



PETRI NET TUTORIAL – PART 2:

ANALYSIS TECHNIQUES FOR MULTISCALE MODELS

MARY ANN BLÄTKE



@ ICSB 2011, Heidelberg



ANALYSIS TECHNIQUES FOR MULTISCALE MODELS

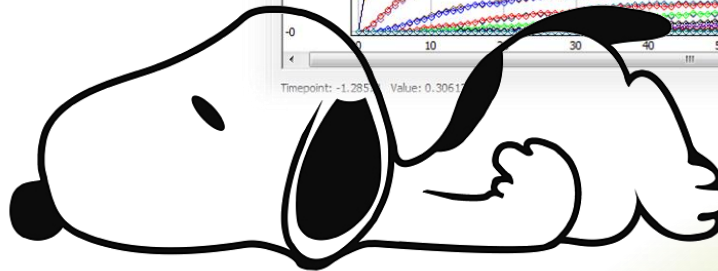
INTRODUCTION



VISUALIZE SPATIAL TEMPORAL DATA

- How to visualize data of 1D, 2D, 3D Models?
- Snoopy is not suitable to plot spatial temporal information
- Other mathematical programs are need, like:
 - Gnu plot
 - **Matlab**
 - Scilab

Information does not show up very well in simple line plots

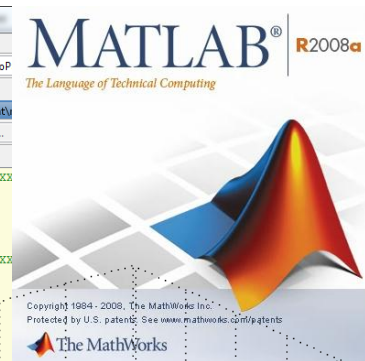




VISUALIZE

How to

- How to visualize data of 1D, 2D, 3D Models?
 - Snoopy is not suitable to plot spatial temporal spatial information
 - Other mathematical programs are need, like:
 - Gnu plot
 - **Matlab**
 - Scilab
- The figure displays the MATLAB environment. The main window shows a 3D surface plot with axes labeled 'Time' (0 to 100), 'X' (0 to 25), and 'Species Level' (0 to 10). The surface plot shows a sharp peak. The MATLAB Editor window displays a script titled 'ANALYSIS OF 1D Models' with author information and a copyright notice. The Command Window shows the execution of a script.
- Automatisisation using scripts
 - Several plotting options for 1D, 2D, 3D data
 - Matrix, 3D array operations
 - Movies
- 4
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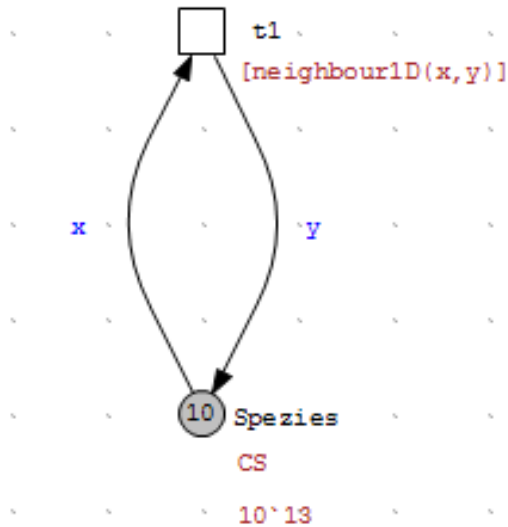
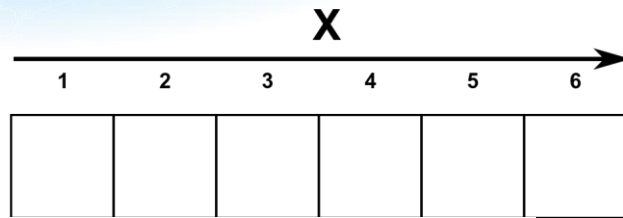


ANALYSIS TECHNIQUES FOR MULTISCALE MODELS

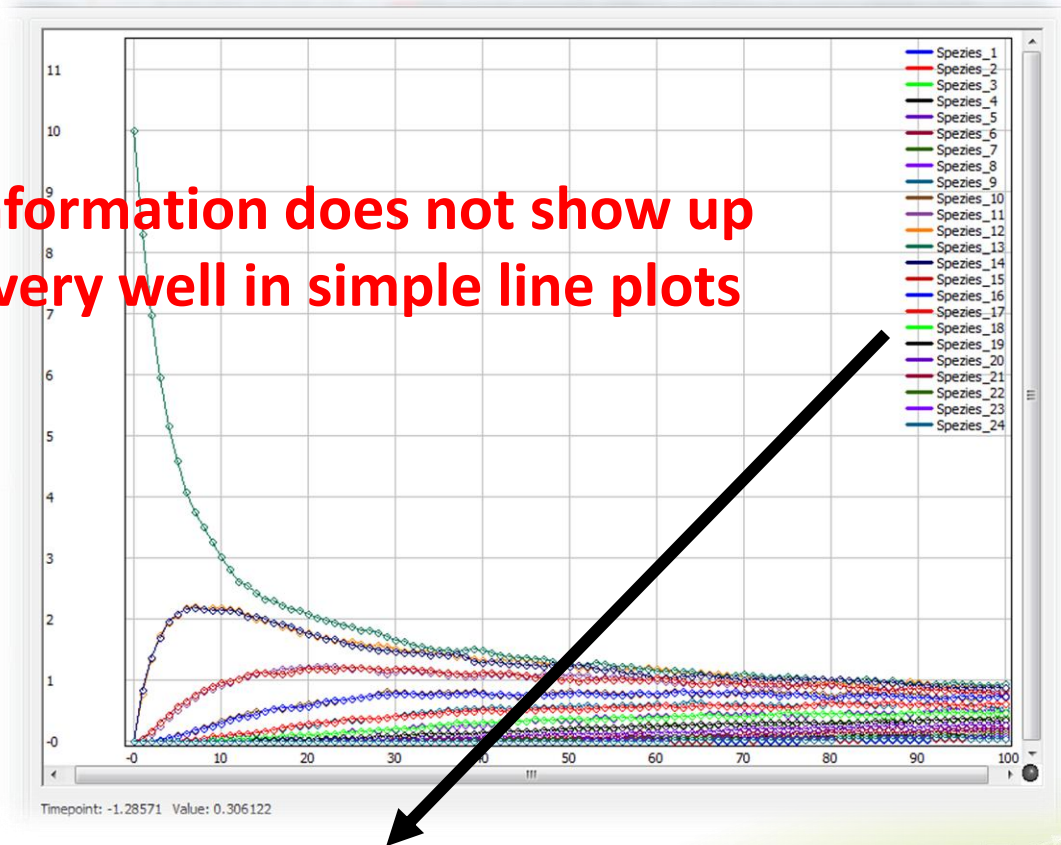
VISUALIZE DATA OF 1D MODELS



1D MODEL IN SNOOPY

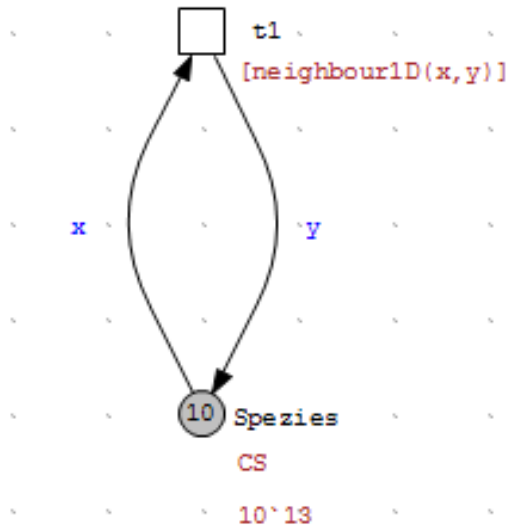
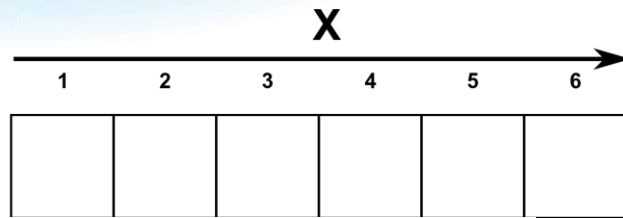


Information does not show up
very well in simple line plots



Spatial information are encoded in
color/place name:
Spezies_X

1D MODEL – DATA STRUCTURE/PRE-PROCESSING

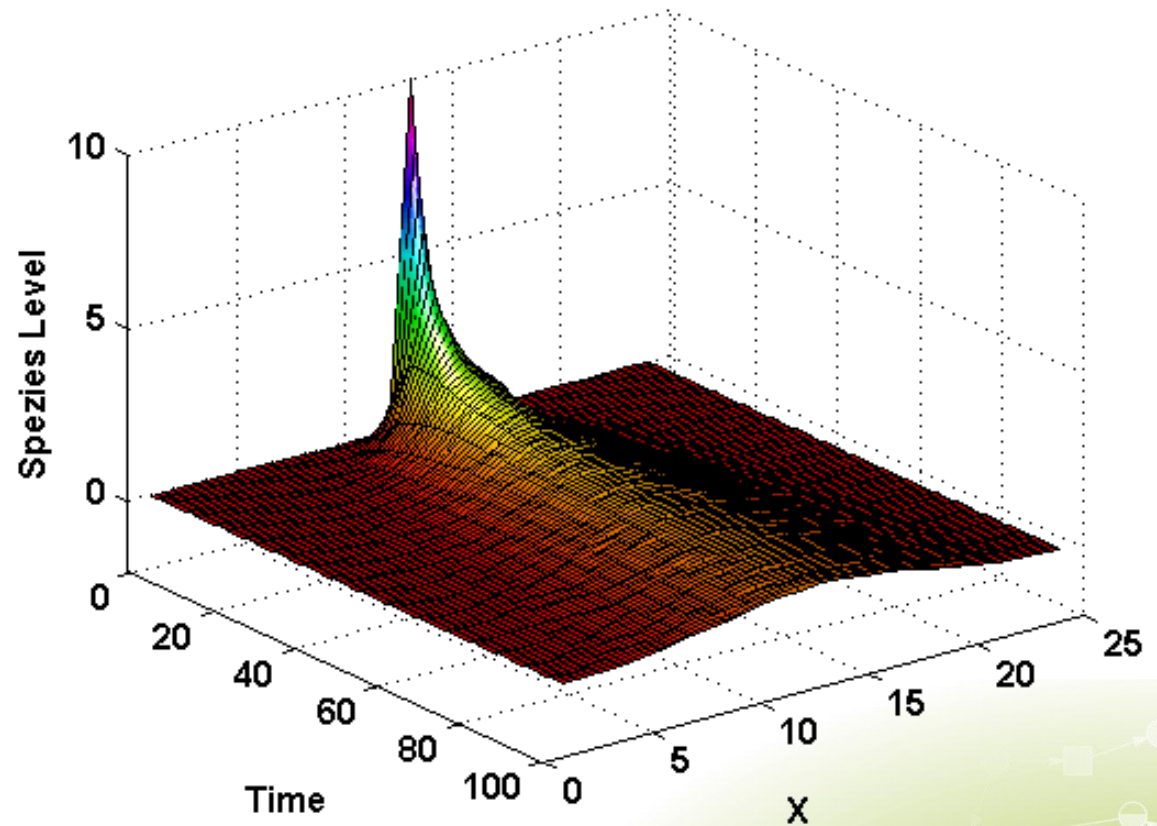
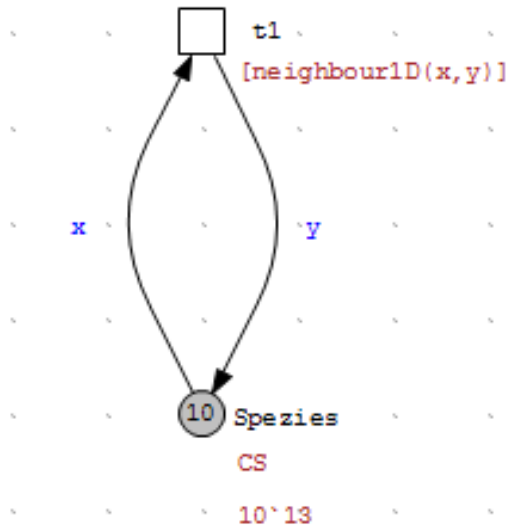
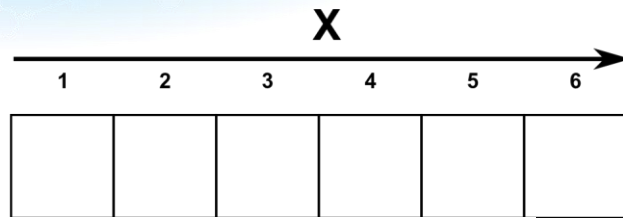


Time	Spezies_1	Spezies_2	Spezies_3	Spezies_4	Spezies_5
0	10	0	0	0	0
0.1	9.1038	0.8523	0.042	0.0018	0.0001
0.2	8.3615	1.4881	0.1409	0.0086	0.0009
0.3	7.7389	1.9571	0.2764	0.0249	0.0027
0.4	7.2061	2.3091	0.4223	0.0569	0.0056
0.5	6.7778	2.5444	0.5727	0.0927	0.0124
0.6	6.3784	2.743	0.7246	0.132	0.022
0.7	6.0352	2.8832	0.862	0.1848	0.0348
0.8	5.7482	2.9649	0.9917	0.2432	0.052
0.9	5.4809	3.0458	1.103	0.2981	0.0722
1	5.2348	3.104	1.2102	0.3597	0.0913
1.1	5.0452	3.1036	1.313	0.4198	0.1184
1.2	4.8655	3.0974	1.4031	0.4847	0.1493
1.3	4.697	3.0871	1.4968	0.5329	0.1862

Time Vector

Data Matrix
Time x Space

1D MODEL -VISUALISATION



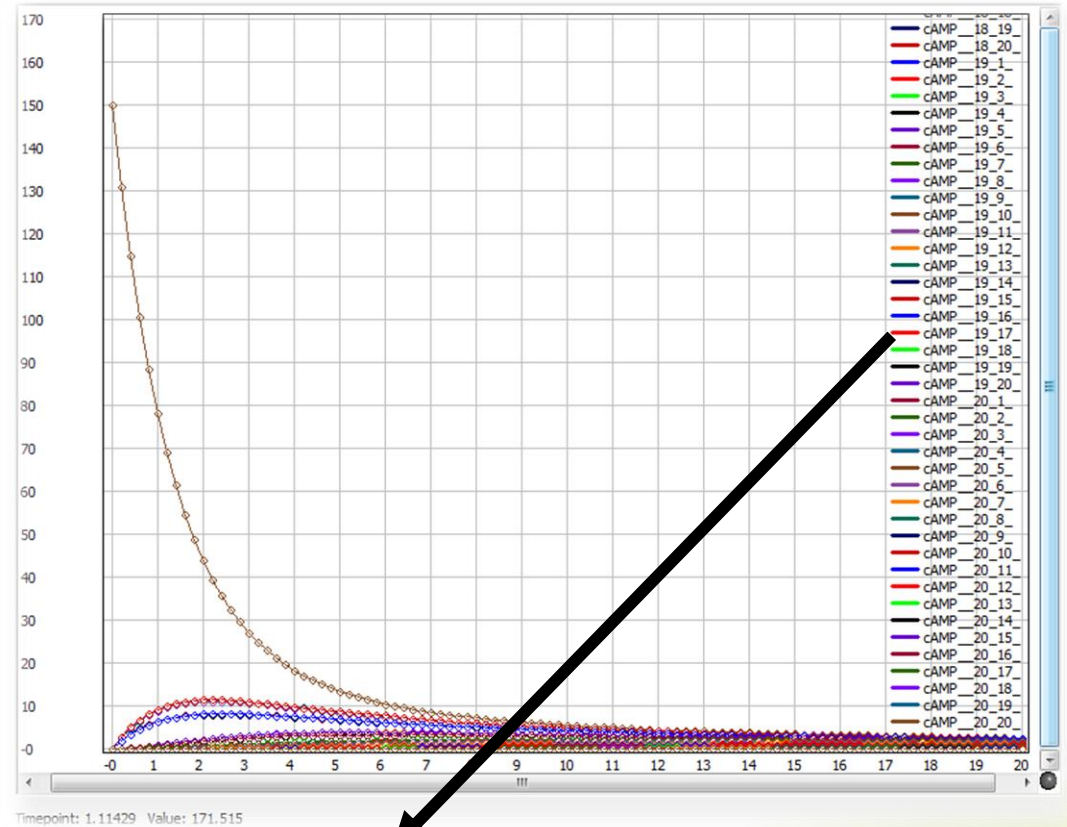
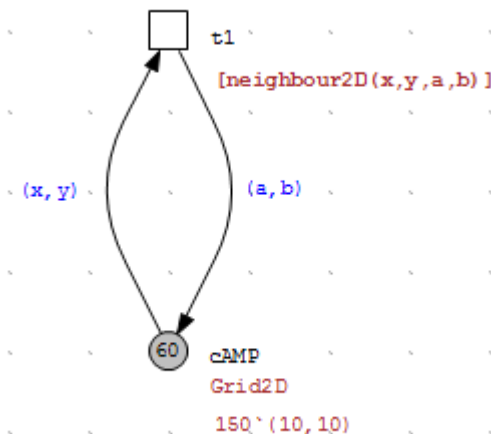
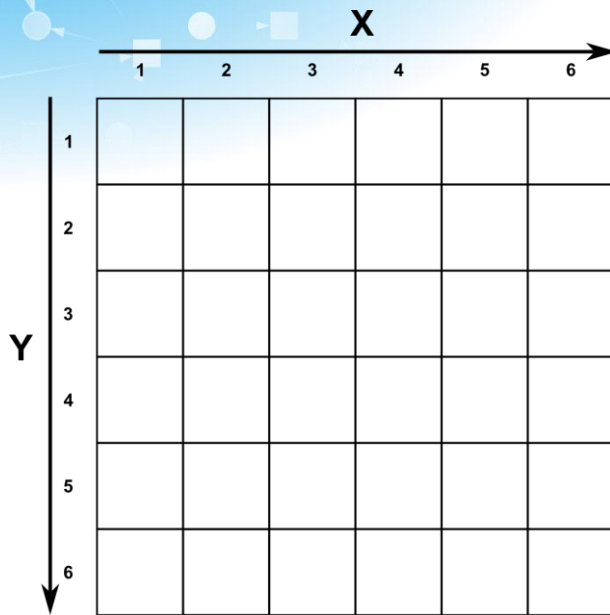


ANALYSIS TECHNIQUES FOR MULTISCALE MODELS

VISUALIZE DATA OF 2D MODELS



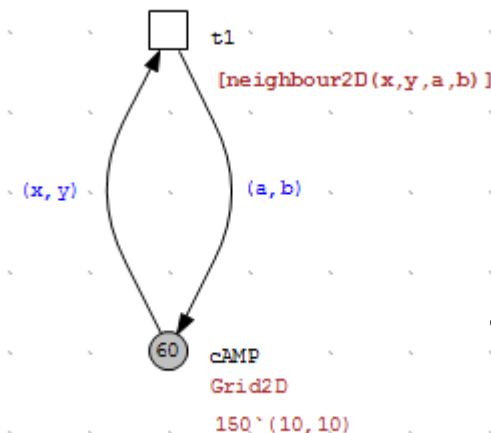
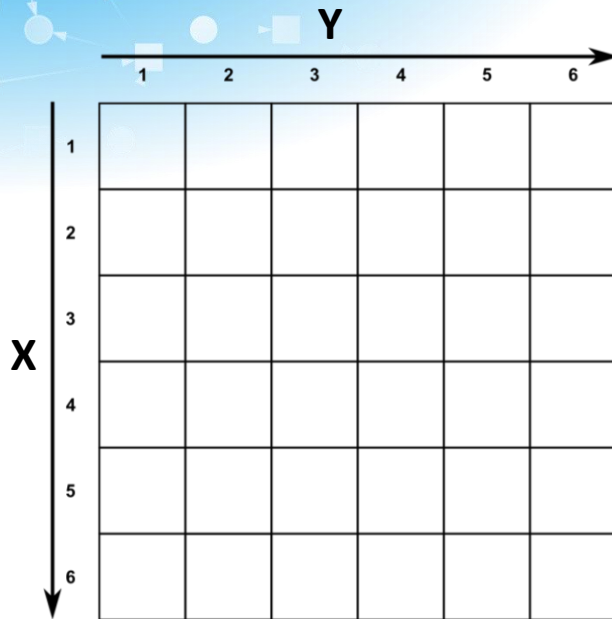
2D MODEL IN SNOOPY



Spatial information are encoded in
color/place name:

Spezies_X_Y

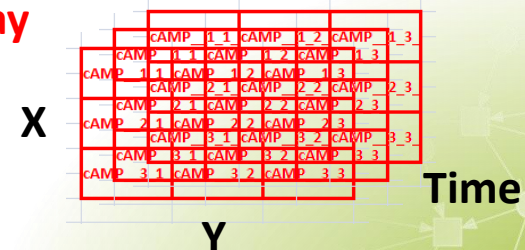
2D MODEL – DATA STRUCTURE/PRE-PROCESSING



Time	cAMP_1_1	cAMP_1_2	cAMP_1_3	cAMP_2_1	cAMP_2_2	cAMP_2_3	cAMP_3_1	cAMP_3_2	cAMP_3_3
0	0	0	0	0	150	0	0	0	0
0.1	1.24	1.35	1.07	1.32	139.88	1.57	1.07	1.45	1.05
0.2	2.23	2.71	2.06	2.62	130.81	2.8	1.93	2.9	1.94
0.3	3.02	4.11	2.89	3.66	122.7	4.11	2.77	3.98	2.76
0.4	3.85	5.4	3.68	4.67	114.98	5.14	3.68	5.03	3.57
0.5	4.62	6.37	4.7	5.87	107.63	6.01	4.47	5.96	4.37
0.6	5.34	7.33	5.36	6.87	100.88	6.85	5.22	6.87	5.28
0.7	5.93	8.14	6.19	7.68	94.89	7.7	5.89	7.61	5.97
0.8	6.39	8.85	6.77	8.44	89.2	8.7	6.6	8.36	6.69
0.9	6.8	9.66	7.39	9.1	84.2	9.6	7.4	9.07	7.19
1	7.26	10.49	7.81	9.88	79.3	10.5	8.1	9.6	7.87
1.1	7.78	10.97	8.38	10.46	74.75	10.62	8.14	10.42	8.48
1.2	8.39	11.64	8.92	11.02	70.22	11.26	8.75	11.13	8.87
1.3	8.74	12.12	9.47	11.3	66.24	12.06	9.28	11.55	9.36
1.4	9.23	12.5	9.75	11.92	61.98	12.68	9.7	12.29	9.95
1.5	9.62	12.93	10.12	12.42	58.1	13.1	10.02	12.5	10.44
1.6	10.07	13.3	10.5	12.93	54.5	13.58	10.48	12.93	10.92
1.7	10.5	13.7	10.97	13.4	51.1	14.06	10.97	13.4	11.26
1.8	10.97	14.1	11.4	13.9	47.8	14.54	11.46	13.9	11.54
1.9	11.4	14.5	11.8	14.4	44.6	15.02	11.94	14.4	11.92

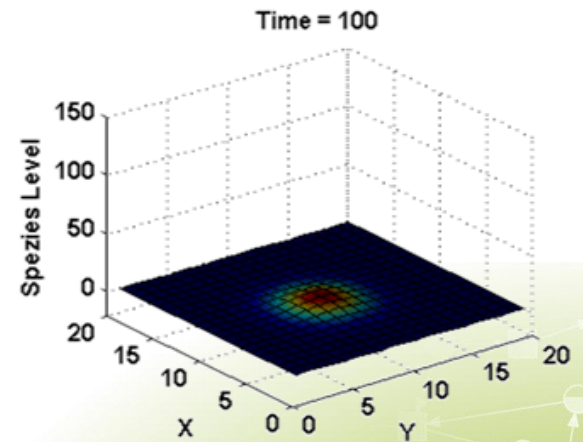
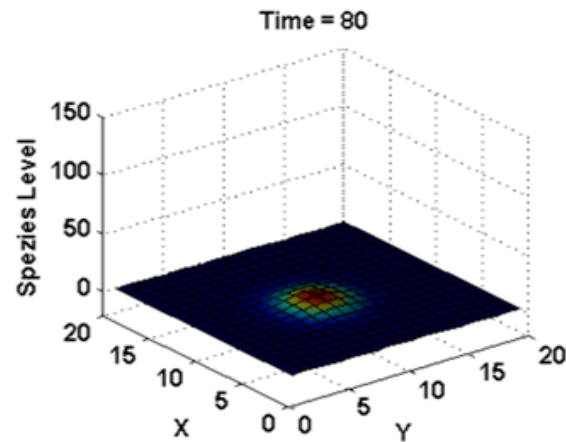
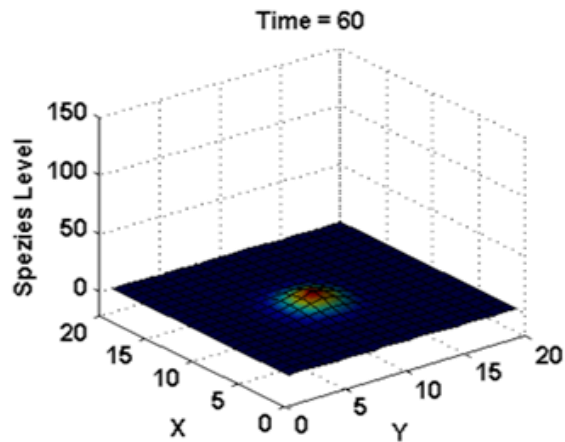
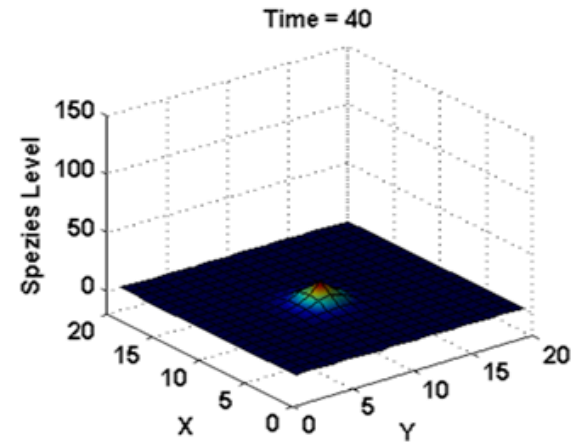
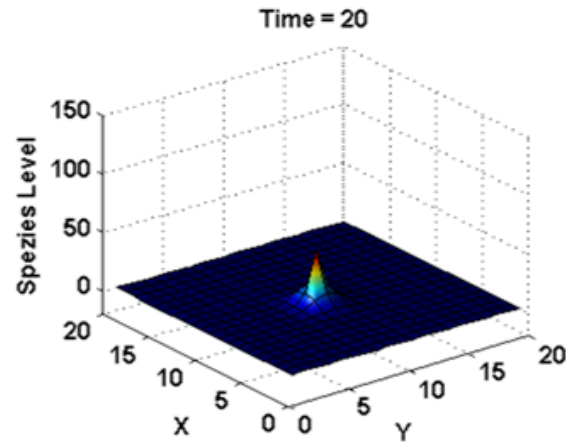
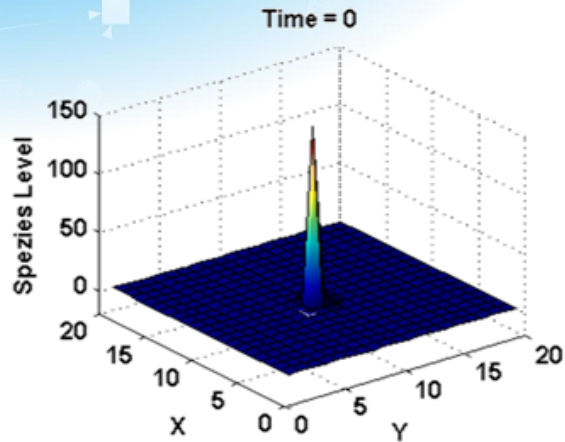
Rearrange Data

For each time point t one matrix $X \times Y$
 \Rightarrow 3D Array

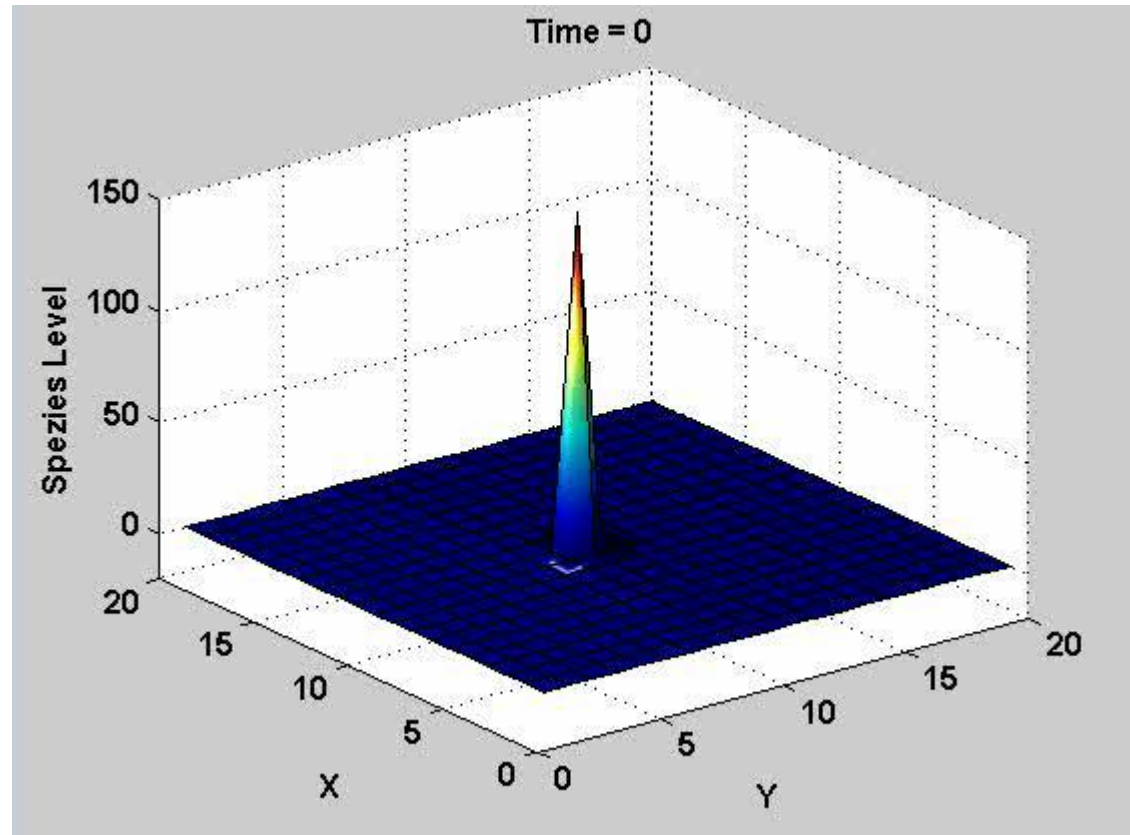
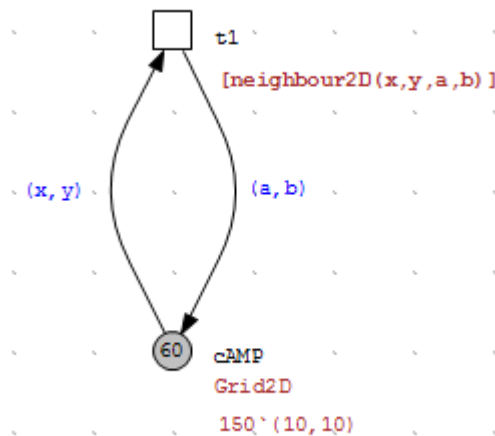
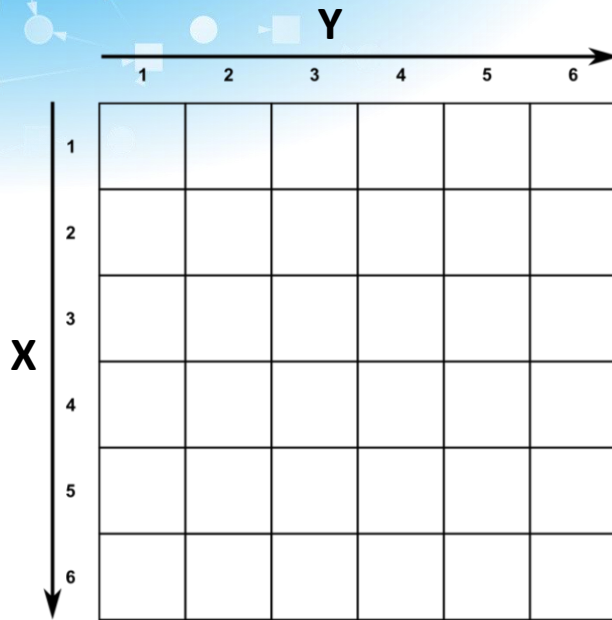


Time Vector

2D MODEL – VISUALISATION



2D MODEL – VISUALISATION



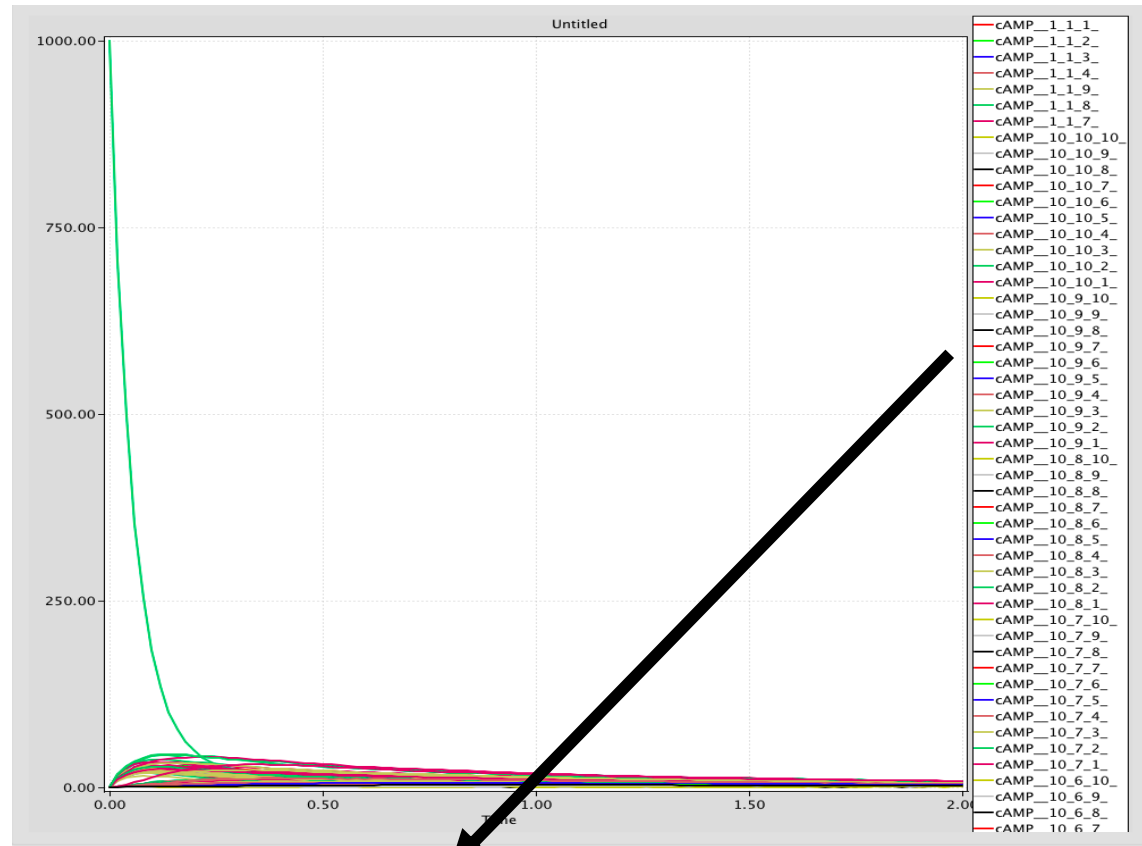
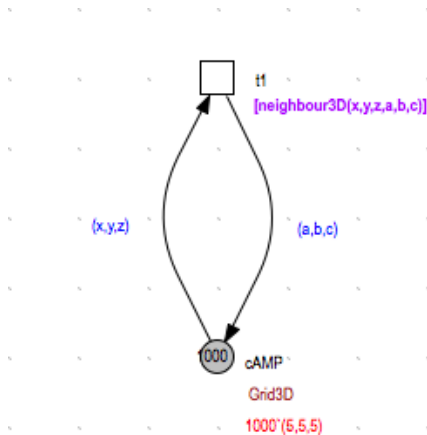
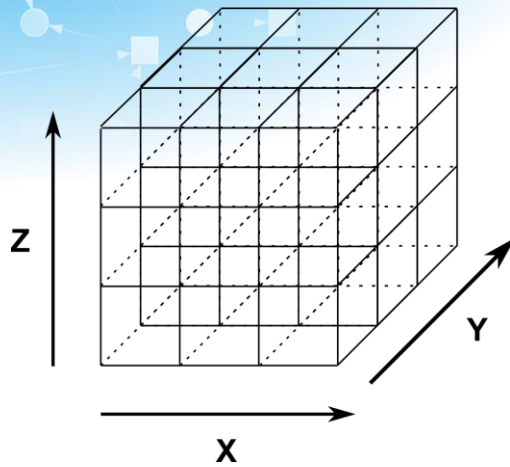


ANALYSIS TECHNIQUES FOR MULTISCALE MODELS

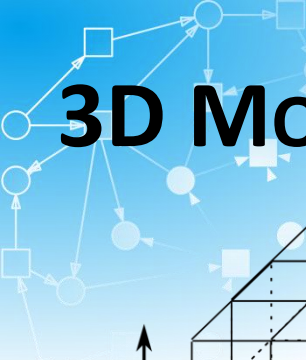
VISUALIZE DATA OF 3D MODELS



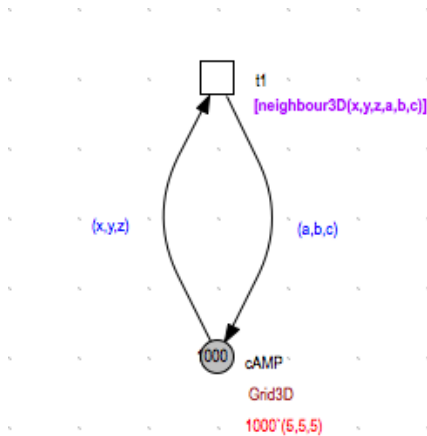
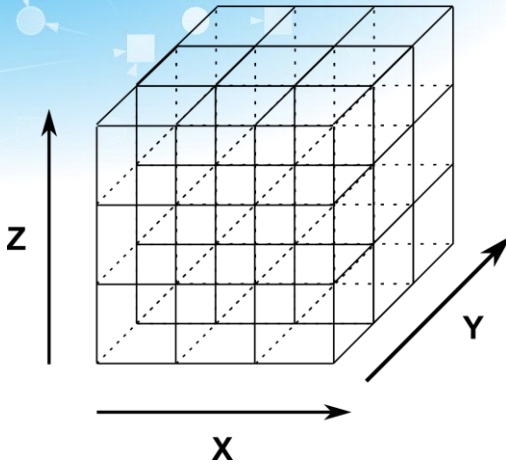
3D MODEL IN SNOOPY



Spatial information are encoded in
color/place name:
Spezies_X_Y_Z



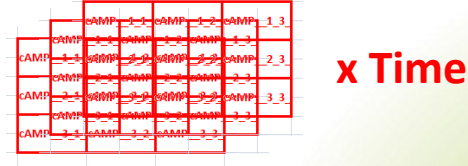
3D Mo



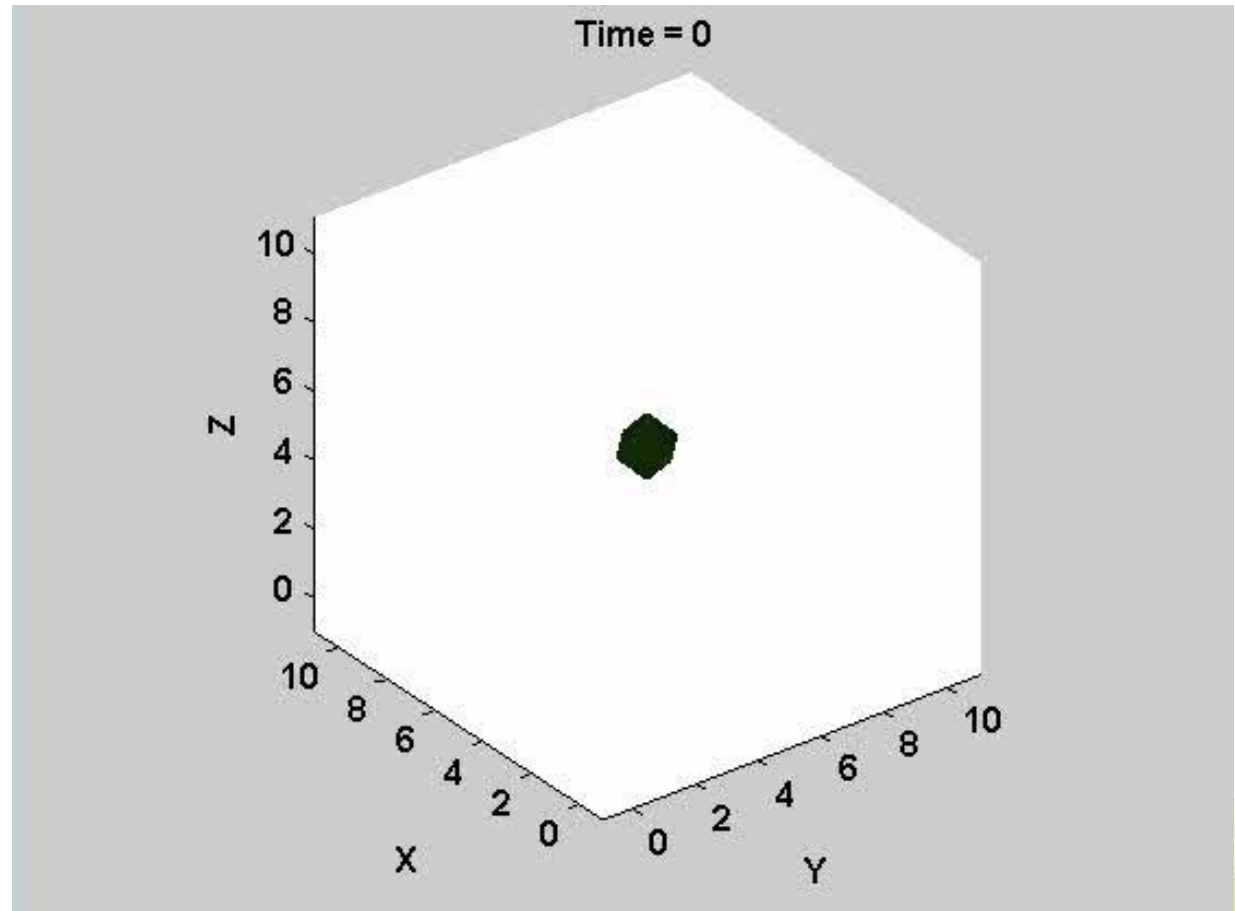
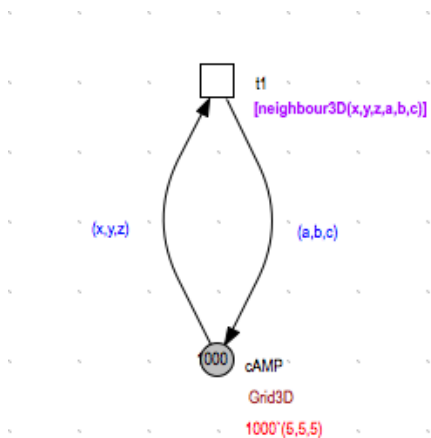
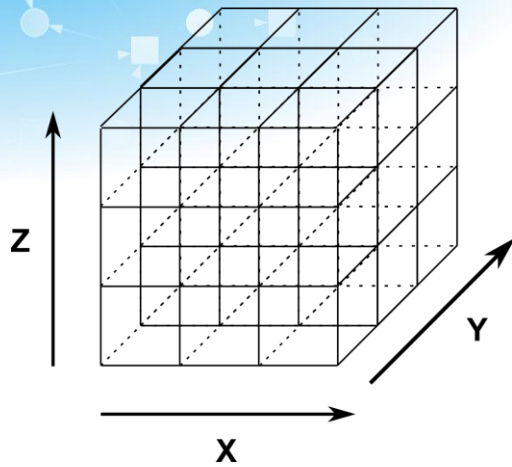
The figure illustrates a data rearrangement process. The top part shows a 3D grid of data points with axes labeled X, Y, and Z. A large black arrow points from the top grid to a smaller, rearranged grid below it. The text "Rearrange Data" is written in red next to the arrow. The bottom grid shows the data points rearranged into a more compact, structured format.

For each time point t one 3D Array $X \times Y \times Z$

⇒ 4D Array

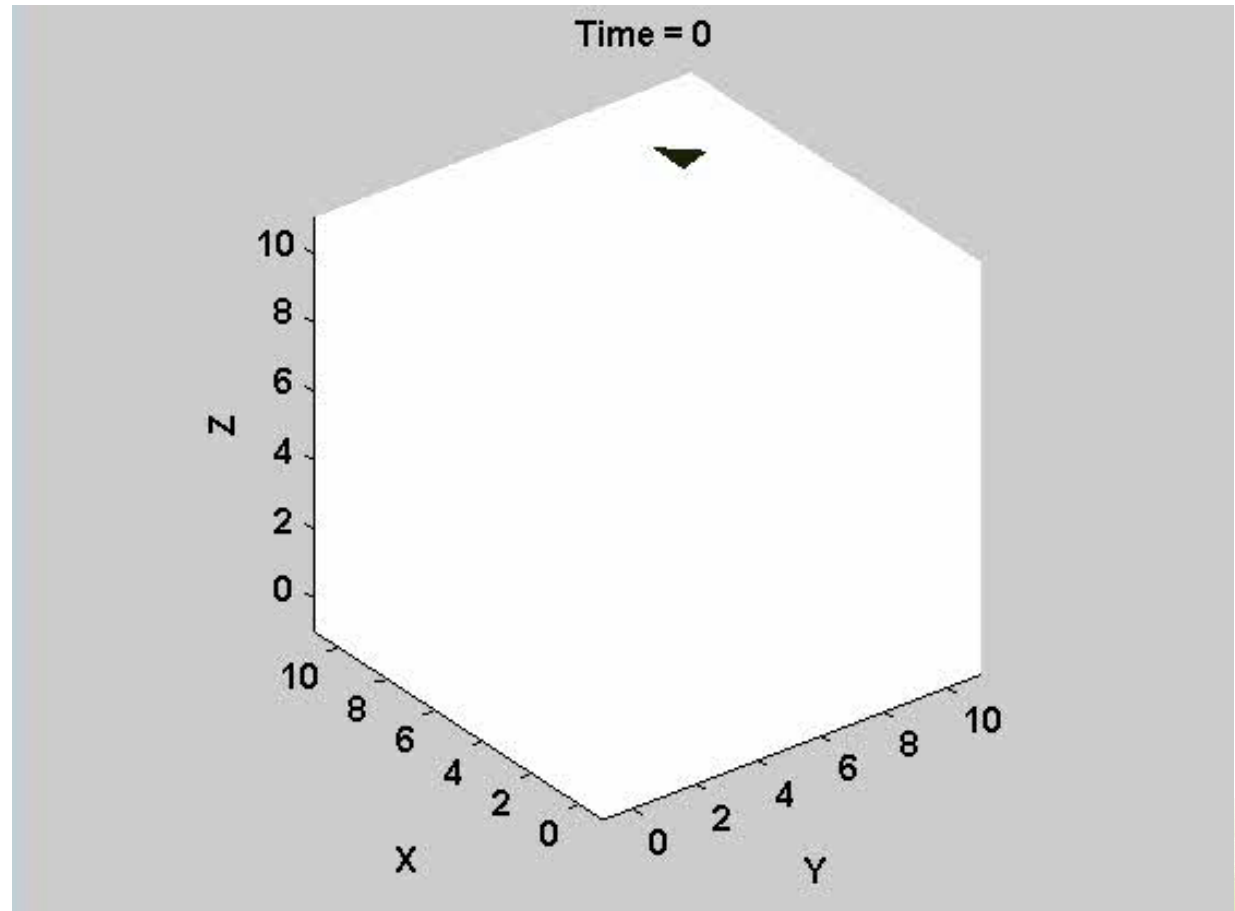
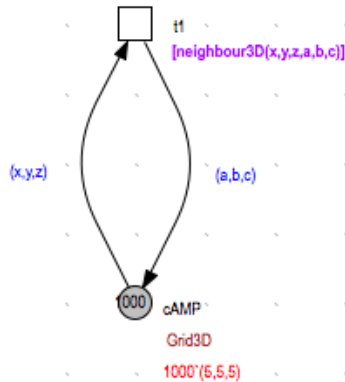
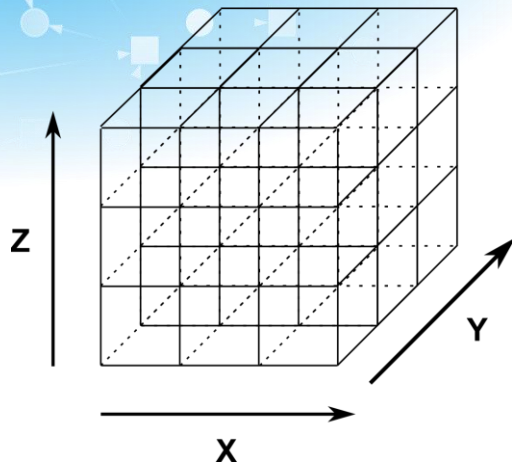


3D MODEL – VISUALISATION



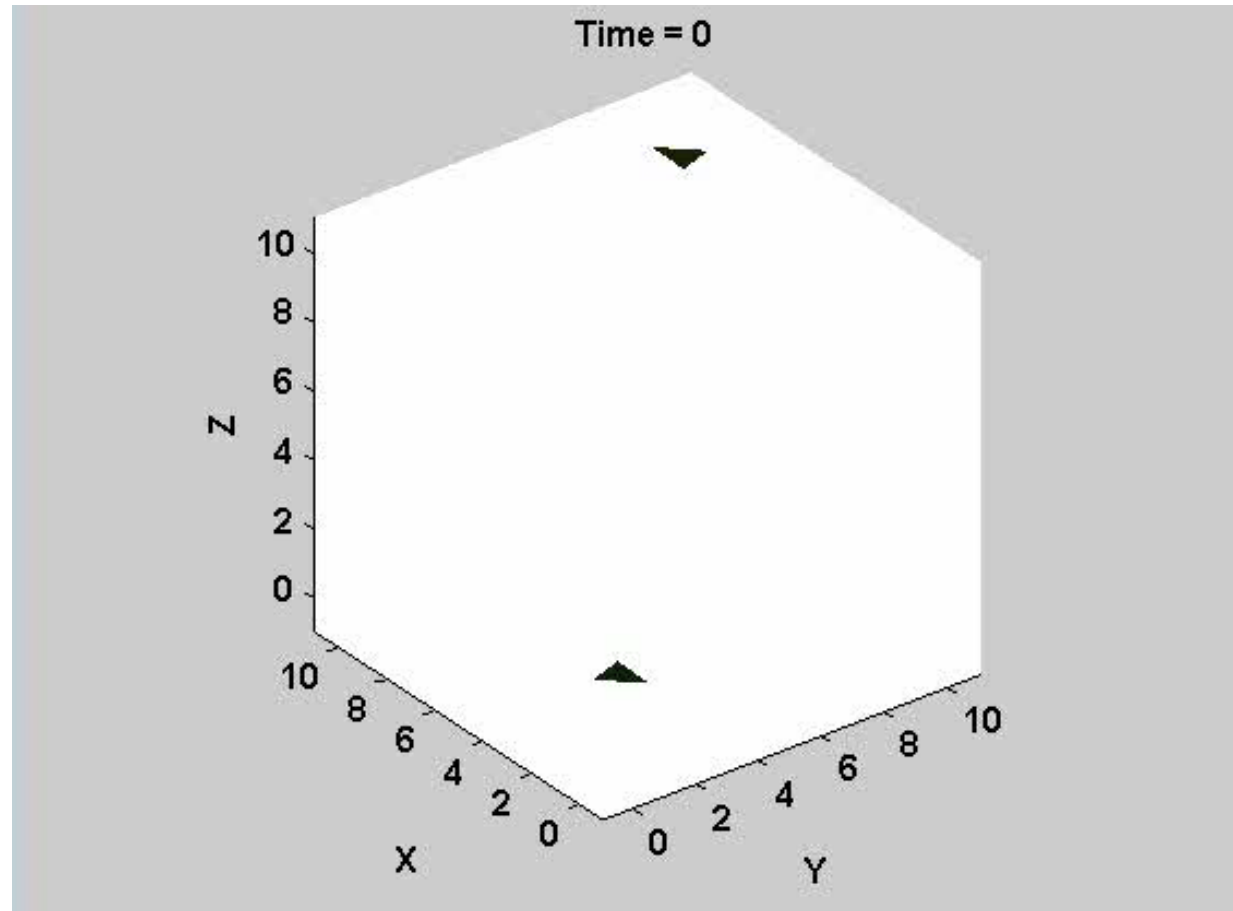
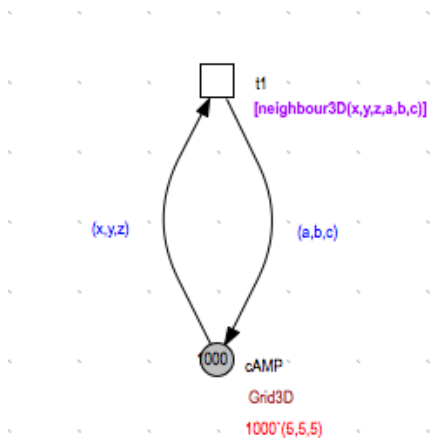
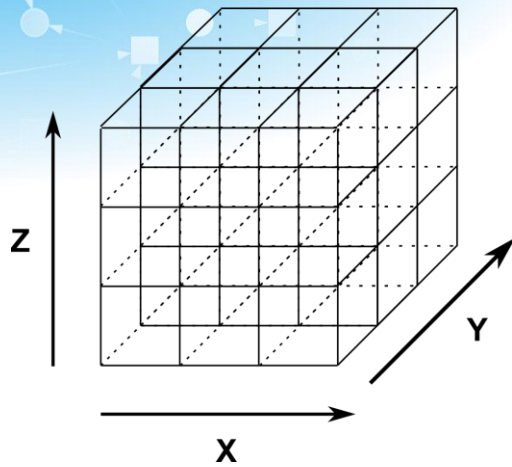
Volume Visualisation – Render 3D Object

3D MODEL – VISUALISATION



Volume Visualisation – Render 3D Object

3D MODEL – VISUALISATION



Volume Visualisation – Render 3D Object

