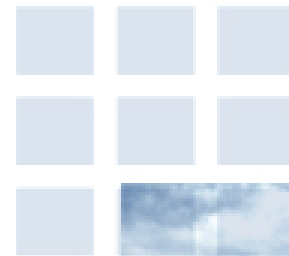




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Vis5d

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Vis5D Overview

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- Visualize data made by weather and ocean models
- Data “grid” in the form of a five dimensional rectangle:
 - three space dimensions,
 - one time dimension
 - one dimension for enumerating physical variables
- Tcl scripting
- OpenGL-based
- Software rendering: Mesa



Vis5D grid structure

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→ **Horizontal grid**

- **Cartesian (x,y)**
- **rectilinear (lat, lon)**
- **rotated rectilinear (lat, lon)**

→ **Vertical grid**

- **equally spaced**
- **unequally spaced**
- **generic, height or pressure**

→ **No curvilinear or irregular grids**

- **re-grid data onto rectilinear grid**



How to set up Vis5D on your system

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- **Download desired Vis5d version, e.g.:**

<ftp://ftp.ssec.wisc.edu/pub/vis5d-5.2>

<http://www.ssec.wisc.edu/~billh/vis5d.html>

<http://vis5d.sourceforge.net/>

- **Compile vis5d source code on your system with changes in following parameters in /src/v5d.h and /src/v5df.h. Parameters these define maximum size of the Vis5d output.**

```
#define MAXVARS 80
```

```
#define MAXTIMES 800
```

```
#define MAXROWS 420
```

```
#define MAXCOLUMNS 420
```

```
#define MAXLEVELS 100
```

```
#define MAXRECS 10000
```



How to use Vis5D with EULAG

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- **Now you can use Vis5D in EULAG in:**
 - **serial or parallel mode,**
 - **single or double precision**

- **To run EULAG with Vis5d**
 - **Set environmental option $VIS5D = 1$**
 - **Check the compiler options on your system**
 - **Set parameters in param.v5d**
 - **Set parameters in subroutine vis5d_out**



How to visualize EULAG's Vis5D output

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- Check if the EULAG single-time files were created:
 - a000outp.v5d
 - a001outp.v5d
 - ...
 - a999outp.v5d

- To visualize output
 - Test output data with “v5dinfo ...” or “v5dstats ...”
 - Edit output properties with “v5dedit ...”
 - Combine time outputs with “v5dappend a*v5d your_name.v5d”
 - Reduce number of variables “v5dappend -variable_name ...”
 - Allocate memory for better performance “vis5d -mbs ...”
 - Use topography/building description “vis5d -topo topo_file”
 - Use TCL script “vis5d -script script_name.tcl”



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Vis5D capabilities – modes

Normal: graphics in the 3-D window.

Trajectory: create and display trajectories.

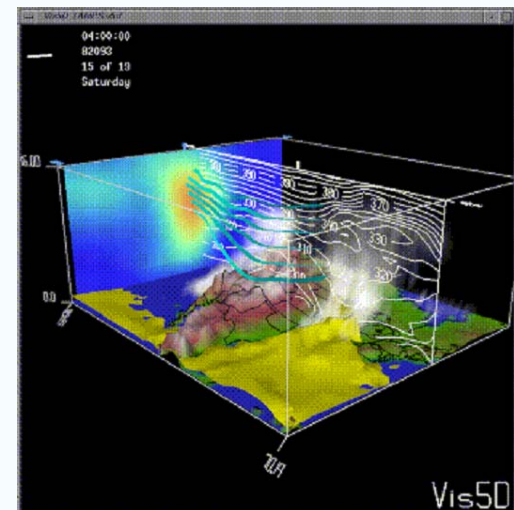
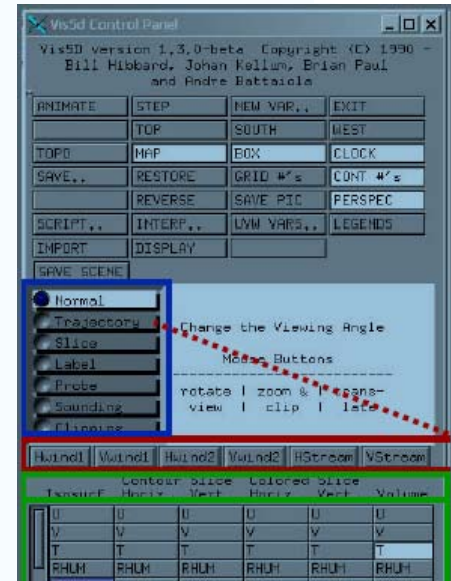
Slice: create horizontal and vertical slides.

Label: create/edit text labels in 3D window

Data Probe: inspect individual grid values by moving cursor through the grid.

Sounding: display vertical sounding and SkewT at the movable cursor location.

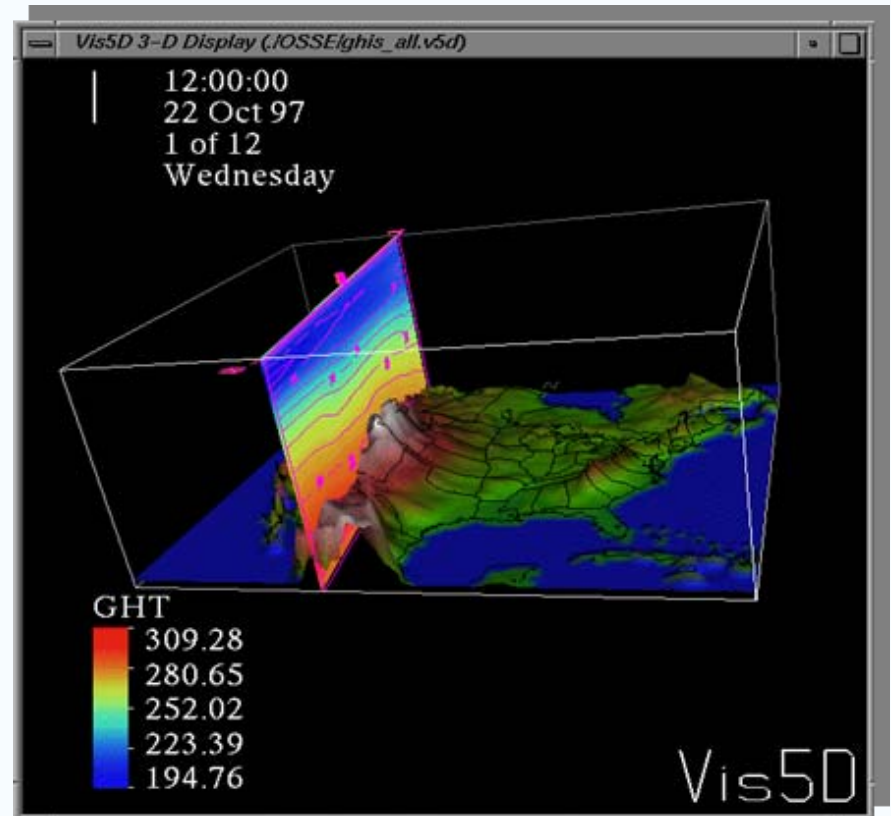
3D display may be:
rotated, zoomed or translated



Vis5D modes – slices

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- **Planar cross sections in 3D box**
 - colored slices,
 - contour lines,
 - wind vectors,
 - wind stream lines.
- **Horizontal or vertical orientation**
- **Position of slices can be changed interactively using the mouse.**





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Vis5D modes – color & contour slices

Contour Slice		Colored Slice		Volume	
Isosurf	Horiz.	Vert.	Horiz.	Vert.	Volume
U	U	U	U	U	U
V	V	V	V	V	V
T	T	T	T	T	T
Q	Q	Q	Q	Q	Q
CLW	CLW	CLW	CLW	CLW	CLW
RNW	RNW	RNW	RNW	RNW	RNW
RADTEND	RADTEND	RADTEND	RADTEND	RADTEND	RADTEND
W	W	W	W	W	W
HRcu	HRcu	HRcu	HRcu	HRcu	HRcu
HRex	HRex	HRex	HRex	HRex	HRex

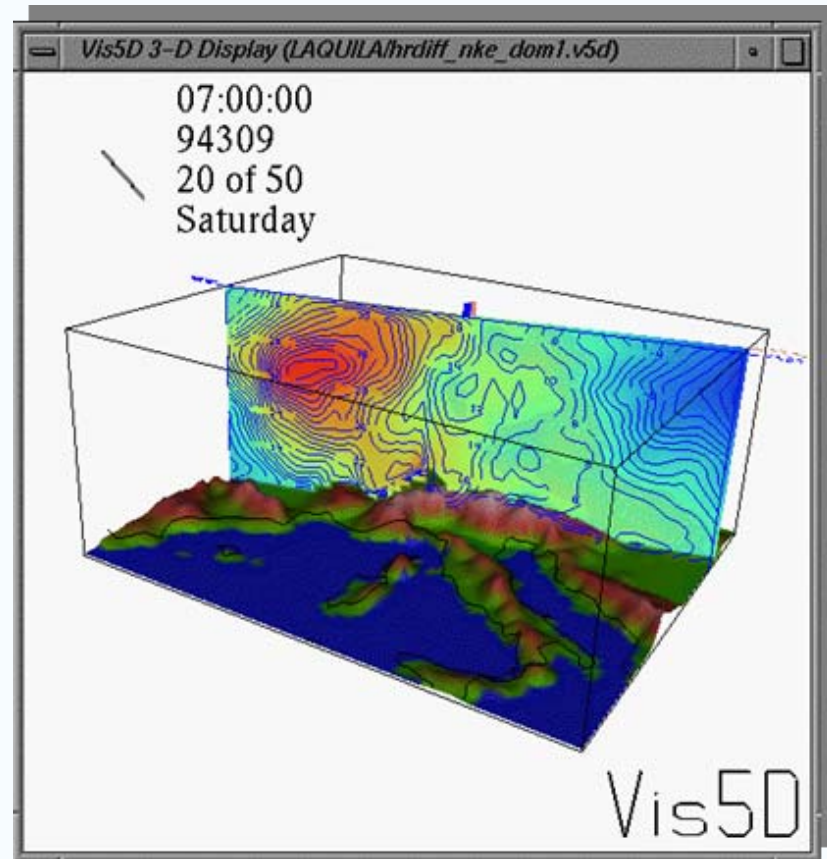
Vis5D Control Panel (LAQUILA/hrdiff_nke_dk)

Up/Down Arrows - change curvature
Left/Rt Arrows - move curves left/right
Shift+Arrows - change transparency curve
R - reset colors
Shift+R - reset transparency
C - copy color to clipboard
P - paste colors from clipboard
S - save colors to file
L - load colors from file

-35.35 V vert slice= -35.35 56.36

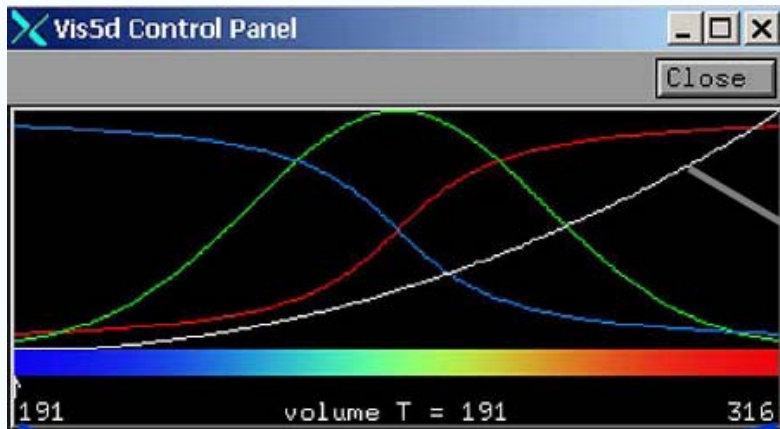
Vis5D Control Panel (LAQUILA/hrdiff_nke_dk)

V Ver. Slice Interval: 2

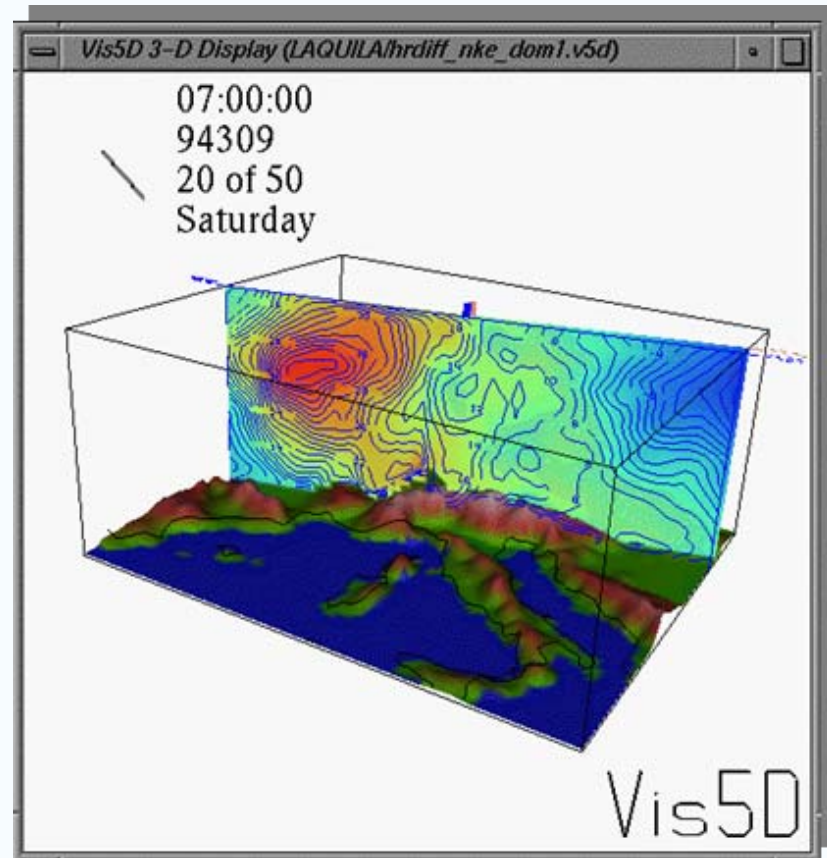


Vis5D modes – color & contour slices

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Up/Down Arrows - change curvature
Left/Rt Arrows - move curves left/right
Shift+Arrows - change transparency curve
R - reset colors
Shift+R - reset transparency
C - copy color to clipboard
P - paste colors from clipboard
S - save colors to file
L - load colors from file





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Vis5D modes – wind vector slices

Buttons near the center of control panel labeled
HWIND-1
VWIND-1
HWIND-2
VWIND2

Vis5D Control Panel (LAQUILA/hrdiff_nke_a)

	Contour	Slice	Colored Slice		
Isosurf	Horiz.	Vert.	Horiz.	Vert.	Volume
U	U	U	U	U	U
V	V	V	V	V	V
T	T	T	T	T	T
Q	Q	Q	Q	Q	Q
CLW	CLW	CLW	CLW	CLW	CLW
RNW	RNW	RNW	RNW	RNW	RNW
RADTEND	RADTEND	RADTEND	RADTEND	RADTEND	RADTEND
W	W	W	W	W	W
HRcu	HRcu	HRcu	HRcu	HRcu	HRcu
HRex	HRex	HRex	HRex	HRex	HRex
	GROUND		GROUND		

V-Wind 1 Scale: 3 Density: .6

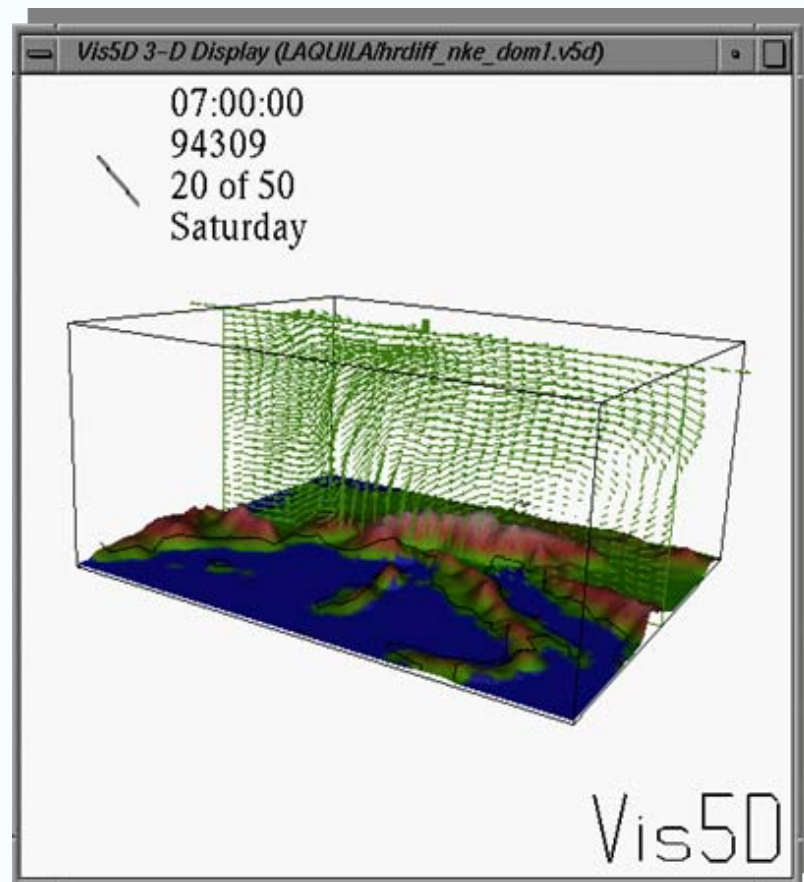
Vertical Wind slice 1 color: Close

0.0 Red = 0.24 1.0

0.0 Green = 0.48 1.0

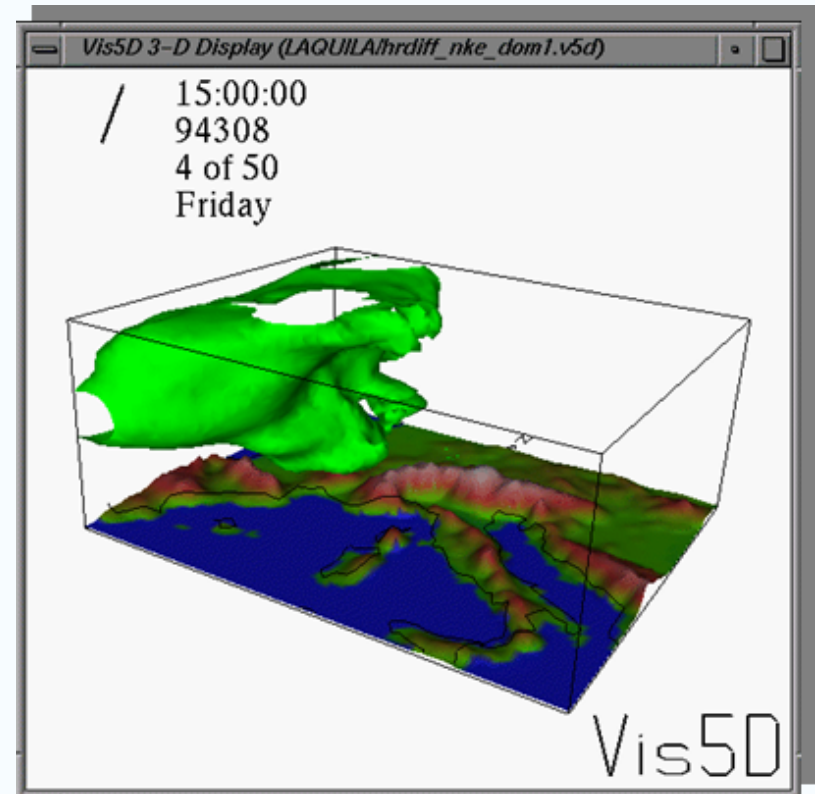
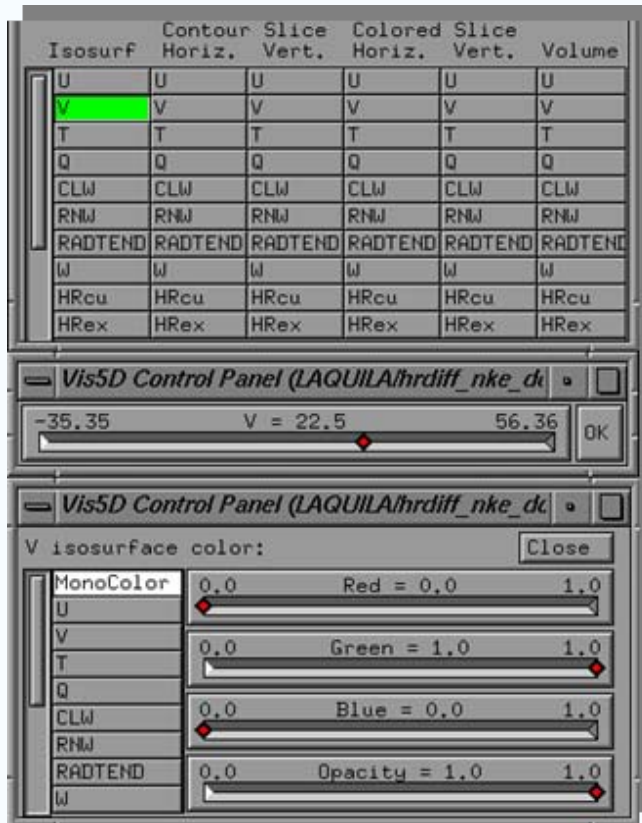
0.0 Blue = 0.08 1.0

Two type-in fields to control the density and scaling of the wind vectors



Vis5D capabilities – isosurfaces

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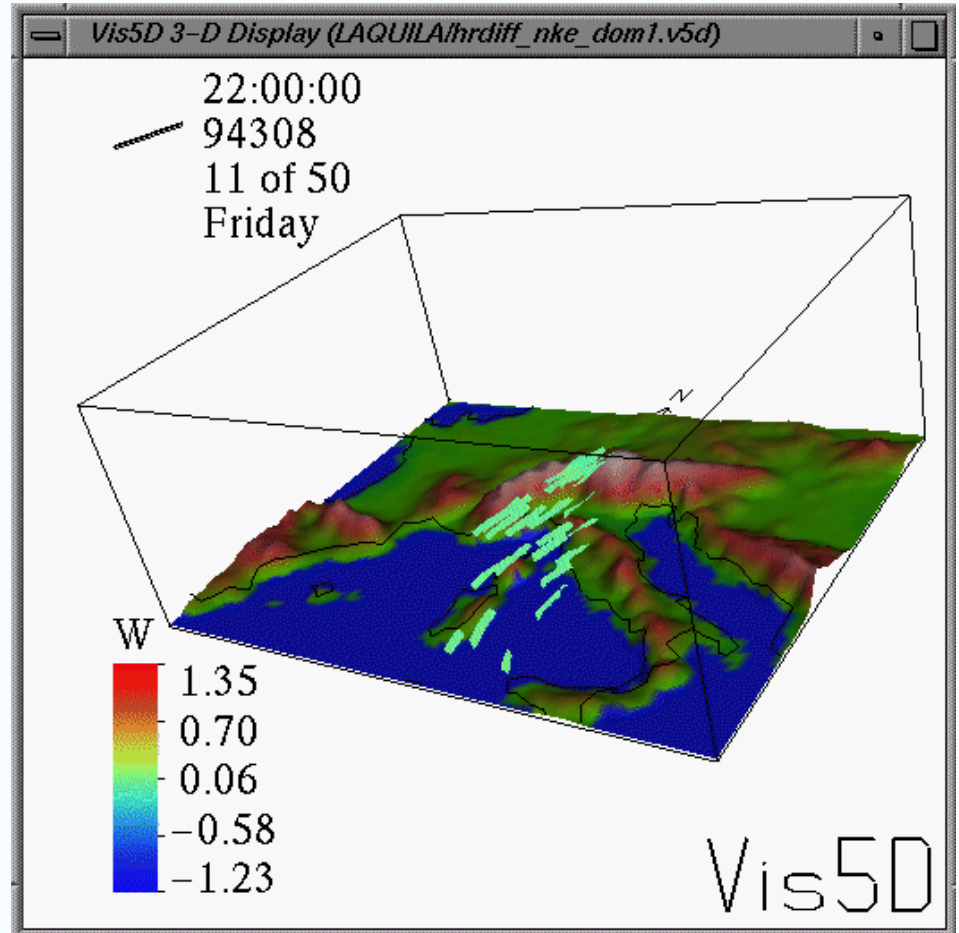
An isosurface may either be drawn entirely in one color or colored according to the values of another physical variable.

Vis5D capabilities – trajectories

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➤ Trace the motion of air through the 3-D volume

➤ Eight in sets available
Set1, Set2, ..., Set8
individually displayed,
colored, or deleted.



Vis5D capabilities – trajectory setup

The image displays the Vis5D software interface. On the left, a control panel has a vertical list of radio buttons: Normal, Trajectory (selected), Slice, Label, Probe, and Sounding. Below these are buttons for Hwind1, Vwind1, HStream, Hwind2, Vwind2, and VStream. A section titled 'Make & View Trajectories' includes 'Mouse Buttons' with instructions: rotate | make | move, view | trajec | cursor. Below this is a table for selecting variables for different display types.

Isosurf	Contour	Slice	Colored Slice		Volume
	Horiz.	Vert.	Horiz.	Vert.	
U	U	U	U	U	U
V	V	V	V	V	V
T	T	T	T	T	T
Q	Q	Q	Q	Q	Q
CLW	CLW	CLW	CLW	CLW	CLW
RNW	RNW	RNW	RNW	RNW	RNW
RADTEND	RADTEND	RADTEND	RADTEND	RADTEND	RADTEND
W	W	W	W	W	W
HRcu	HRcu	HRcu	HRcu	HRcu	HRcu
HRex	HRex	HRex	HRex	HRex	HRex
	GROUNDT		GROUNDT		
	RAINCON		RAINCON		

On the right, there are two 'Vis5D Control Panel' windows. The top one is titled 'Trajectory set 1 color:' and shows a color scale from -1.23 to 1.35 with a 'Close' button. The bottom one is titled 'Interactive Wind Trajectories' and includes buttons for Set 1 through Set 8, input fields for Step (1) and Length (5), and buttons for Ribbon, Delete Last, and Delete Set.

- Select the **TRAJECTORY** radio button on the control panel.
- Select a position with the 3D cursor.
- Select time step with the **STEP** button on the control panel.
- Press middle mouse button inside 3D window to make a trajectory at the current cursor location and current time step
- Turn on **ANIMATE** button to observe trajectory in time & space.

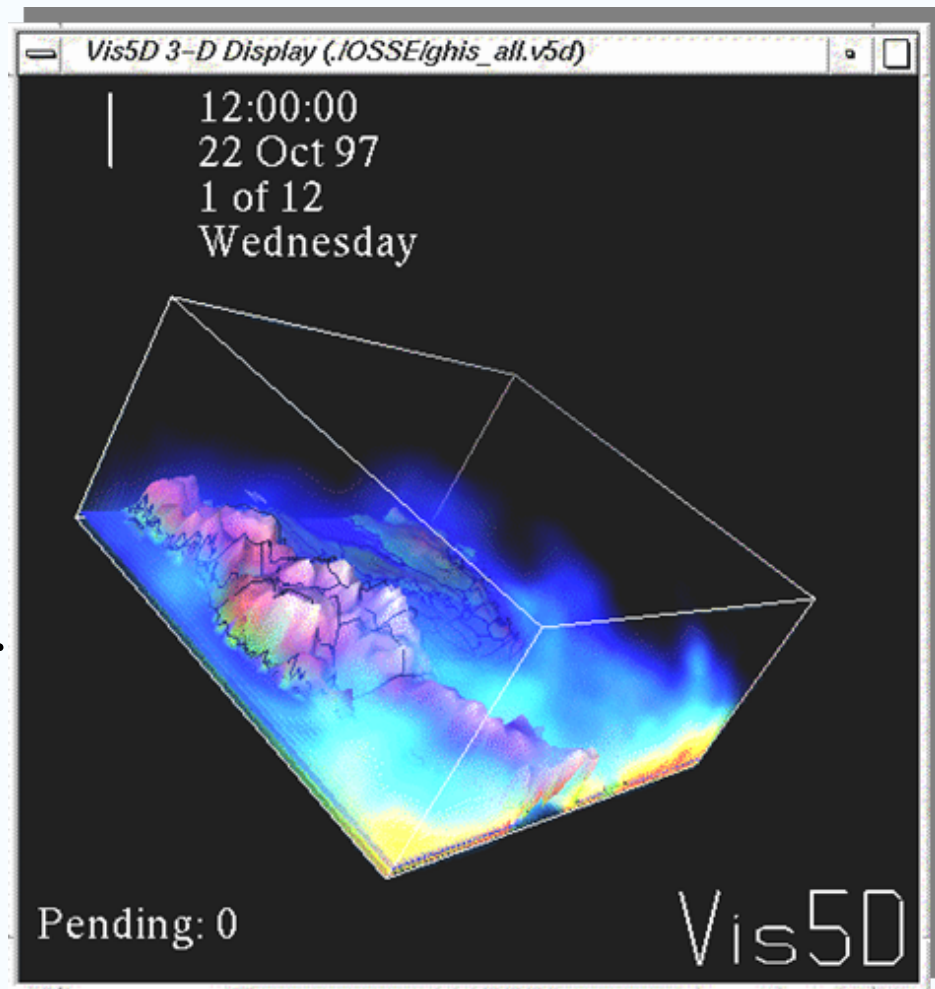
Vis5D capabilities – volume rendering

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Displaying a 3D field
as a semi-transparent
colored fog

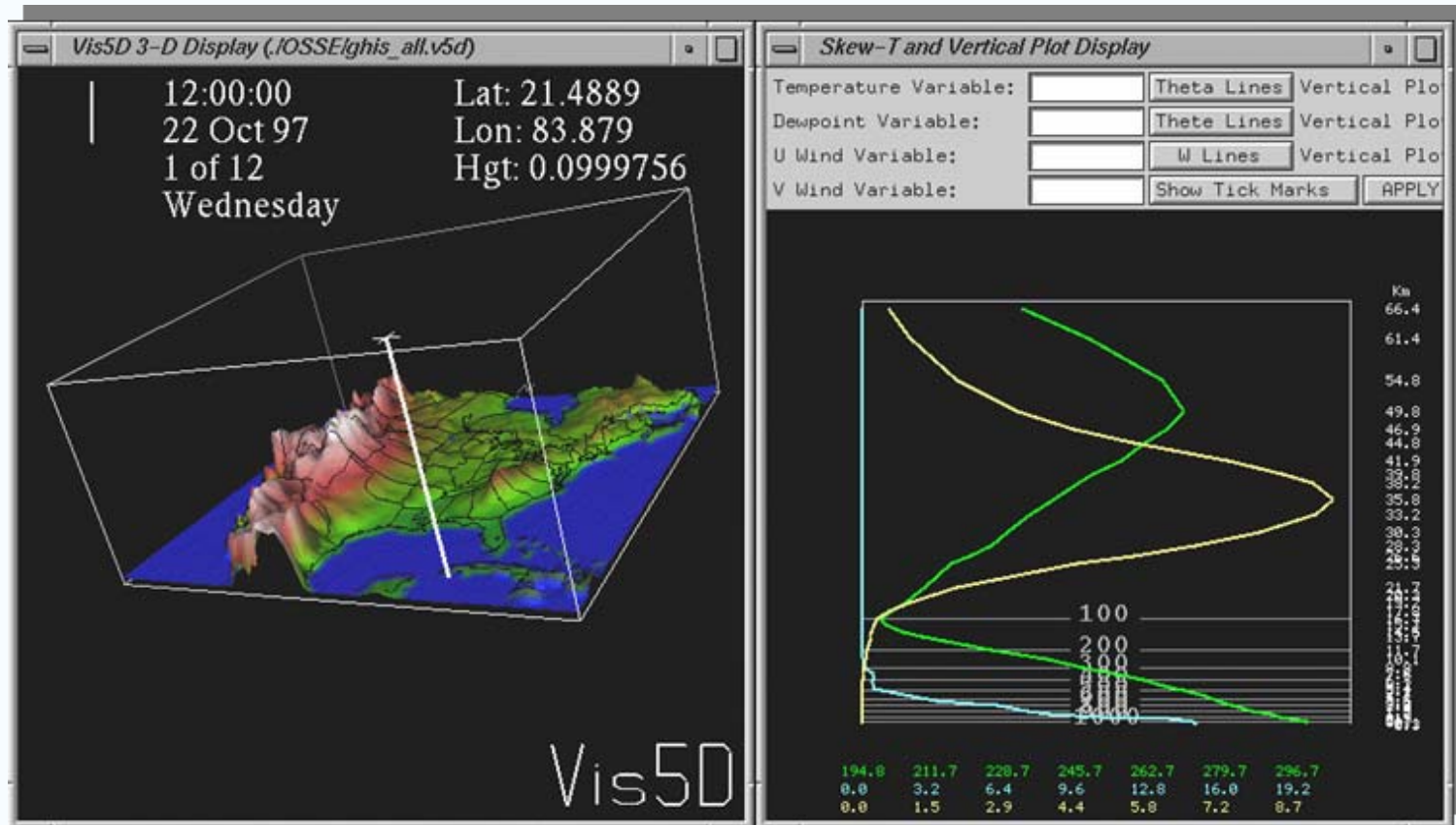
Cons:

- Memory sensitive
- Very slow compared to e.g Vapor



Vis5D capabilities – vertical soundings

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Display a vertical sounding and SkewT at the movable cursor location.



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Vis5D capabilities – additional features

- **Default variables: wind (u,v,w), pressure (p), temperature (T)**
- **Making new variables**
- **Cloned variables**
- **Type-in formulas**
- **Saving image files and printing**
- **Text labels and annotation**
- **Keyboard functions**



Vis5D utilities

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- **v5dimport** - converting grid files to v5d format, combining multiple source files, resampling to new coordinate systems and culling variables and time steps
- **v5dappend** - utility to join v5d files together
- **v5dinfo** - see summary of a v5d file
- **v5dstats** - see statistics of a v5d file
- **v5dedit** - edit the header of a v5d file
- **topoinfo** – see topography information
- **maketopo** – create your own topography file



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Vis5D scripting

- **Tcl (Tool command language) interpreted scripting language for Vis5D automation with scripts**
- **Automatically setting colors, computing graphics, and making off-line animations.**
- **Two buttons On Vis5D control panel labeled **SCRIPT** (execute a Tcl script from a file) and **INTERP** (interactively type in Tcl commands)**
- **Execute a script file when you start Vis5D with command line option: *vis5d LAMPS.v5d -script foo.tcl***



EULAG -> Vis5D data output

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Fortran/C I/O functions :

- **v5dcreate (name, numtimes, numvar, nr, nc, nl, varname, timestamp, datestamp, compress, projection, proj_args, vertical, vert_args)**
- **v5dwrite (time, var, data)**
- **v5dsetunits (varnum, “unit type”)**
- **v5dclose ()**

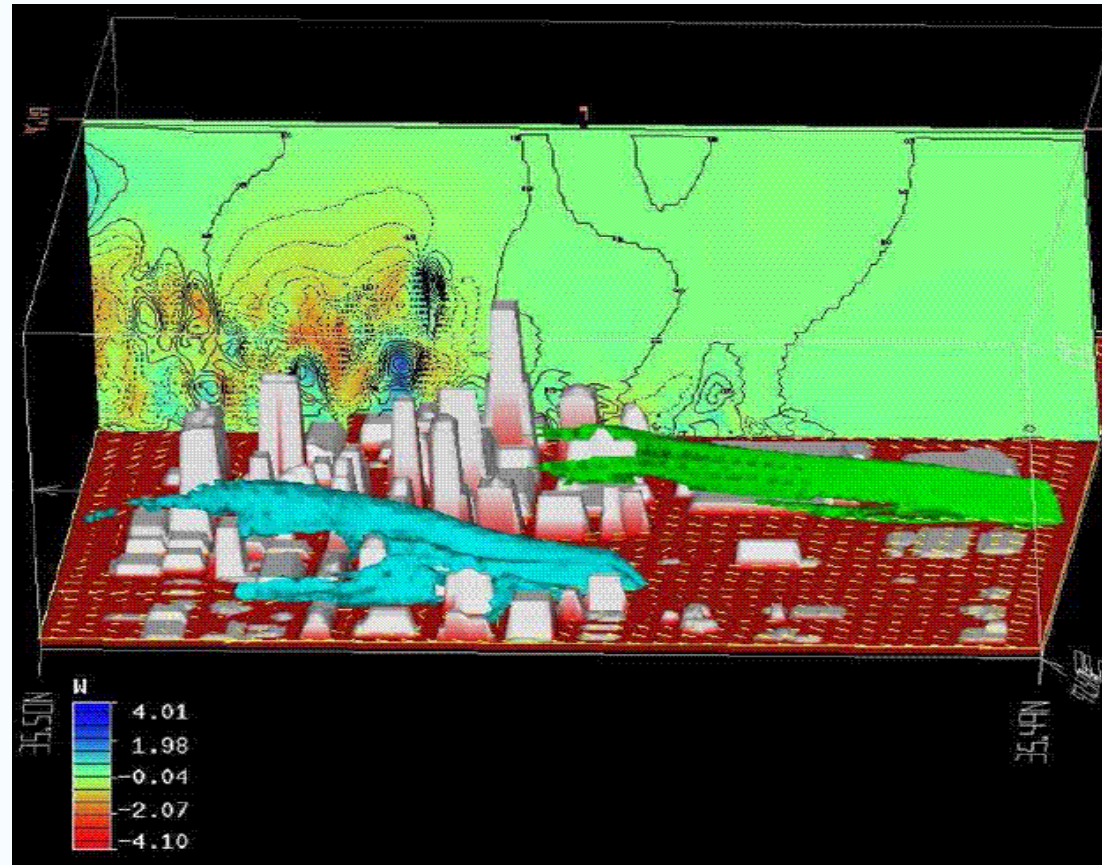
EULAG special options:

- **enforce single precision for double precision run**
- **vis5d output in parallel mode**
- **clipping option for large domains**
- **output for 2D runs**



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EULAG – urban modeling application

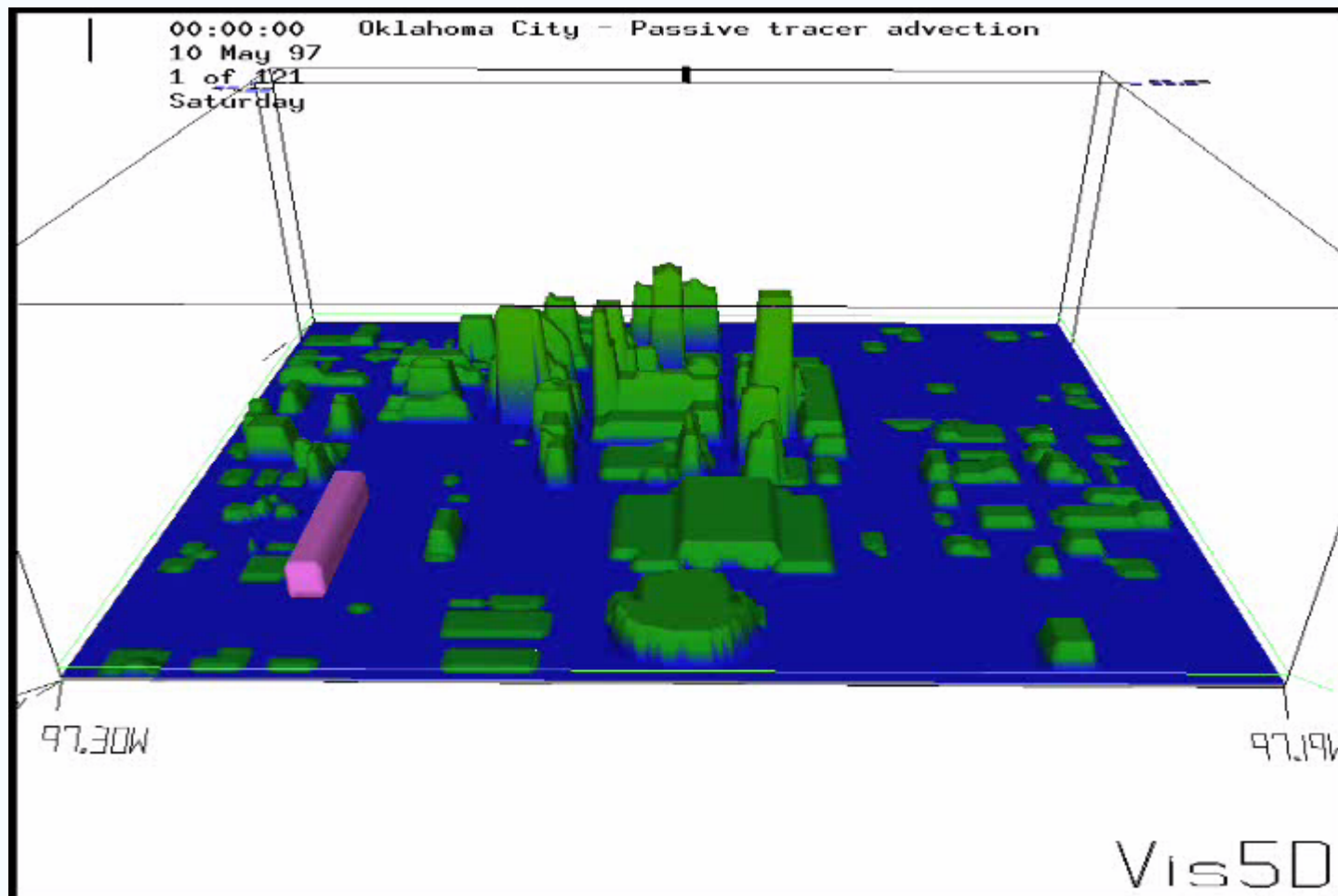


- building shape as the topography file
- change of building colors require hard coding in Vis5D source files



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EULAG – urban modeling application

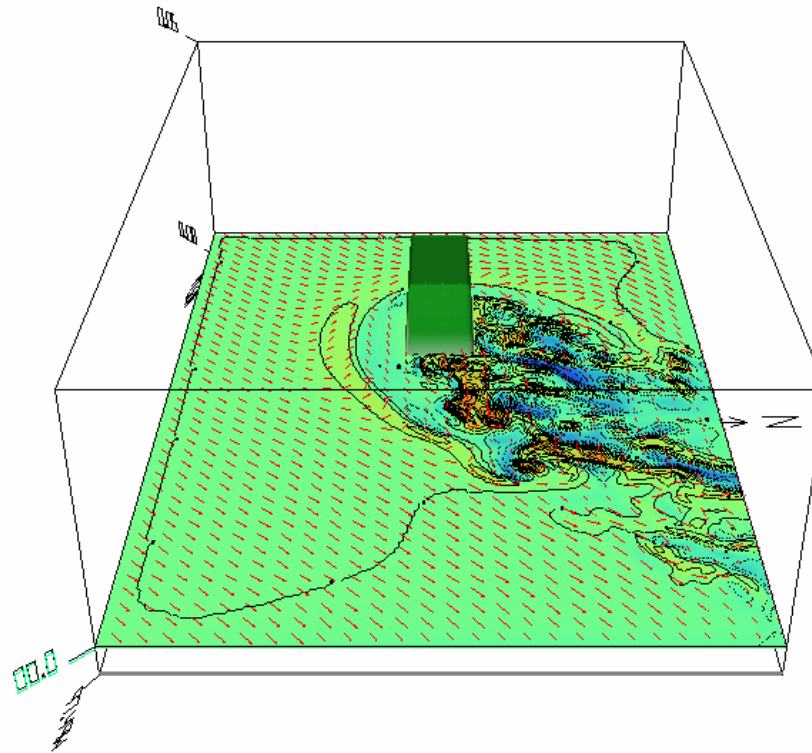




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EULAG – urban modeling application

00:00:40 rectangular building L=40x20x20
10 May 97
2 of 60
Saturday

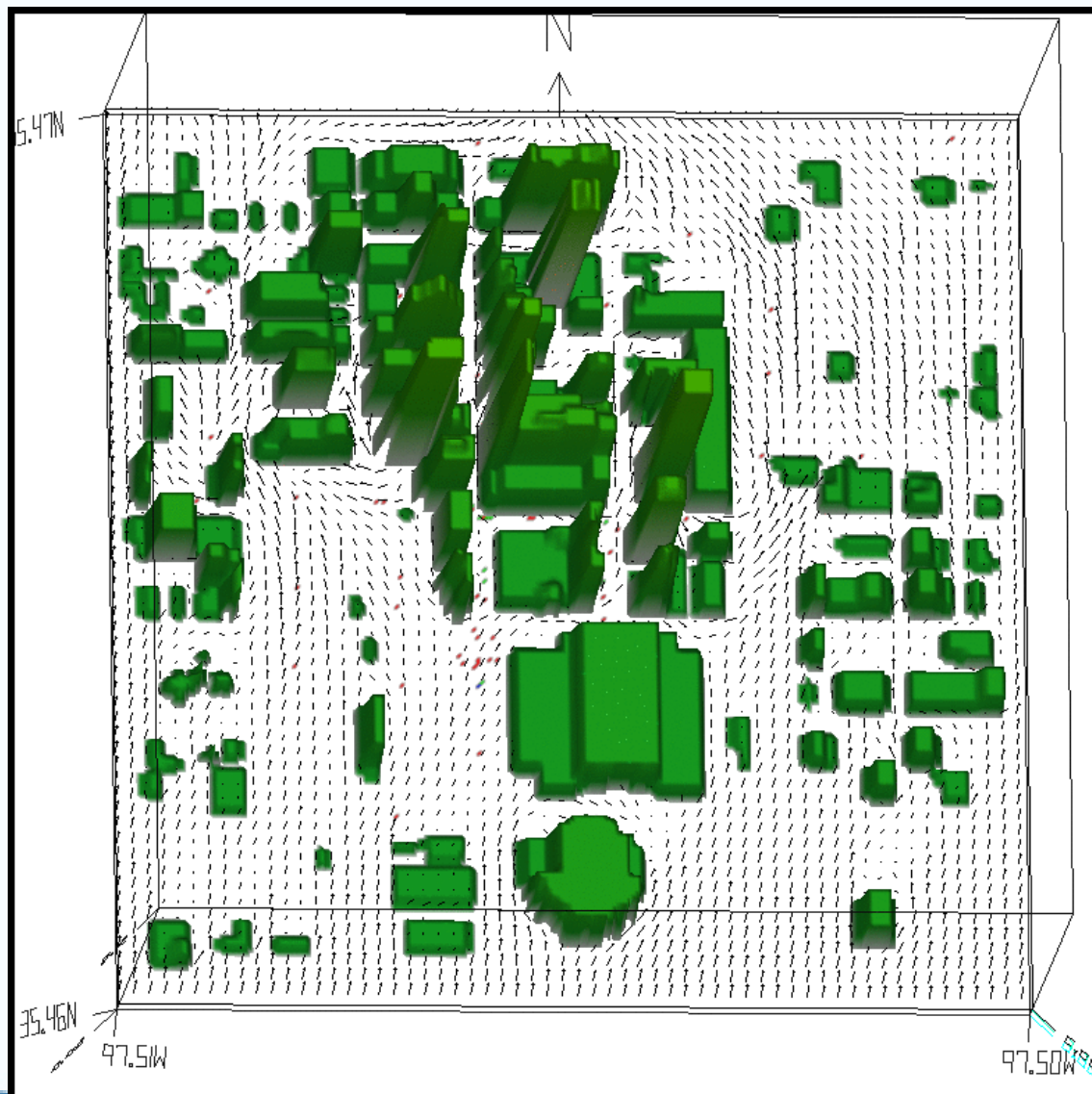


Vis5D



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EULAG – urban modeling application





Vis5D main versions and extensions

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- **Vis5D – v 4.3, v 5.0, v 5.2.....**
- **Vis5d+ central repository for enhanced versions and Vis5D development based on Vis5d 5.2. Conversion of Vis5d's build process to use GNU automake and autconf.**
- **VisAD - Java component library for interactive visualization and analysis of numerical data. It combines a flexible data model and distributed objects (via Java RMI) to support sharing of data, visualizations and user interfaces between different data sources, different computers and different scientific disciplines. Access to HDF-EOS, netCDF, FITS, Vis5D, GIF and JPEG Data Files.**
- **Cave5D - virtual reality version of Vis5D for the CAVE and ImmersaDesk. It was written by the SSEC Visualization Project in the VROOM (virtual reality room) at Siggraph '94.**