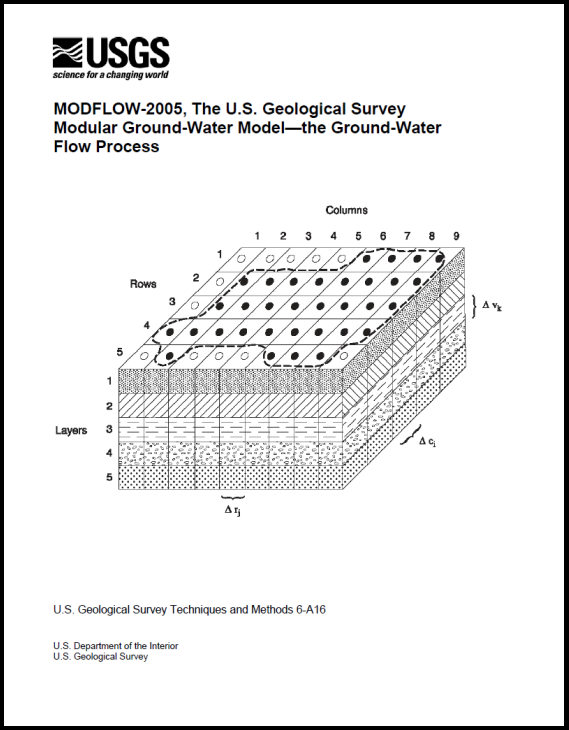
Overview

Pre- and post-processors

Generic 3D software

File manipulation

Examples – primarily MODFLOW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science for a changing world

MODFLOW-2005, The U.S. Geological Survey Modular Ground-Water Model—the Ground-Water Flow Process

U.S. Geological Survey Techniques and Methods 6-A16

U.S. Department of the Interior
U.S. Geological Survey

ftp://ftpext.usgs.gov/pub/cr/ar/little.rock/clark/3D/

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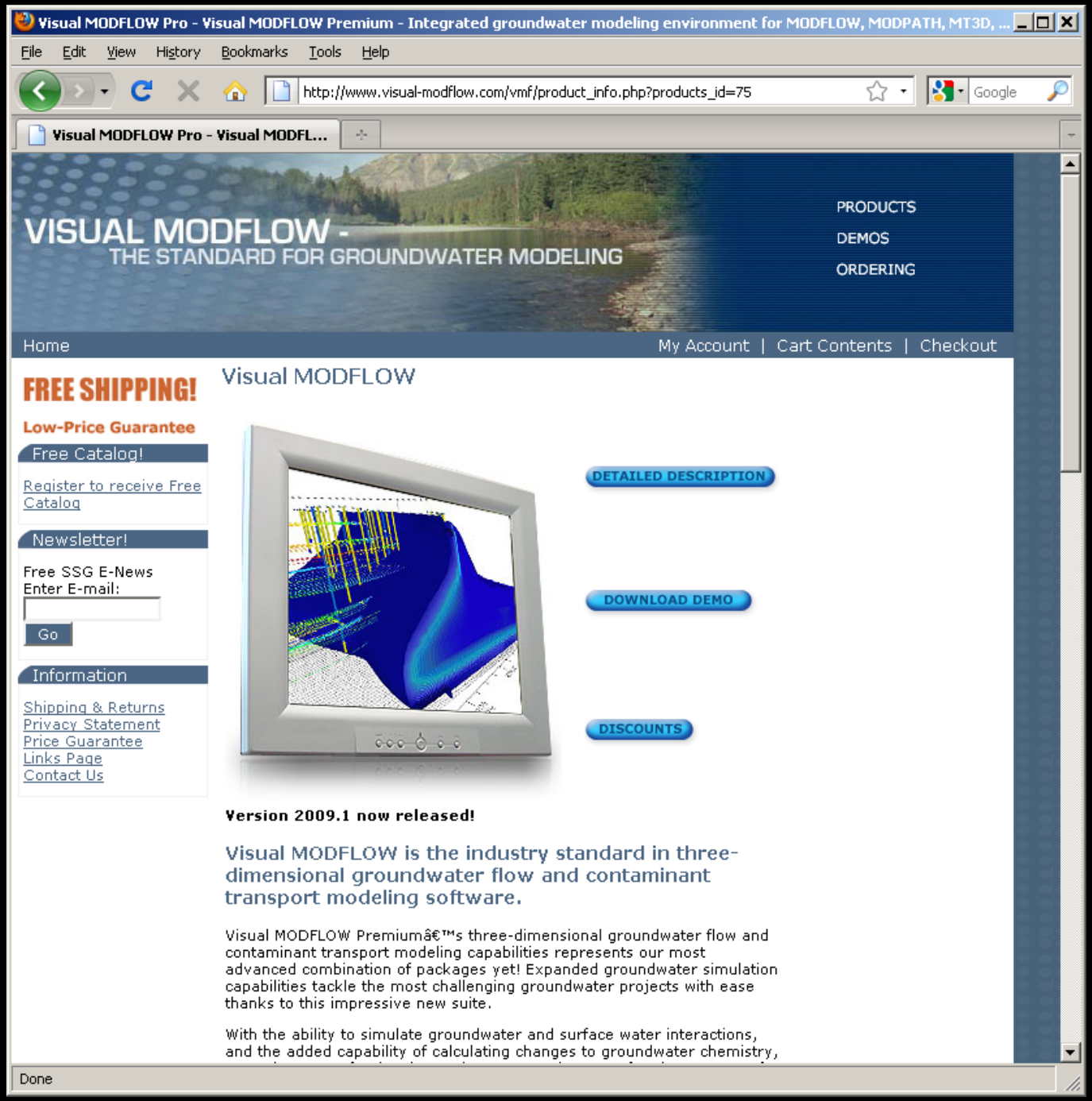
*For product and ordering information World Wide Web: http://www.usgs.gov/pubprodTelephone: 1-888-ASK-USGS
For more information on the USGS--the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment: World Wide Web: http://www.usgs.govTelephone: 1-888-ASK-USGS
Any
In order to respond to evolving national priorities, the USGS must periodically reflect on and optimize its strategic directions. This report is the first comprehensive science strategy since the early 1990s to critically examine our major science goals and priorities. The development of this science strategy comes at a time of global trends that have important natural-science implications. The emergence of a global economy affects the demand for all resources. In turn, use of these natural resources is occurring on a scale that may modify the terrestrial, marine, and atmospheric environments upon which human civilization depends. The use of and competition for natural resources on the global scale, and natural threats to those resources, has the potential to impact the Nation's ability to sustain its economy, national security, quality of life, and natural environment.
Responding to these national priorities and global trends requires a science strategy that not only builds on our existing strengths and partnerships but also demands the innovation made possible by integrating the full breadth and depth of our capabilities. The USGS chooses to go forward in the science directions proposed here because the societal issues addressed by these science directions represent major challenges for our Nation's future and for the stewards of our Federal lands, both onshore and offshore.

Pre/Post processors

Visual MODFLOW



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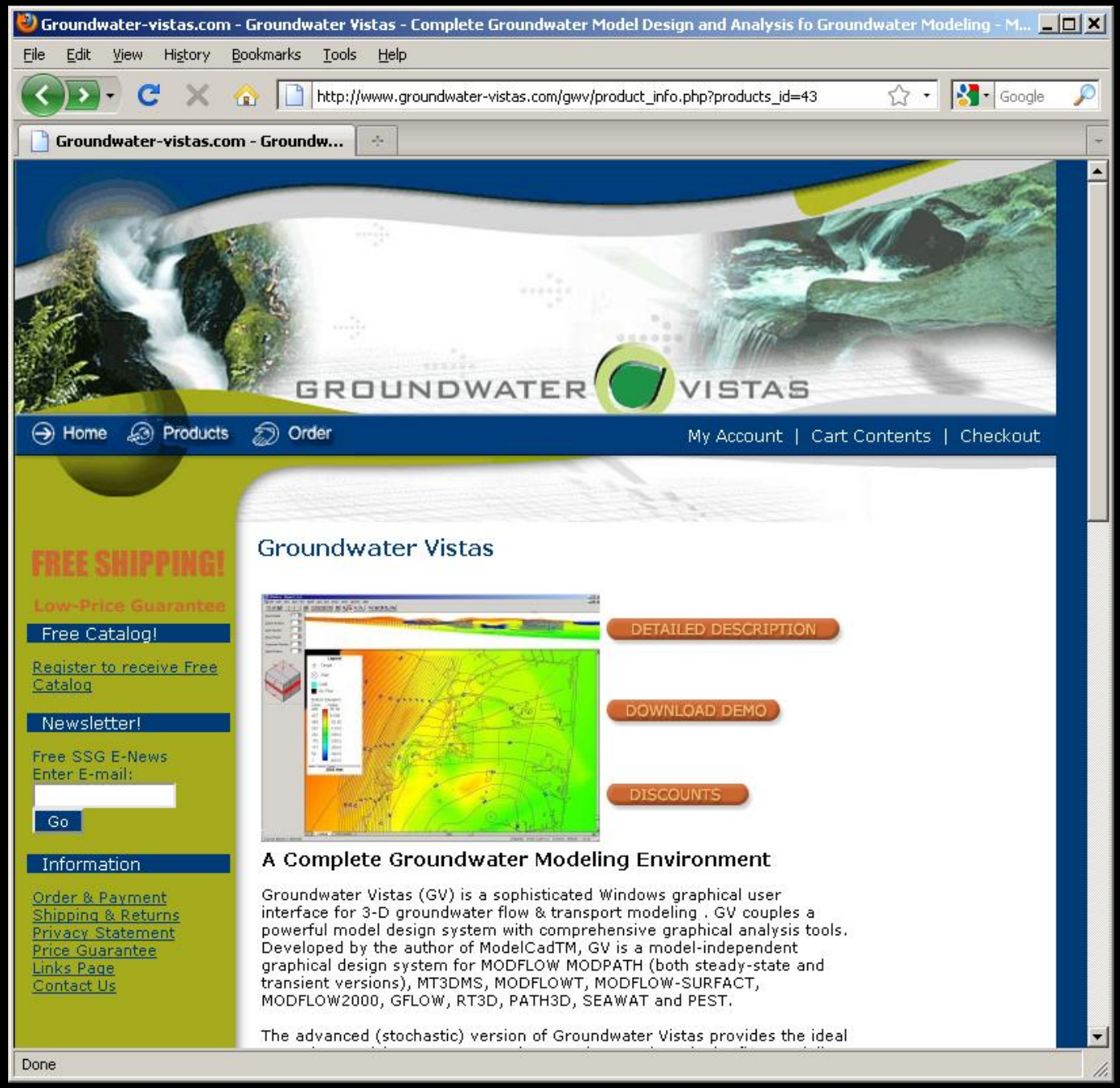
Pre/Post processors

Groundwater Vistas



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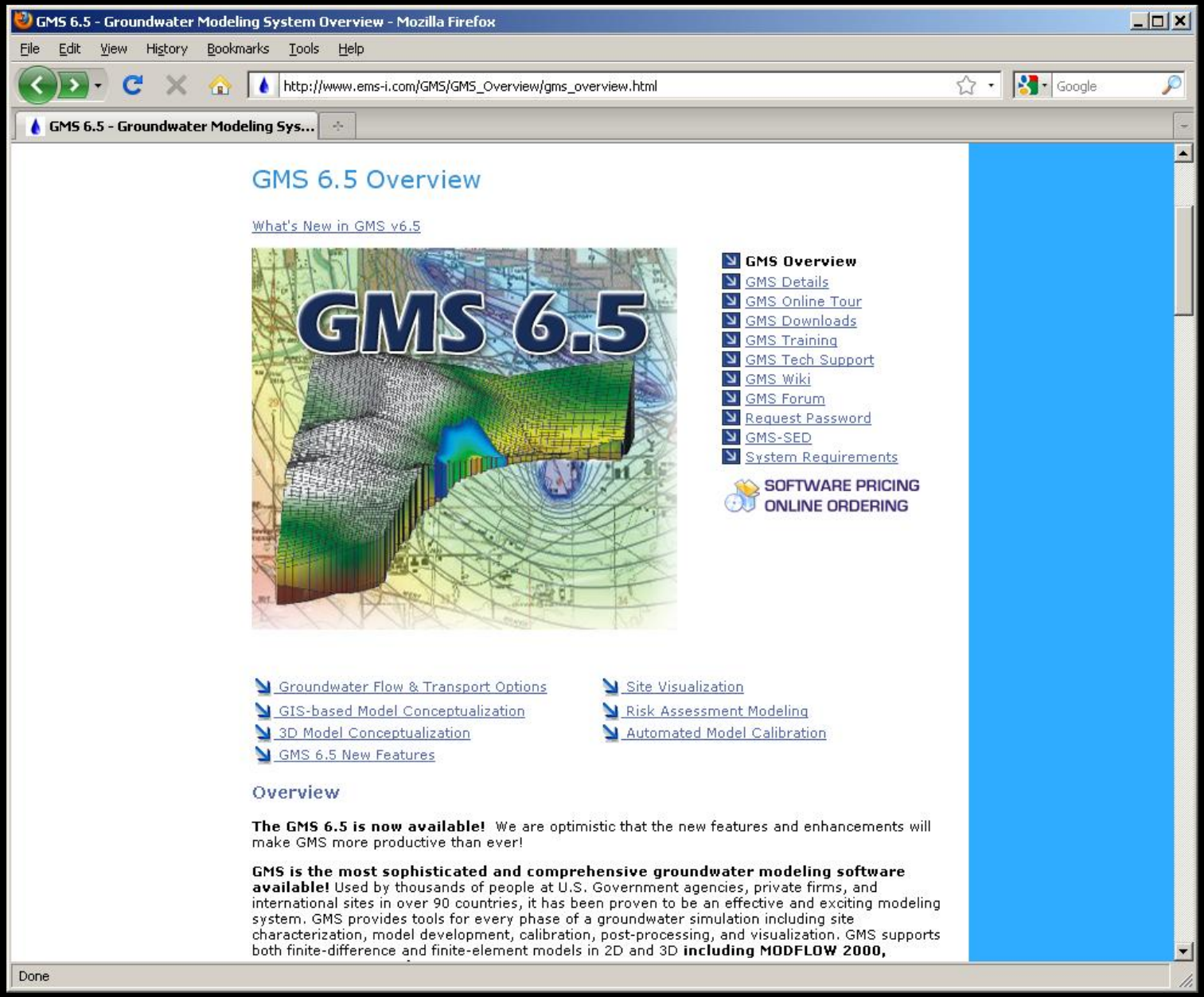
Pre/Post processors



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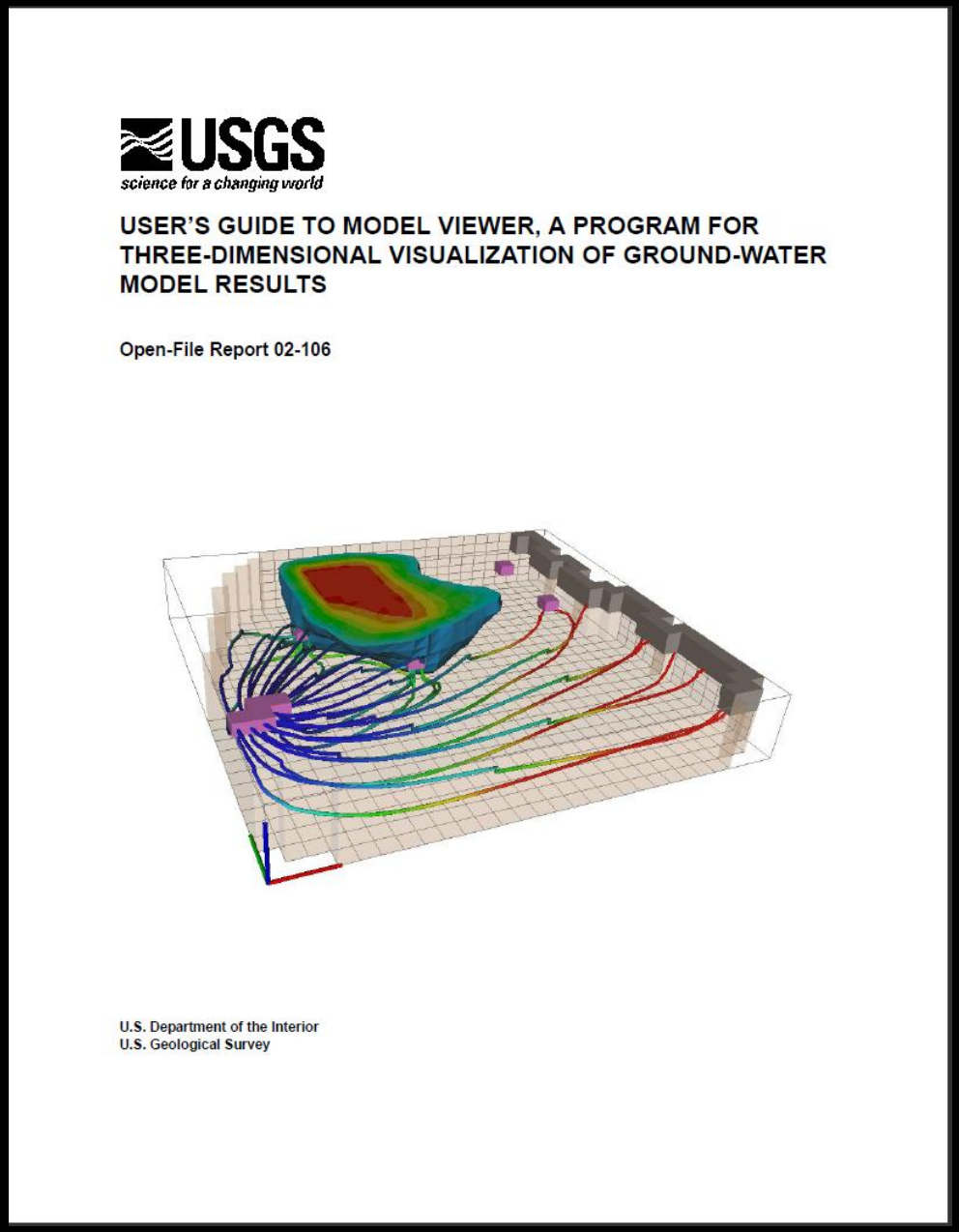
3D viewers

Model Viewer



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USER'S GUIDE TO MODEL VIEWER, A PROGRAM FOR THREE-DIMENSIONAL VISUALIZATION OF GROUND-WATER MODEL RESULTS

Open-File Report 02-106

U.S. Department of the Interior
U.S. Geological Survey

3D viewers

Tecplot

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Tecplot RS »

Done

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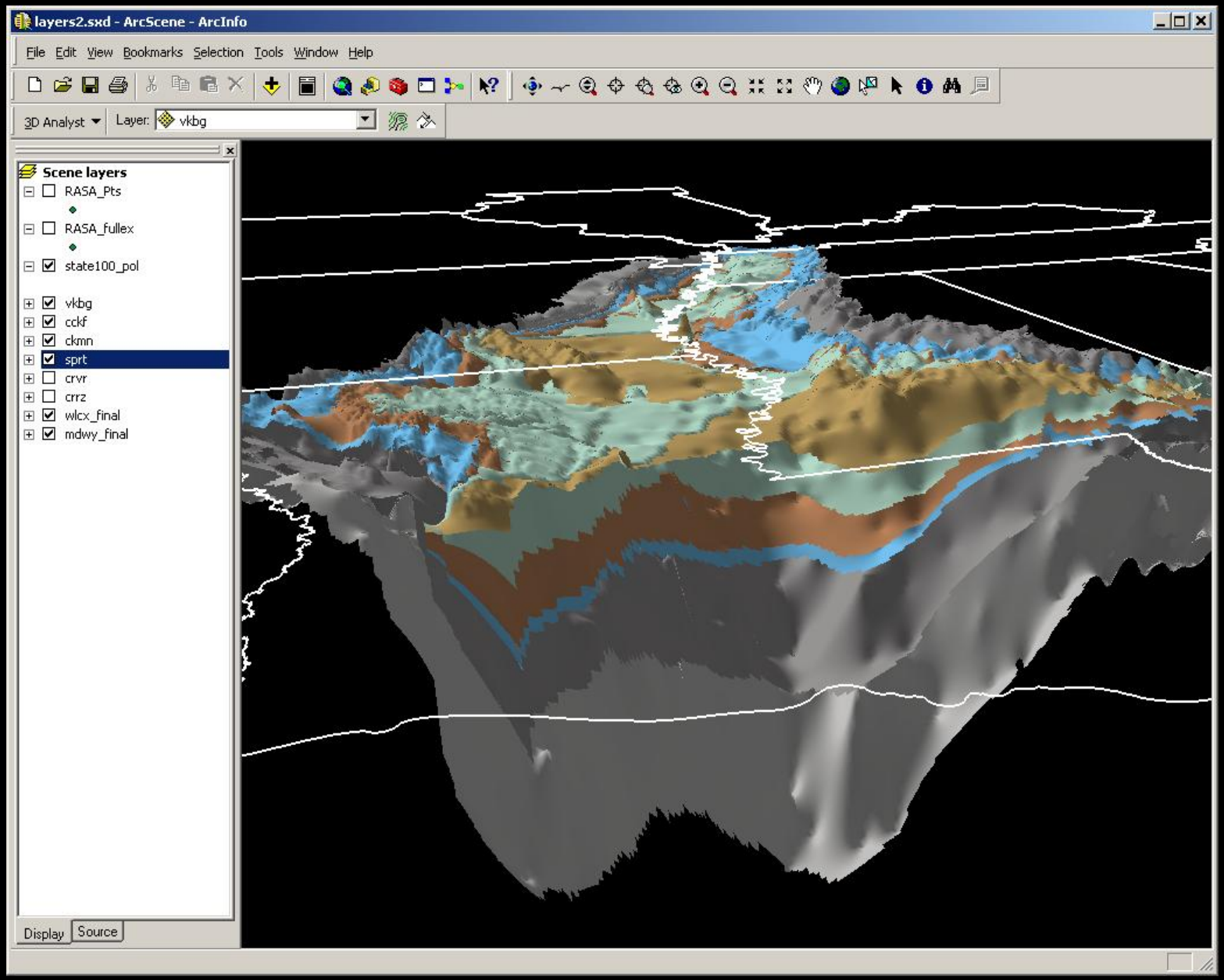
3D viewer

ArcGIS
Arcscene



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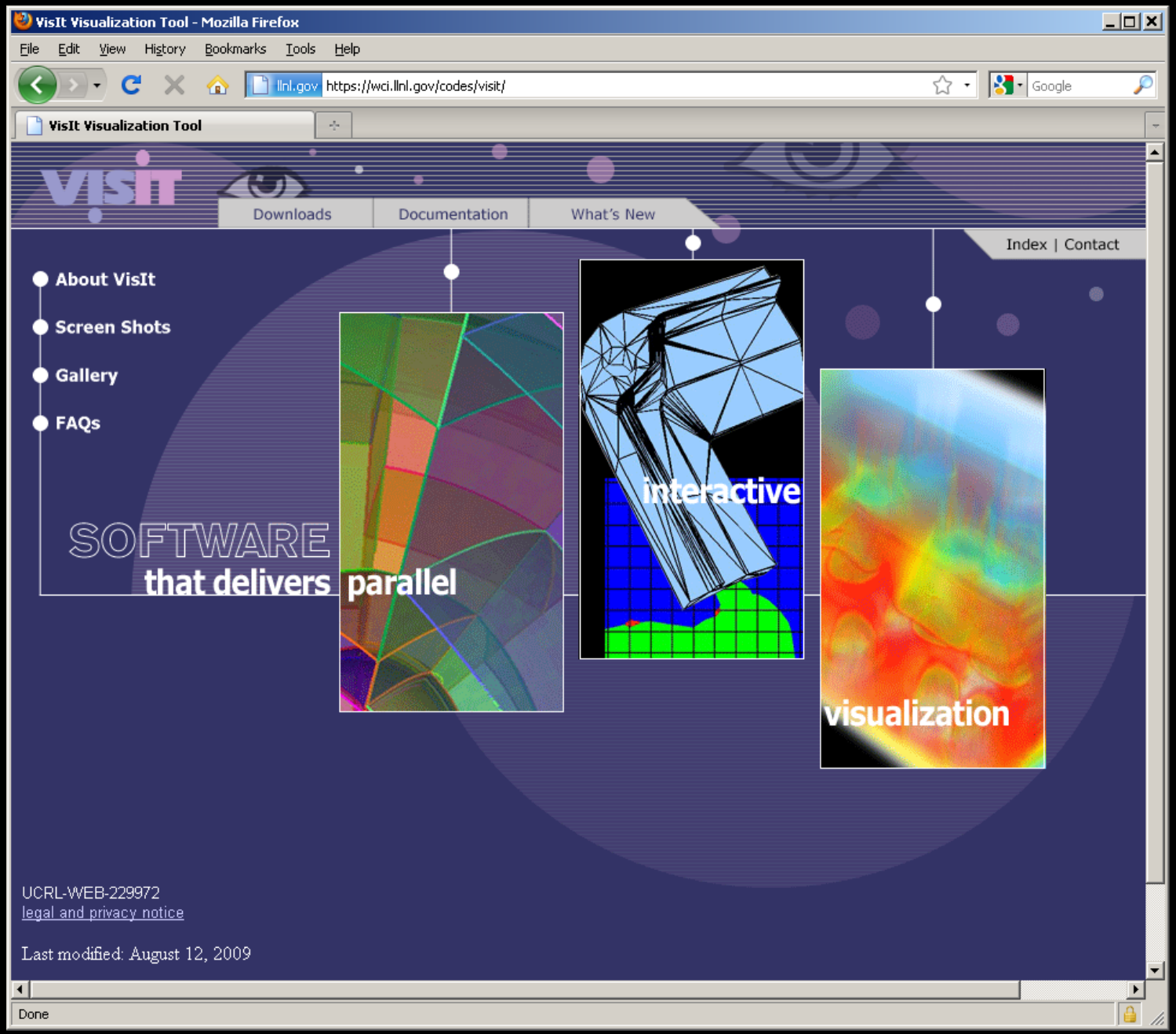
3D viewer

VisIt



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Pixar

Rendering – translating all data into a single Frame of film
-each frame is 1/24 of a second and takes about Six hours to render (some as many as 90 hours)

To code or not to code

Does the model produce

- Importable file types (xyz, netCDF, VTK)
- Brick Of Values (BOV)
- none of the above (wrapped fortran, other binary)

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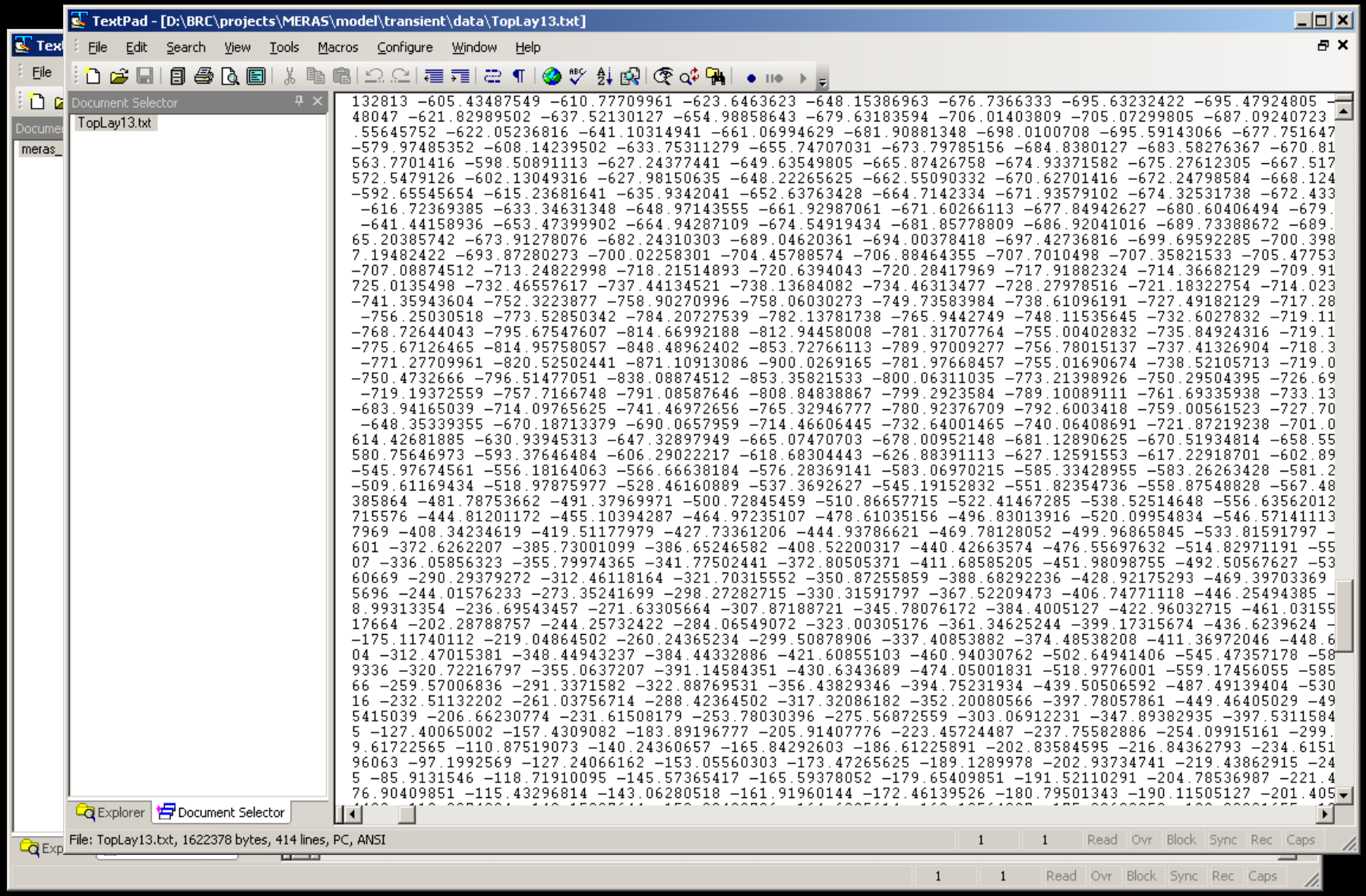
Model files


TextPad - [D:\BRC\projects\MERAS\model\transient\data\TopLay13.txt]
File Edit Search View Tools Macros Configure Window Help
Document Selector
TopLay13.txt
Explorer
Document Selector
File: TopLay13.txt, 1622378 bytes, 414 lines, PC, ANSI
Read Ovr Block Sync Rec Caps

Language of choice

Python
Visual Basic
C

Grid_format_4.py - D:\BRC\projects\Reed\nexrad\Grid_format_4.py

```
        j=-1 #so gridHRAP starts at element zero
        precip = 0 #reset precip
        for iRow in gridHRAP:
          j = j + 1
          nexIndx =  nexHRAP.index(iRow)
          precip = float(nexPrecip[nexIndx])*gridRatio[j] + precip
          #check if current basin same as prev basin - add precip, or print it out
          #print str(j) + ' basin ' + str(gridBasin[j]) + ' gridlines ' + str(gridLines)
          if j+1 >= gridLines or gridBasin[j]
            subBsn[gridBasin[j]].write(str(grid
            precip = 0
      #if int(strmonth) > 10:
      #  sys.exit()
      except:
        print 'error ' + strmonth + day + year
        errorfile.write(strmonth + day + year +
```

util - Microsoft Visual Studio

TextPad - [D:\BRC\projects\Reed\nexrad\nctoasc.c]

```
int main (int argc, char *argv [])
{
int      i, j, counter;
char         inputdate[11];
FILE         *out_file;
char         infile[150], outfile[150];
int      ncid, hrap_xor_id, hrap_yor_id, hrapx_id, hrapy_id, amountofprecip_id; /*netCDF stuff*/
const size_t    start[] = {0,0}; /*netCDF stuff*/
const size_t    count[] = {HRAP_Y, HRAP_X}; /*netCDF stuff*/
float        xoryor;
int      l_xor, l_yor, l_hrap_x, l_hrap_y;
short int    preciparray[HRAP_Y][HRAP_X];
HRAP         hrap, latlon;
float        value;


if (argc == 2) sprintf(inputdate, "%s", argv[1]);
else  {
   printf ("USAGE: nctoasc MMDDYYYYHH\n");
   return 1;
   }
```

	Description	File	Line	Column	Project
1	Unused local variable: 'J'.	utilMod.vb	178	13	util
2	Unused local variable: 'J'.	utilMod.vb	219	13	util
3	Unused local variable: 'L'.	utilMod.vb	221	13	util
4	Unused local variable: 'row'.	utilMod.vb	251	13	util
5	Unused local variable: 'col'.	utilMod.vb	252	13	util

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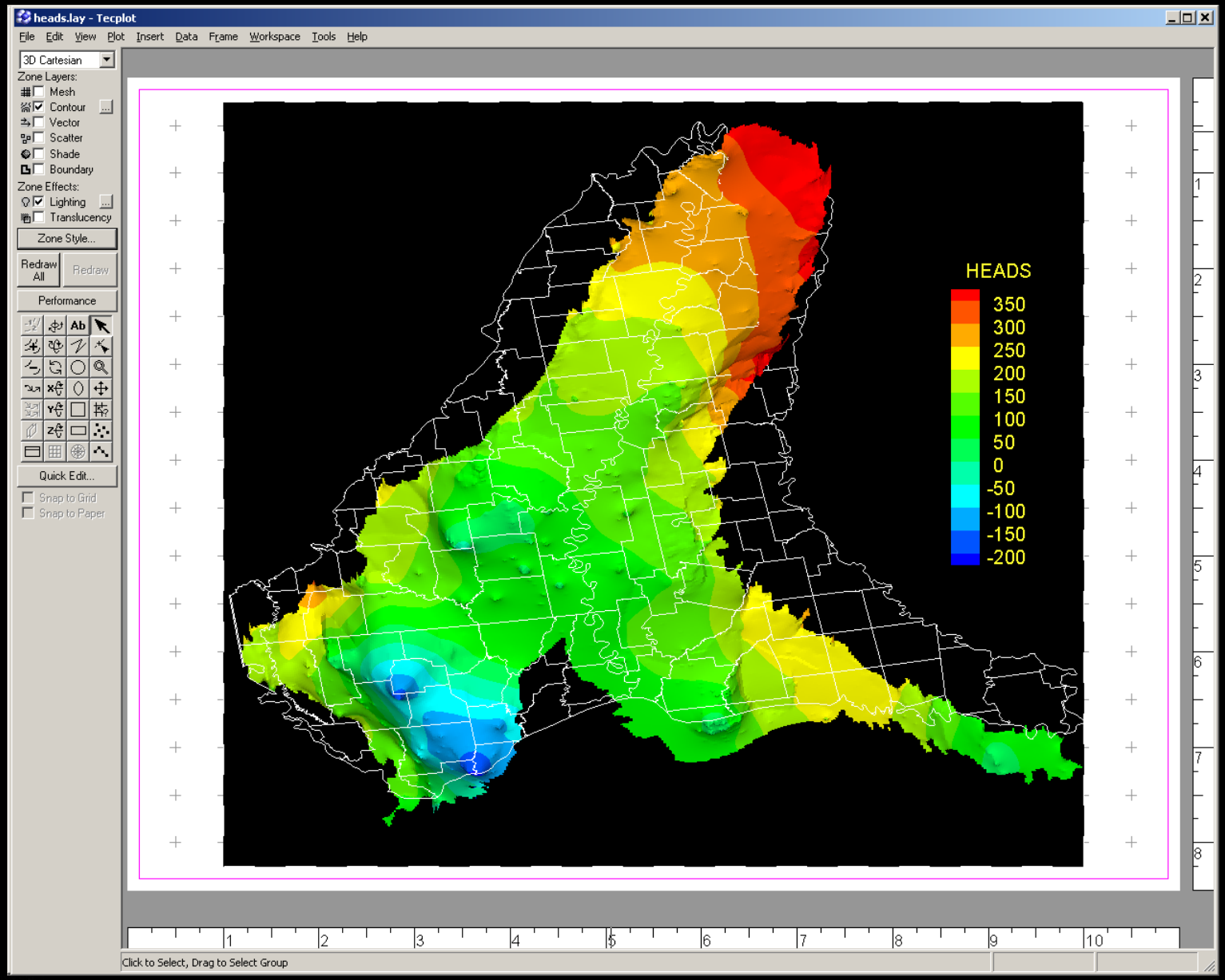
Tecplot – water levels



Tecplot – native file

Coding - 300 lines

TextPad - [D:\BRC\projects\MERAS\GIS\lay7.dat]

File Edit Search View Tools Macros Configure Window Help

Document Selector

lay7.dat

```
TITLE="HEADS"
VARIABLES= "XFIELD","YFIELD","HEADS","SP"
ZONE I=394 J=414 T="stressPeriod1"
179193.671775833 1603975.32822416 -999 1001
180803.015903819 1603975.32822416 -999 1002
182412.360031802 1603975.32822416 -999 1003
184021.704159789 1603975.32822416 -999 1004
185631.047968201 1603975.32822416 -999 1005
187240.392096188 1603975.32822416 -999 1006
188849.735904604 1603975.32822416 -999 1007
190459.080032587 1603975.32822416 -999 1008
192068.423841003 1603975.32822416 -999 1009
193677.767968986 1603975.32822416 -999 1010
195287.111777402 1603975.32822416 -999 1011
196896.455905389 1603975.32822416 -999 1012
198505.800033372 1603975.32822416 -999 1013
200115.143841788 1603975.32822416 -999 1014
201724.487969775 1603975.32822416 -999 1015
203333.831778187 1603975.32822416 -999 1016
204943.175906174 1603975.32822416 -999 1017
206552.520034157 1603975.32822416 -999 1018
208161.863842573 1603975.32822416 -999 1019
209771.20797056 1603975.32822416 -999 1020
211380.551778972 1603975.32822416 -999 1021
212989.895906959 1603975.32822416 -999 1022
214599.240034942 1603975.32822416 -999 1023
216208.583843358 1603975.32822416 -999 1024
217817.927971344 1603975.32822416 -999 1025
219427.272099327 1603975.32822416 -999 1026
221036.61622731 1603975.32822416 -999 1027
```

Explorer Document ...

1 1

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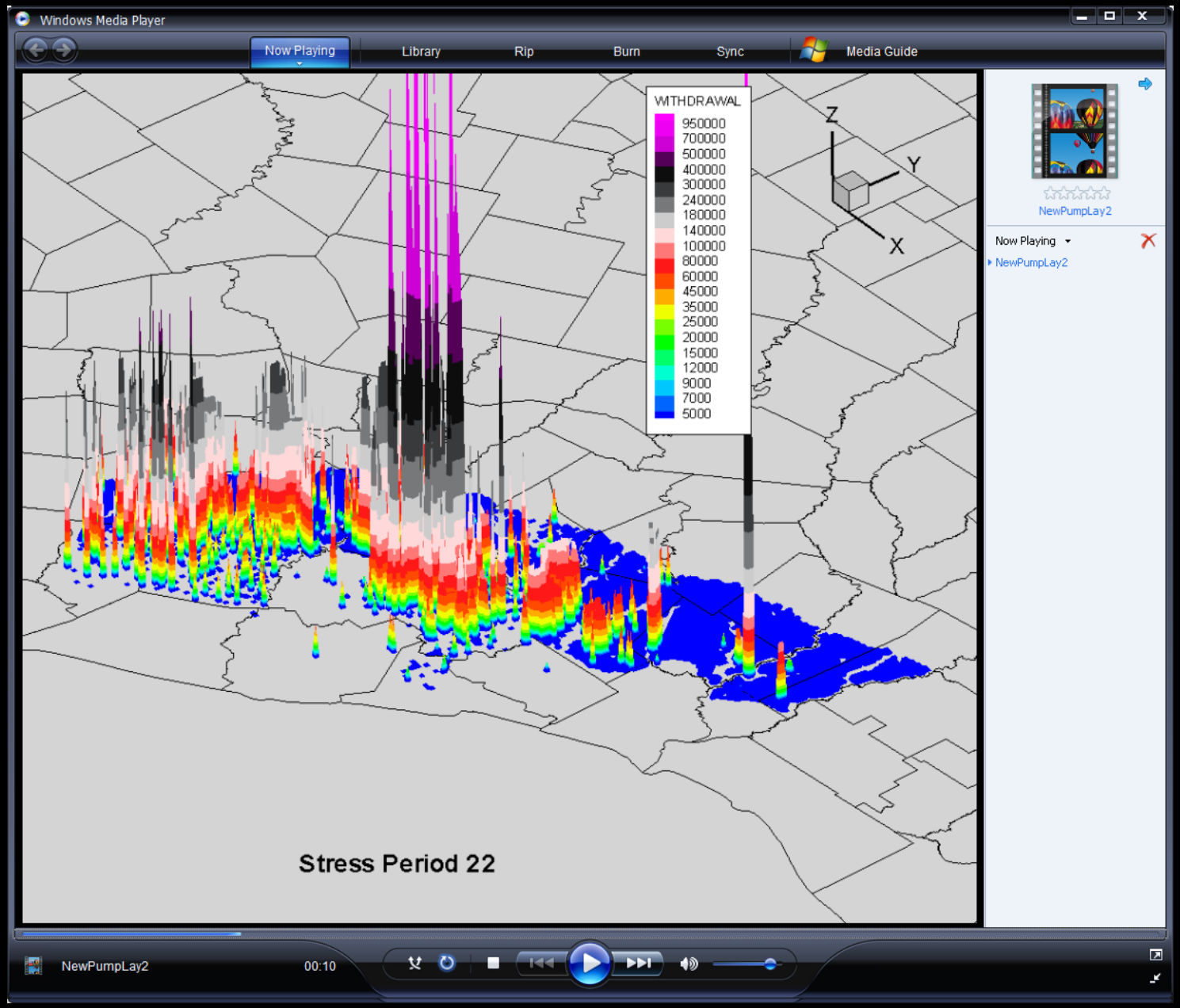
Tecplot – water use



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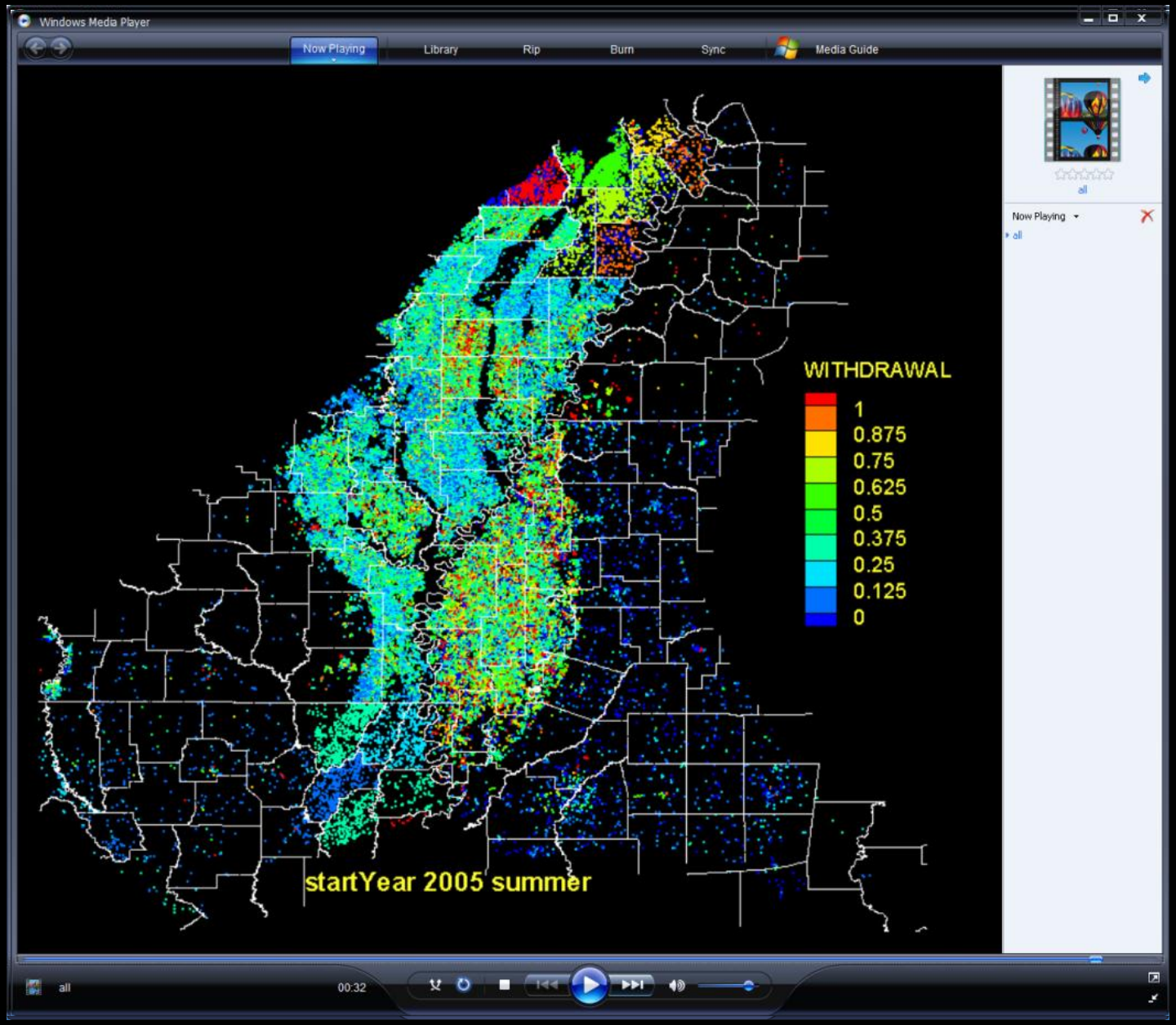
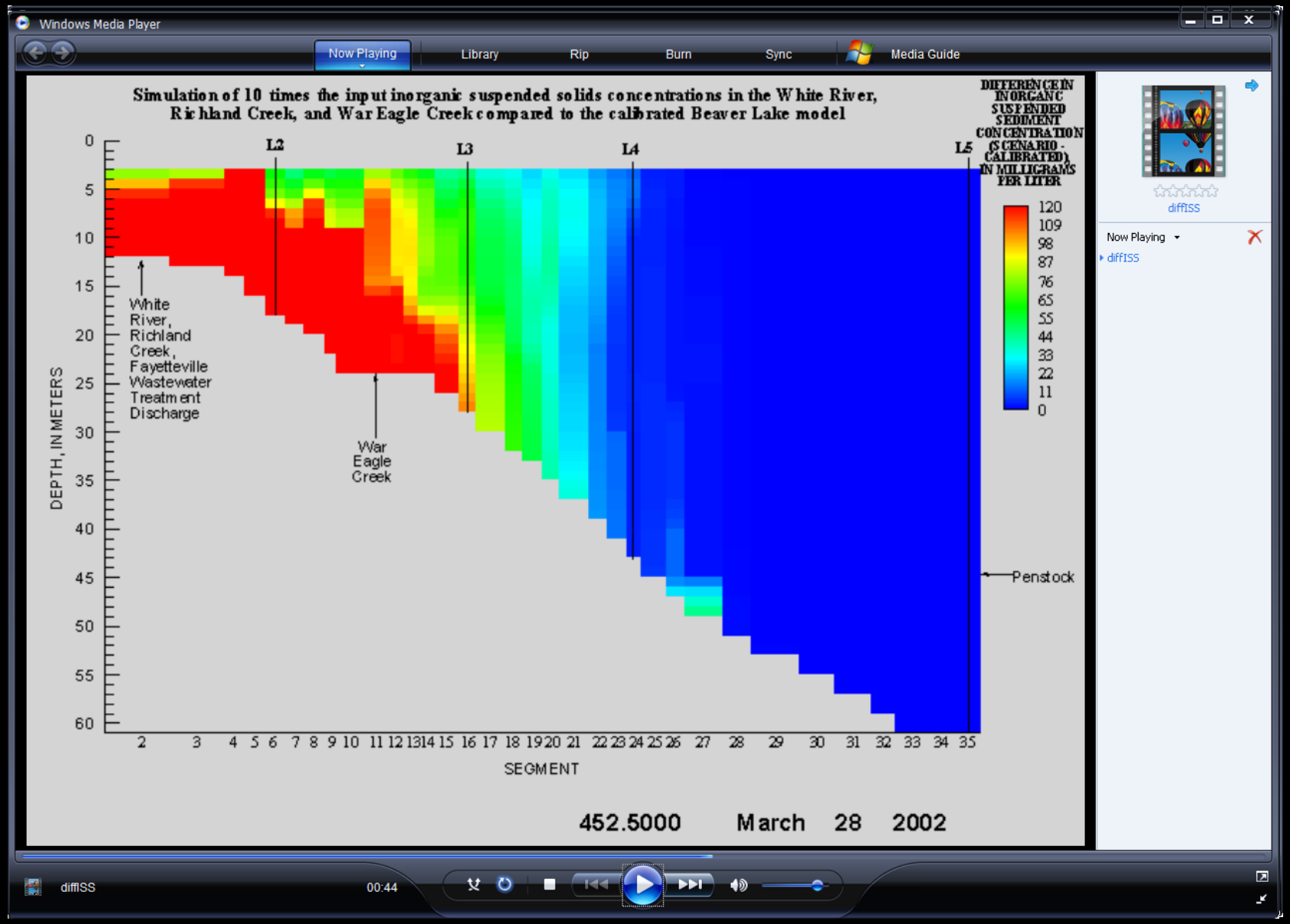
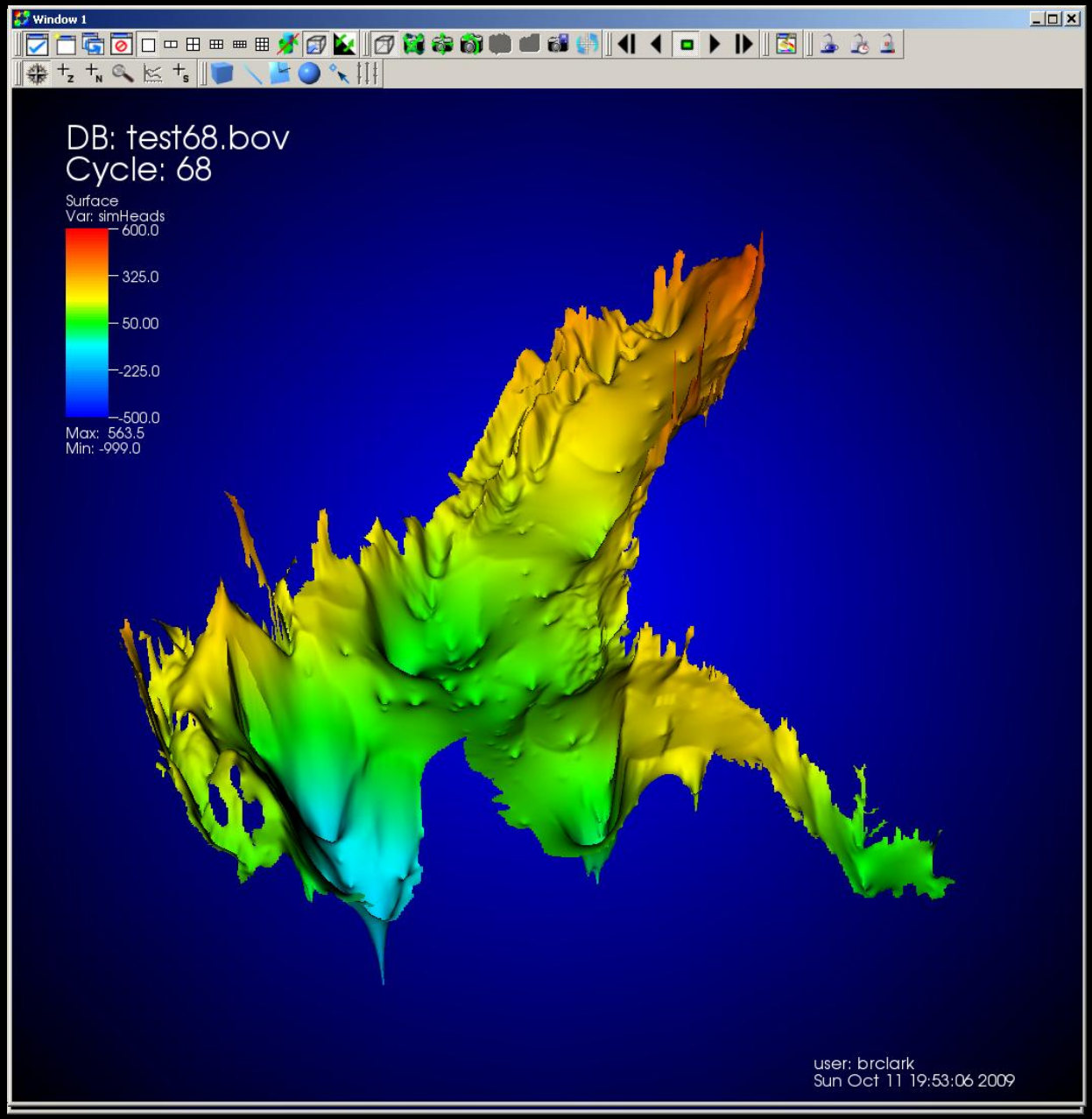
Tecplot - Error checking



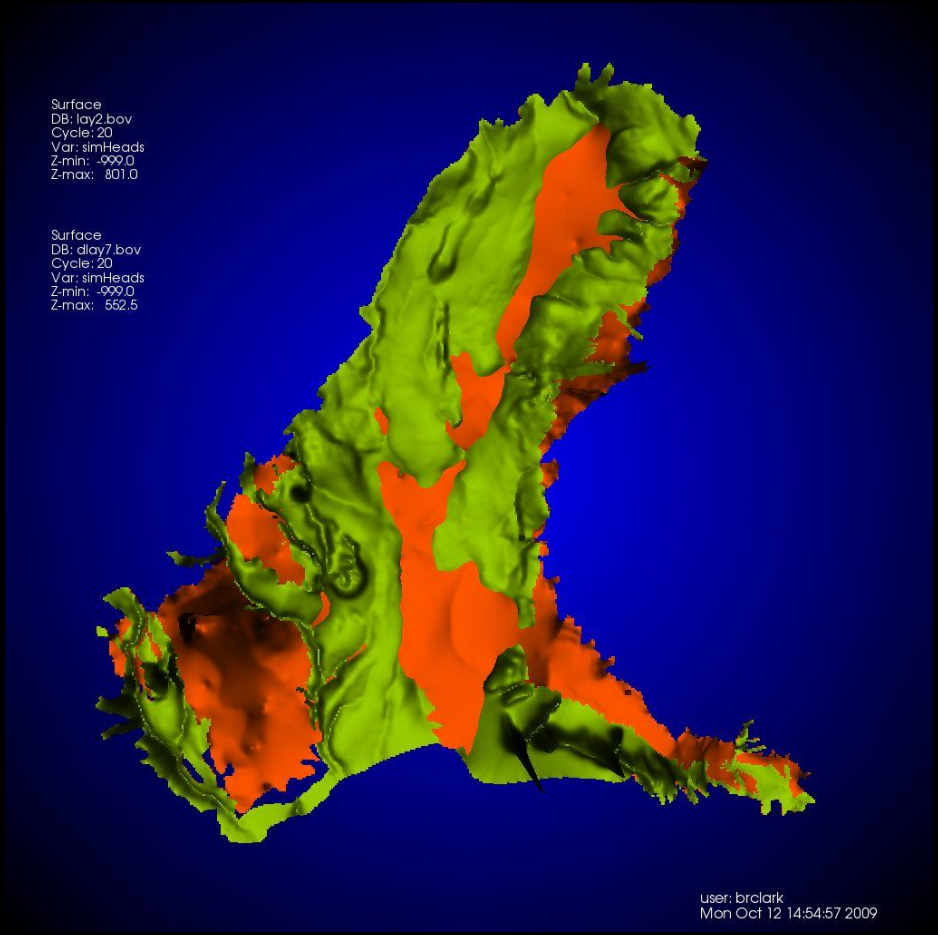
Tecplot – reservoir model

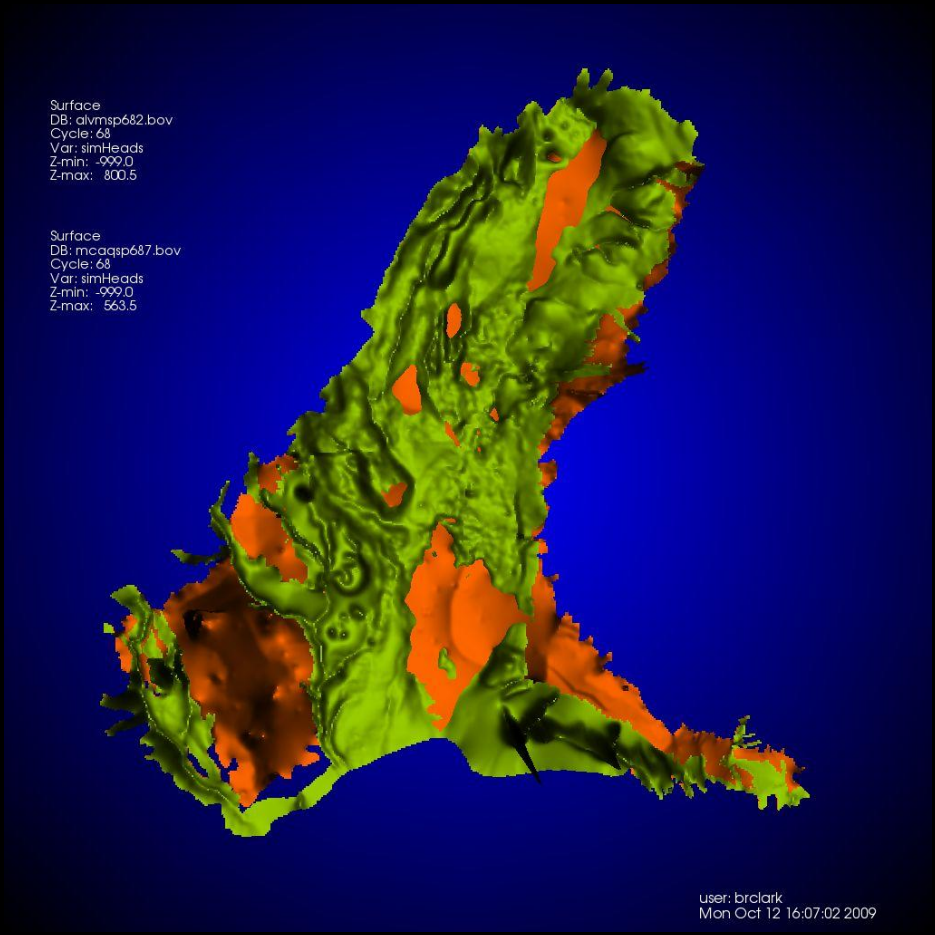


VisIt – water level



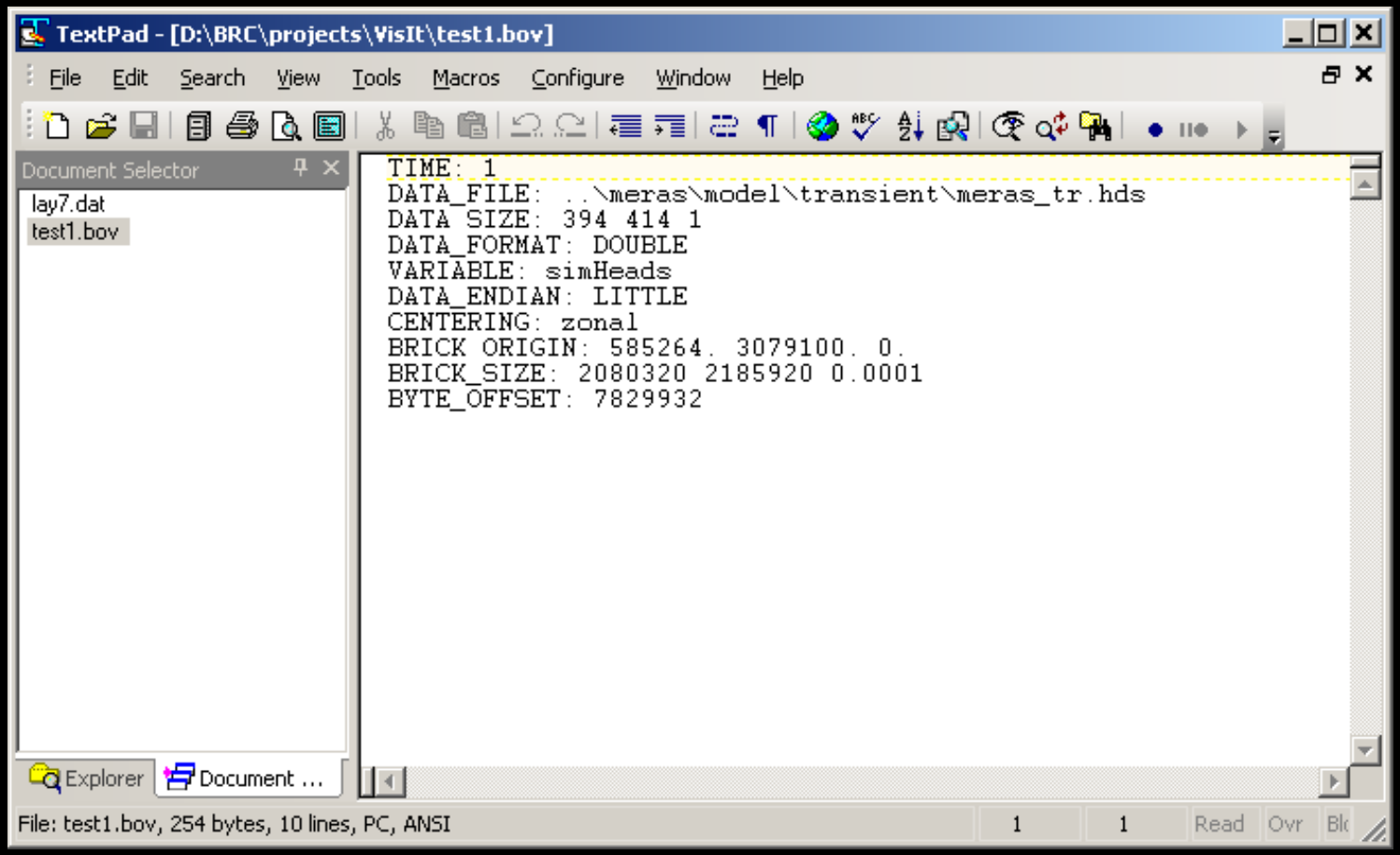
VisIt - Water level comparison



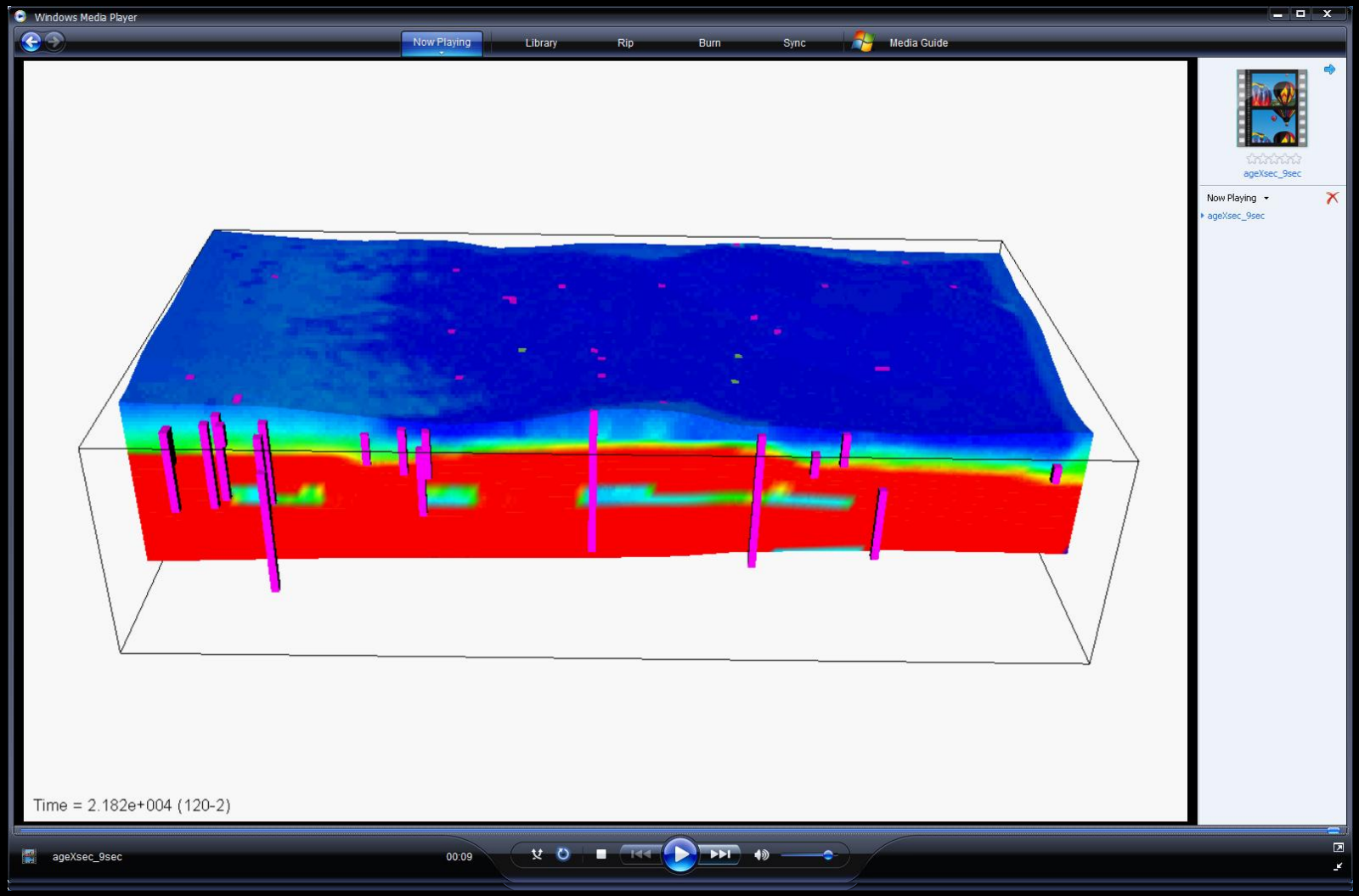


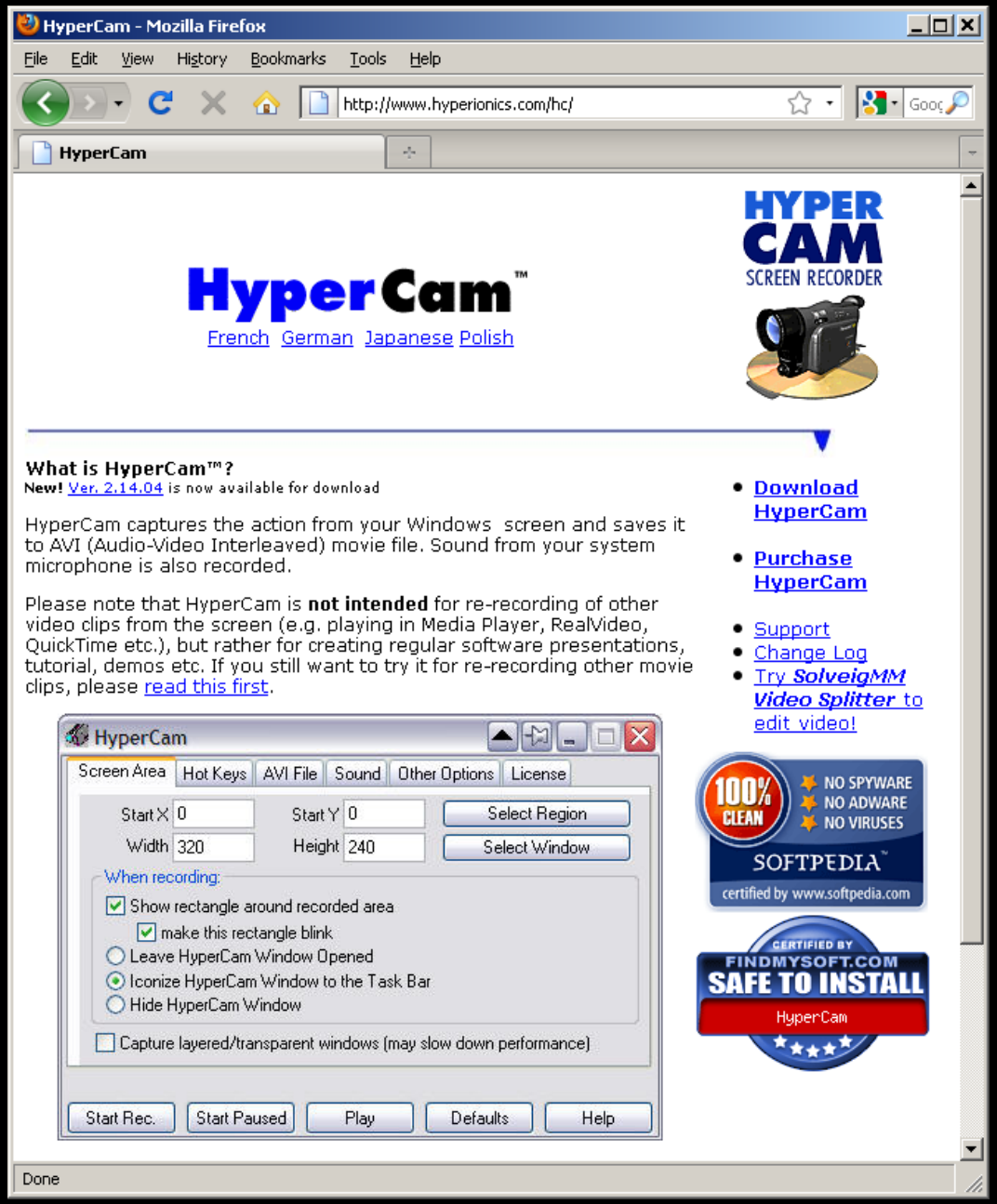
VisIt – BOV format

Coding – 100 lines



Model Viewer – solute transport




HyperCam - Mozilla Firefox
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http://www.hyperionics.com/hc/
HyperCam
HyperCam™
French German Japanese Polish
HYPER CAM SCREEN RECORDER
What is HyperCam™?
New! Ver. 2.14.04 is now available for download
HyperCam captures the action from your Windows screen and saves it to AVI (Audio-Video Interleaved) movie file. Sound from your system microphone is also recorded.
Please note that HyperCam is not intended for re-recording of other video clips from the screen (e.g. playing in Media Player, RealVideo, QuickTime etc.), but rather for creating regular software presentations, tutorial, demos etc. If you still want to try it for re-recording other movie clips, please read this first.
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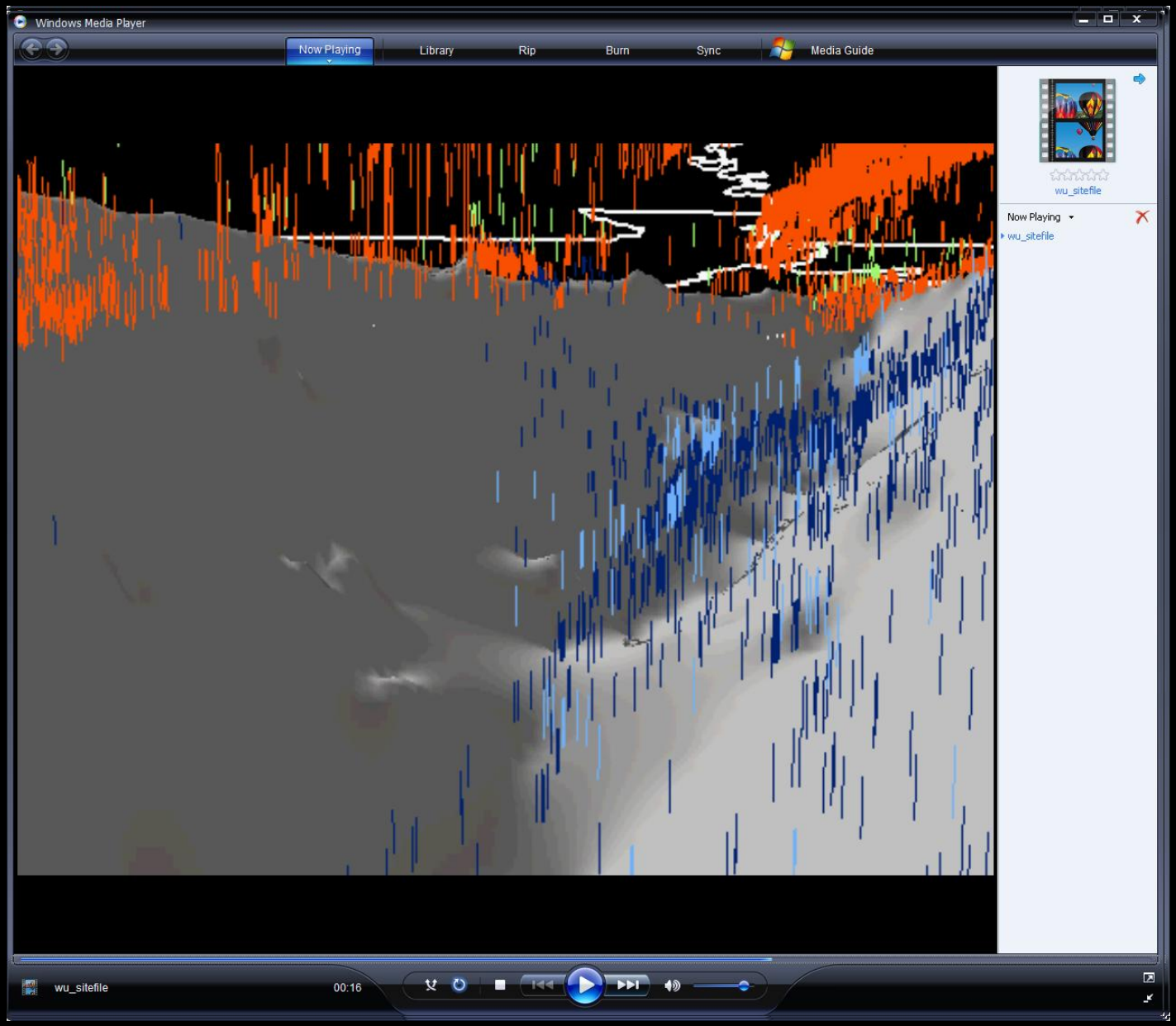
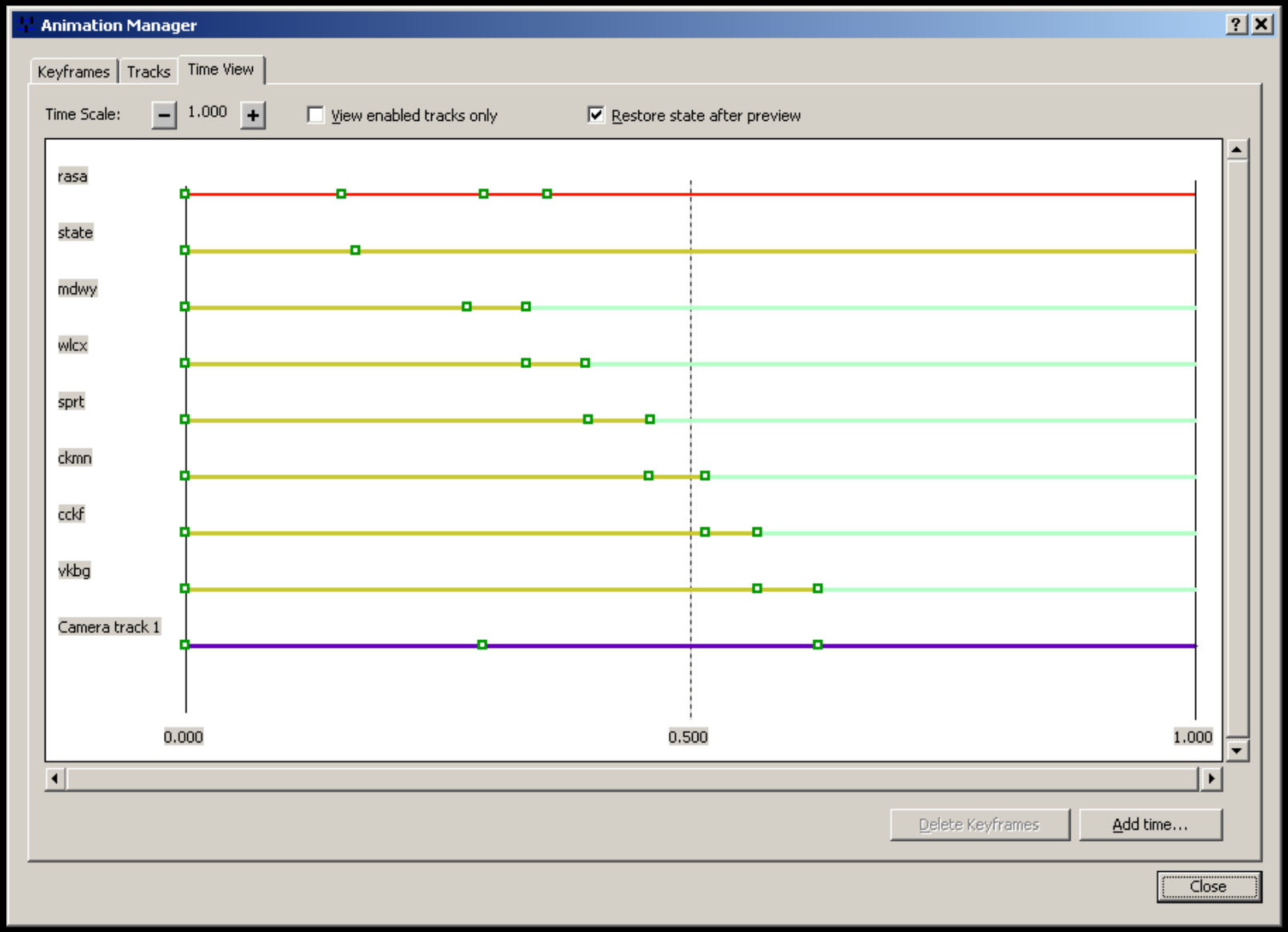
HyperCam
Screen Area Hot Keys AVI File Sound Other Options License
Start X 0 Start Y 0 Select Region
Width 320 Height 240 Select Window
When recording:
Show rectangle around recorded area
make this rectangle blink
Leave HyperCam Window Opened
Iconize HyperCam Window to the Task Bar
Hide HyperCam Window
Capture layered/transparent windows (may slow down performance)
Start Rec. Start Paused Play Defaults Help
100% CLEAN NO SPYWARE NO ADWARE NO VIRUSES SOFTPEDIA certified by www.softpedia.com
CERTIFIED BY FINDMYSOFT.COM SAFE TO INSTALL HyperCam
Done

ArcScene – fly through



keyframes


Animation Manager
Keyframes
Tracks
Time View
Time Scale:
1.000
View enabled tracks only
Restore state after preview
rasa
state
mdwy
wlcx
sprt
ckmn
cckf
vkbg
Camera track 1
0.000
0.500
1.000
Delete Keyframes
Add time...
Close

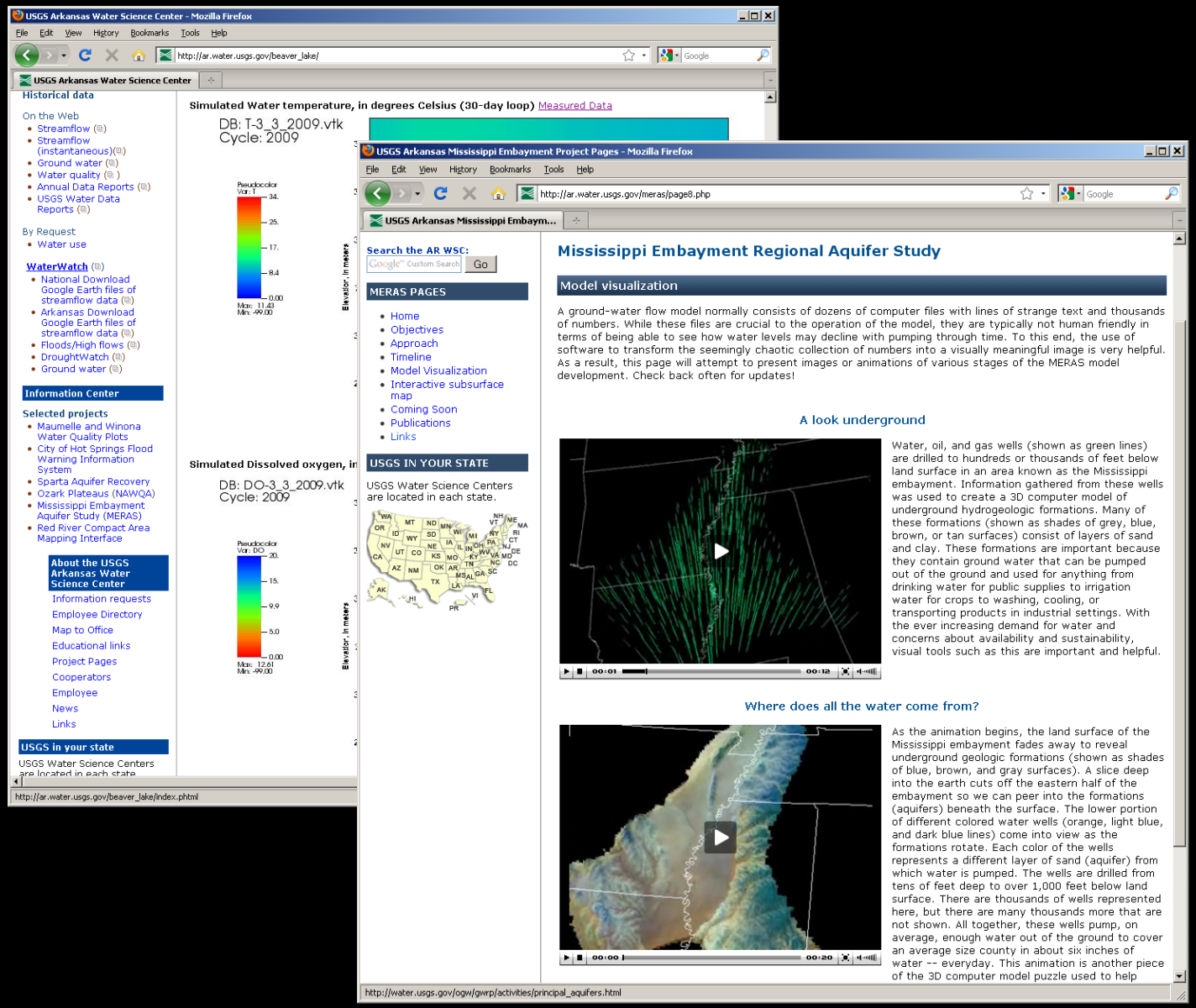
Animations on the web

Php

Html

Javascript

flash



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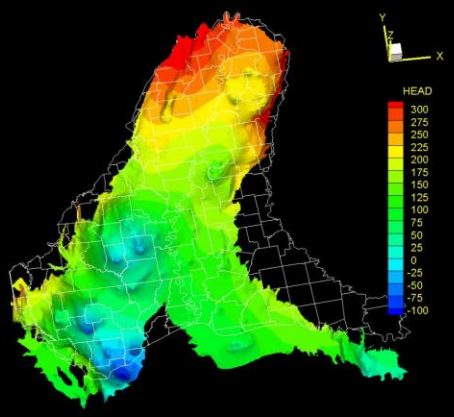
WYSIWYG

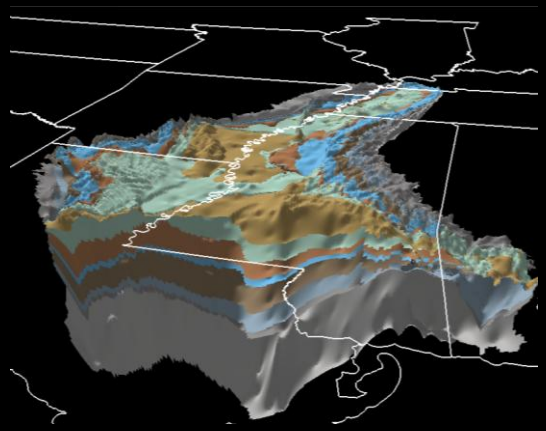
(not always)



Watch out -

Odd rendering (ghost layers, dropped frames, etc)

Power point disasters (video acceleration)
– Test it!



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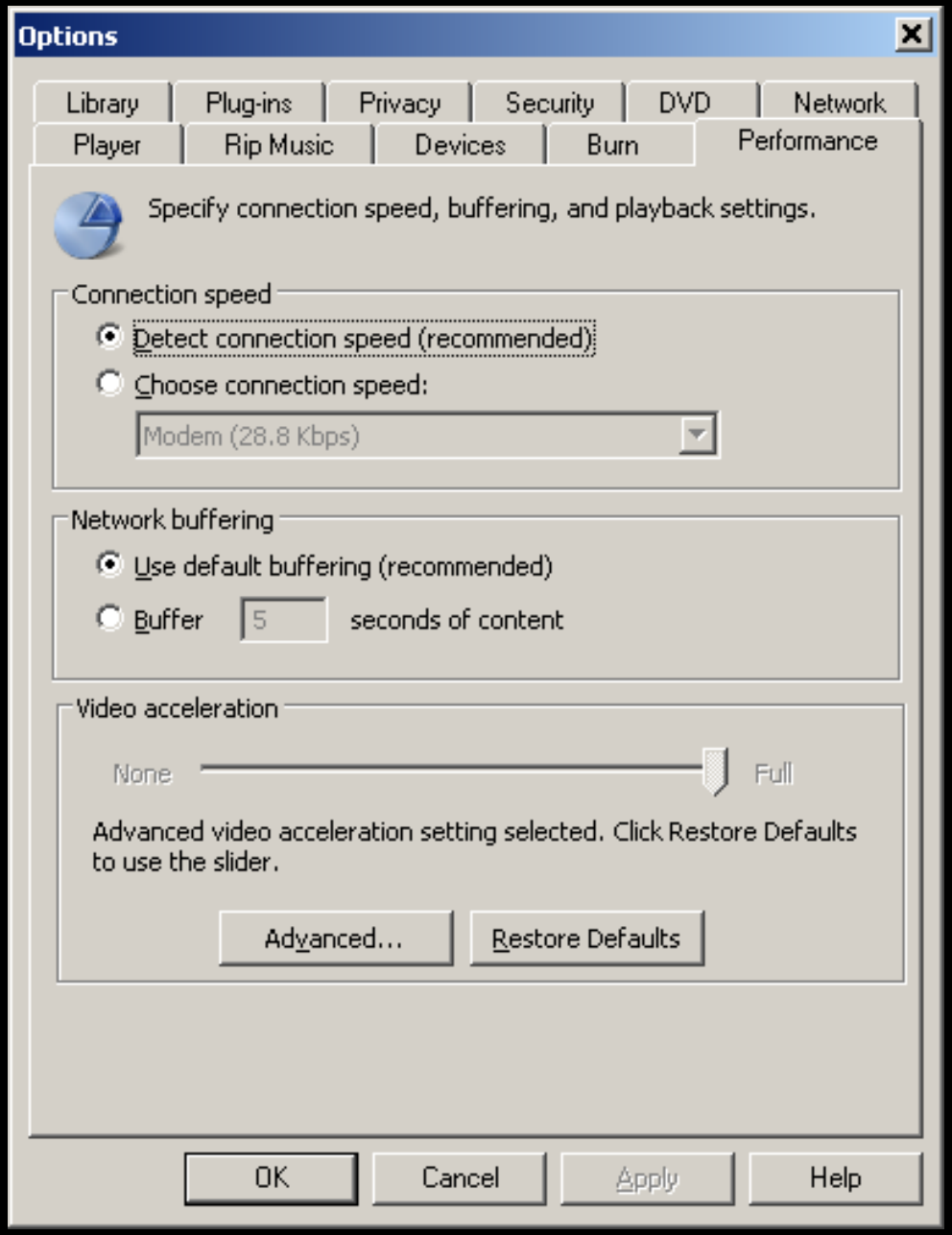

Windows media player

brclark@usgs.gov
501 228 3655

Examples
ftp://ftpext.usgs.gov/pub/cr/ar/little.rock/clark/3D/