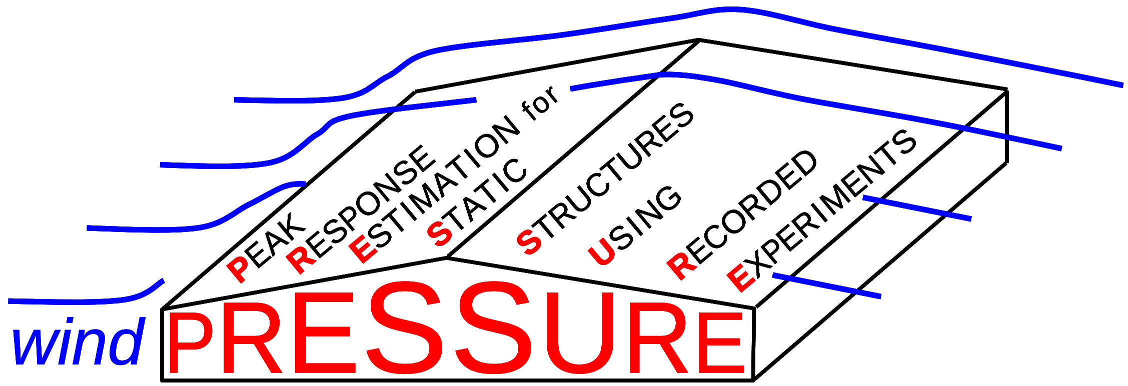

Database-**A**ssisted **D**esign Software for Rigid, Gable-Roofed Buildings

User's Manual

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Updated March 15, 2006
Current version available at www.nist.gov/wind

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Installation and Setup

The following files are required for use of the **windPRESSURE** software, and are being made available at www.nist.gov/wind. The files can also be obtained on CD by request.

- **windPRESSURE** program files: provided in the following alternative forms:
  - o MATLAB m-files (requires version 7 of MATLAB)
  - o Stand-alone executable (for Windows 2000/XP; requires installation of MCRInstaller.exe, which is also provided)

- Building input files: two sample files are provided:
  - o BLD_W=120,L=187.5,H=18,R=5,Open_Country.csv
  - o BLD_W=120,L=187.5,H=18,R=5,Directional.csv

- HDF pressure databases: Results are provided from four tests conducted at the University of Western Ontario, and results from three different wind directions are provided from each test. All models have the same roof slope of 1:12, length scaling of 1:100, width of W = 36.6 m (120 ft), and length of L = 57.2 m (187.5 ft), but the eave height and terrain conditions are different, as follows:
  - o eave height of H = 3.7 m (12 ft), “Open_Country” terrain
  - o eave height of H = 5.5 m (18 ft), “Open_Country” terrain
  - o eave height of H = 5.5 m (18 ft), “Suburban” terrain
  - o eave height of H = 7.3 m (24 ft), “Open_Country” terrain

- Simulated directional hurricane wind speed data: data files are provided from 55 different locations (mileposts) along the Gulf of Mexico and North Atlantic coasts.

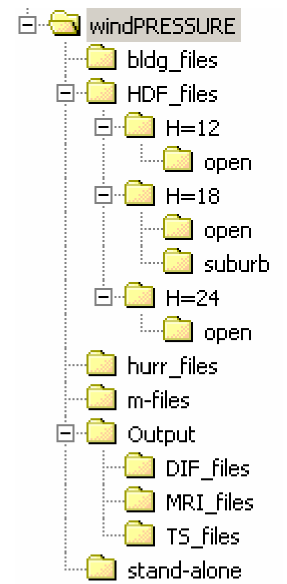

Figure 1. Recommended windPRESSURE directory structure.

It is recommended that users create a single folder named “windPRESSURE” on their local hard drive, in which to save all downloaded files and folders, and a recommended directory structure is shown in Figure 1. The “m-files” folder contains all MATLAB m-files (required only for execution within MATLAB), and the “stand-alone” folder contains the stand-alone executable and related files (required only for stand-alone execution). The “bldg_files” folder contains the building input files, the “HDF_files” folder contains HDF pressure database files (separate subfolders must be created within this folder for each of the four tests listed above), and the “hurr_files” folder contains simulated directional hurricane wind speed files. As shown in Figure 1, it is also recommended that separate folders be created for the following three types of output files: Directional Influence Factor (DIF) output files, Time Series output files, and Mean Recurrence Interval output files.

For execution within MATLAB, add the “m-files” folder to the MATLAB search path, and save changes:

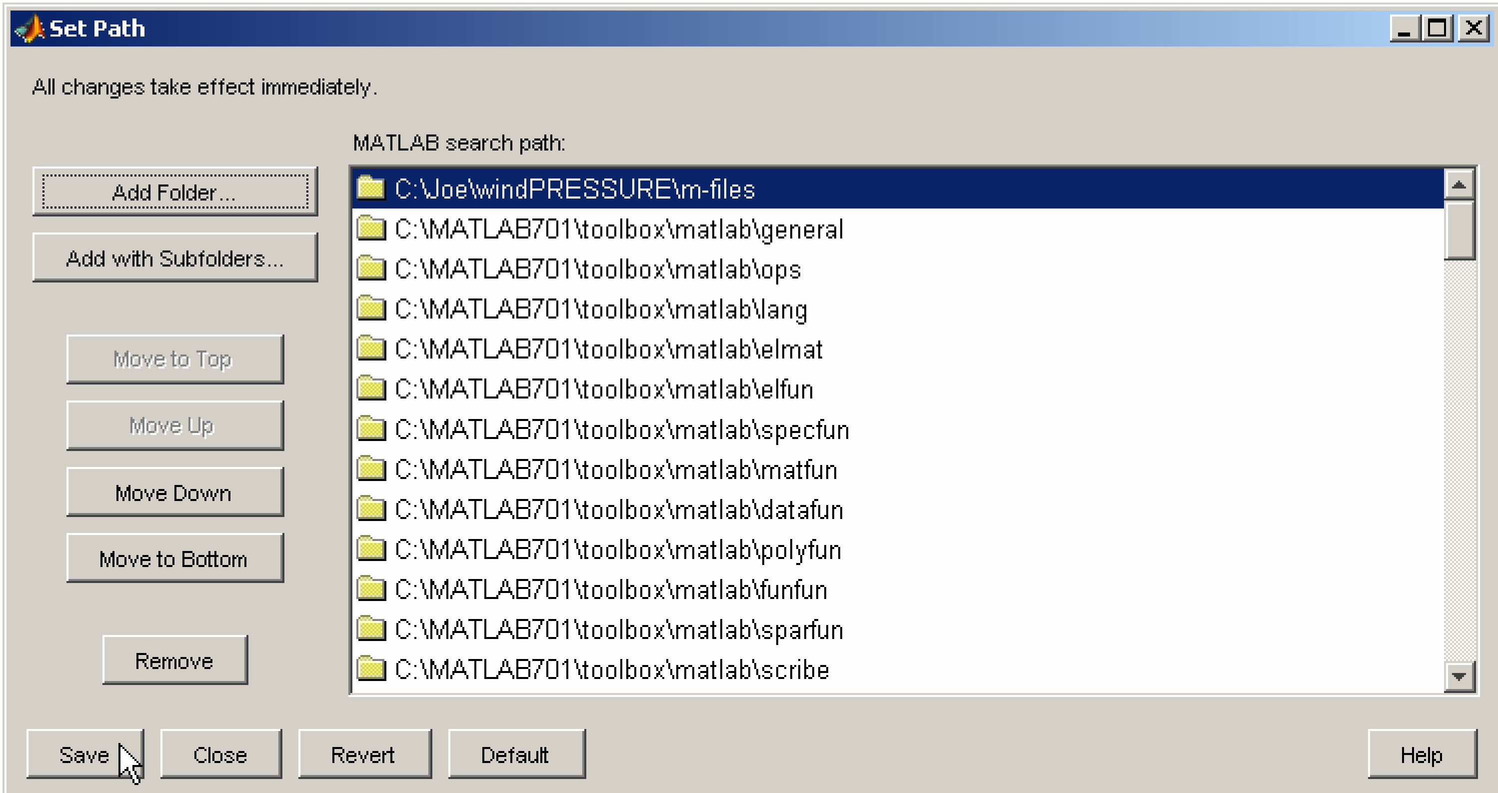

Figure 2. Adding “windPRESSURE\m-files” to the MATLAB search path.

The **windPRESSURE** software can then be executed by typing “windpressure” at the MATLAB command prompt.

For stand-alone execution, the MCRInstaller must first be installed by executing the application “MRCInstaller.exe”. The **windPRESSURE** software can then be launched by double-clicking the file “windpressure.exe” within the “stand-alone” folder. The stand-alone version of **windPRESSURE** may take up to a minute to initialize upon execution, so please be patient.

Graphical User Interface

Launching the windPRESSURE software opens the graphical user interface shown in Figure 3. Within this interface, a building input file can be selected and its contents displayed graphically, and the folder containing HDF pressure databases can also be selected, upon which all subfolders will be searched for HDF files and the

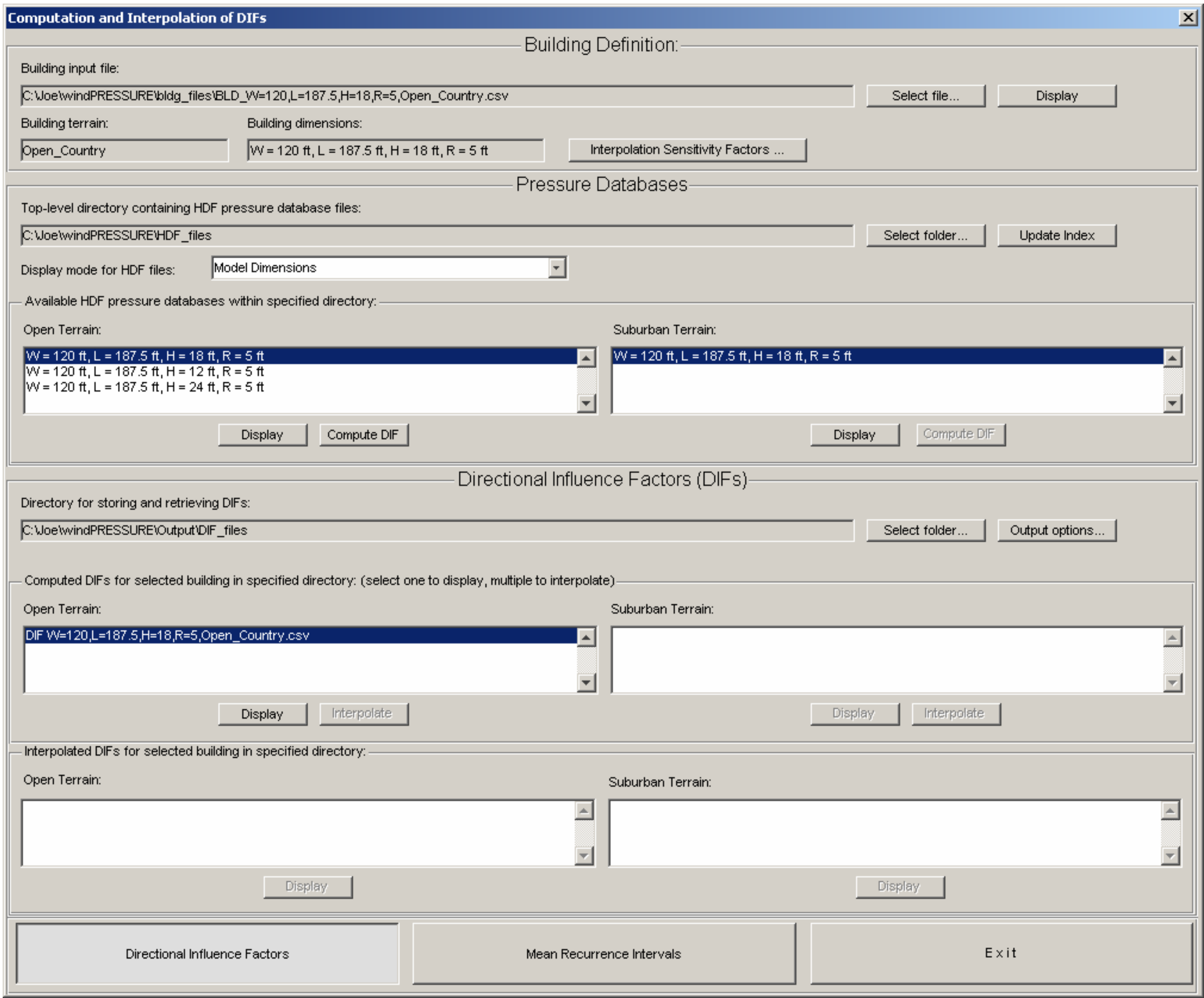

Figure 3. Graphical interface for calculation, interpolation, and display of Directional Influence Factors.

available results listed. The folder in which DIF output files should be stored and retrieved can also be selected through this interface, and the results to be stored the output file can be selected by pressing the "Output options..." button, which opens the dialog box shown in Figure 4. Directional Influence Factors can then be computed by selecting an available set of HDF pressure databases and pressing the "Compute DIF" button. If the dimensions of the wind tunnel model do not match the dimensions of the structure of interest, the pressure tap coordinates will be automatically scaled to match the structure of interest.

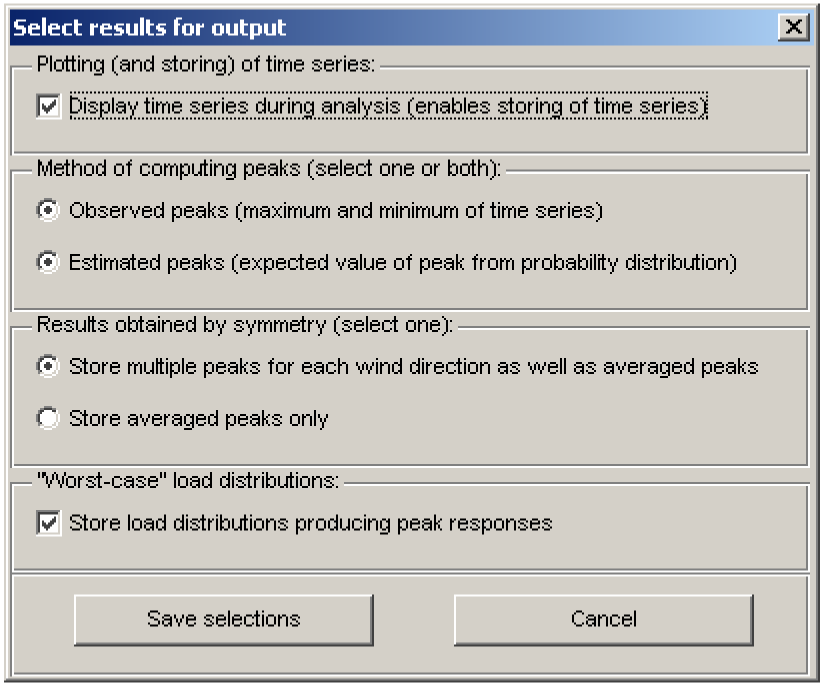

Figure 4. Output options for computation of Directional Influence Factors.

If the option "Display time series during analysis" is selected in the dialog box shown in Figure 4, then time series of computed responses will be plotted during the analysis, as shown in Figure 5, with the option of saving these results to a Time Series output file. Once DIFs have been computed, the user will be prompted to confirm the name with which to save the file, and the listing of available DIF files within the interface of Figure 3 will be updated. The results in the DIF files can then be displayed graphically by selecting a DIF file and pressing "Display", which opens the graphical interface shown in Figure 6, in which the quantities to display can be selected.

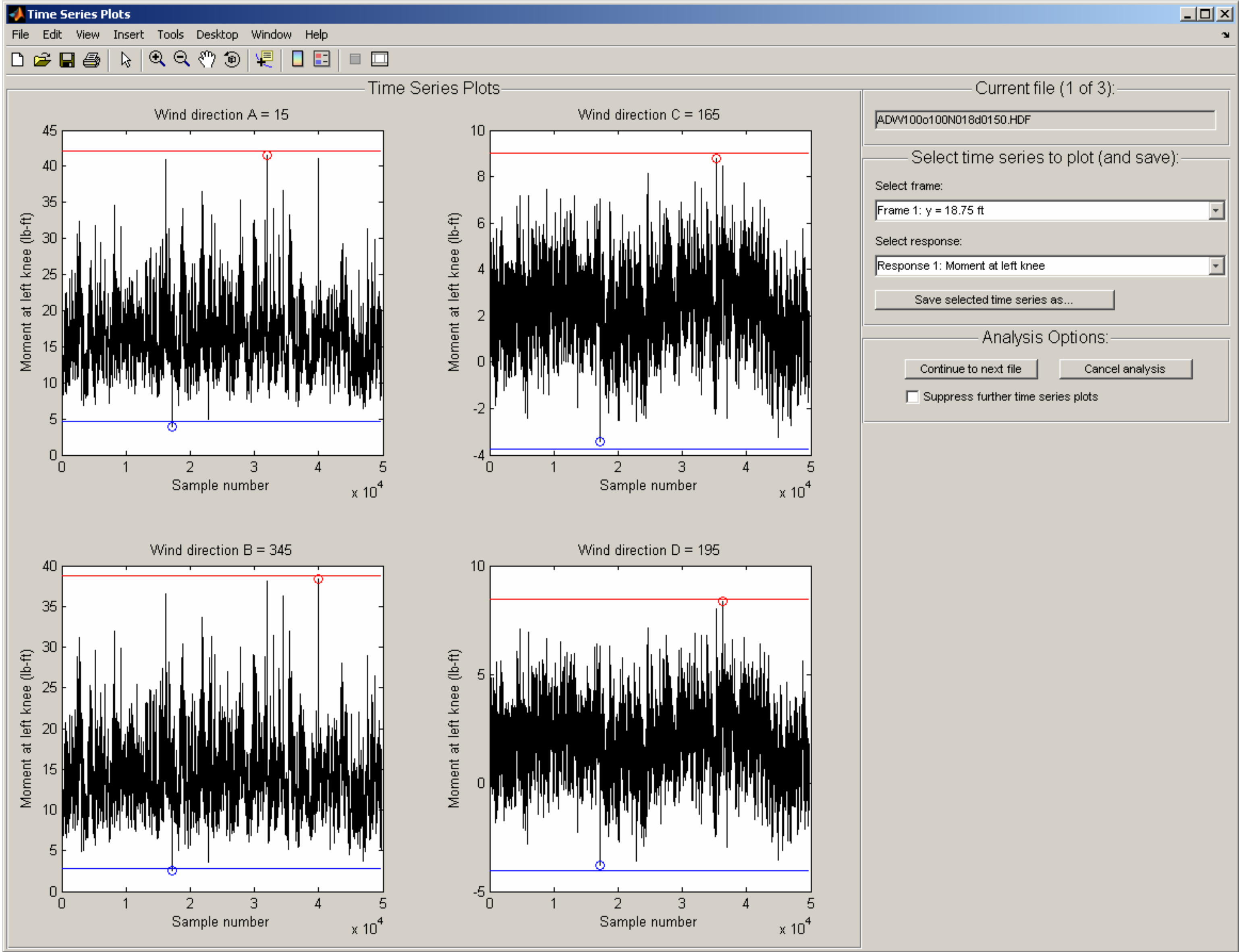

Figure 5. Graphical interface for plotting and saving of response time series (Observed peaks circled, estimated peaks shown as horizontal lines).

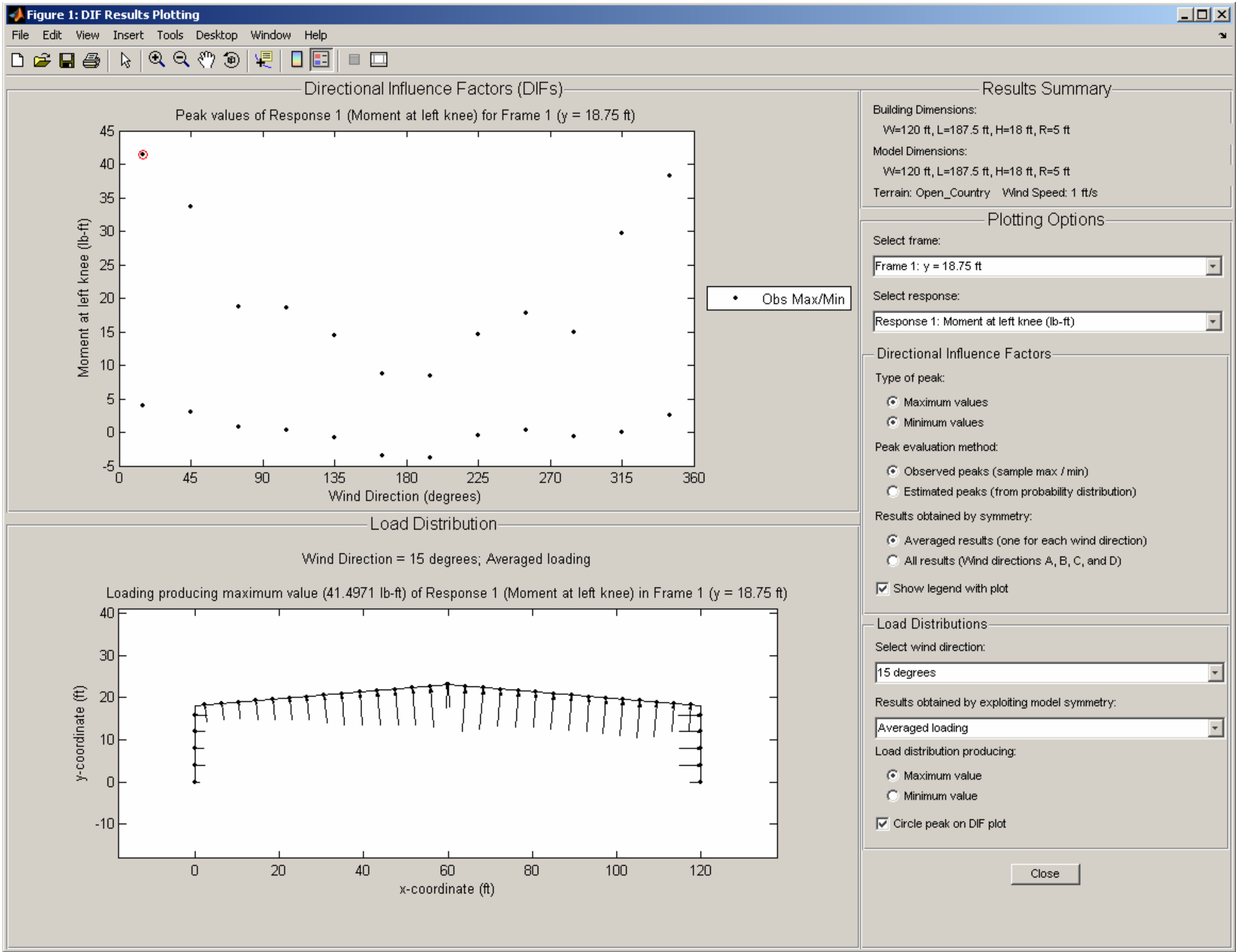

Figure 6. Graphical interface for displaying DIF file contents.

The windPRESSURE software incorporates an interpolation scheme to allow estimation of DIFs for the structure of interest from DIFs computed from several different wind tunnel models with dimensions that do not match the dimensions of the structure of interest. Interpolation can be performed within the interface of Figure 3 simply by selecting several DIF files computed from different HDF files (with the same terrain conditions) and pressing the "Interpolate" button. The interpolated results will then be saved and displayed in one of the lower panels shown in Figure 3. The interpolation scheme performs a weighted average of the selected DIFs based on the "closeness" of the model dimensions to the dimensions of the structure of interest, and the sensitivity to different dimensions used in assessing this "closeness" can be adjusted by pressing the "Interpolation Sensitivity Factors" button in the interface of Figure 3, which opens the dialog box shown in Figure 7, in which the sensitivity factors can be adjusted and saved.

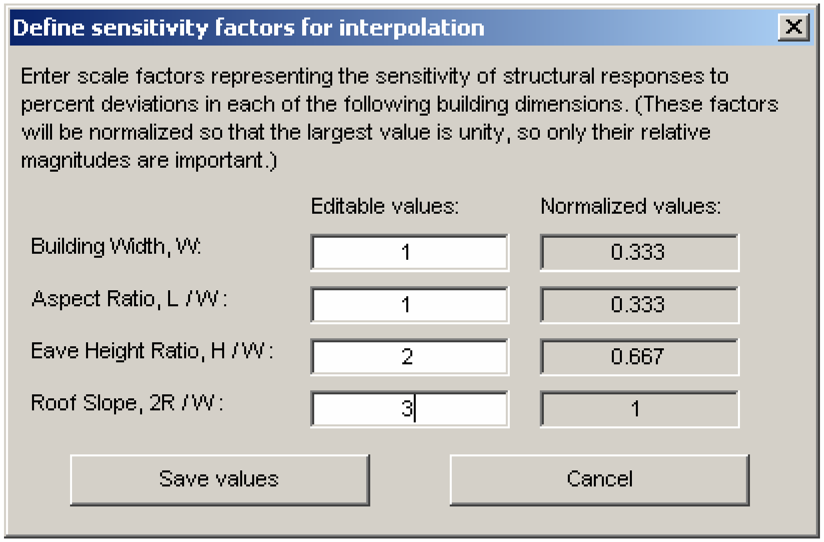

Figure 7. Dialog box for adjusting sensitivity factors used in interpolation of DIFs.

By pressing the “Mean Recurrence Intervals” button at the bottom center of the graphical interface shown in Figure 3 , another graphical interface is opened, which is shown in Figure 8. This interface handles the second major stage of the analysis, in which DIF results files are combined with simulated directional hurricane wind speeds to compute peak responses with specified Mean Recurrence Intervals. The folder containing the simulated hurricane wind speed data files can be selected through the interface, and the building location can

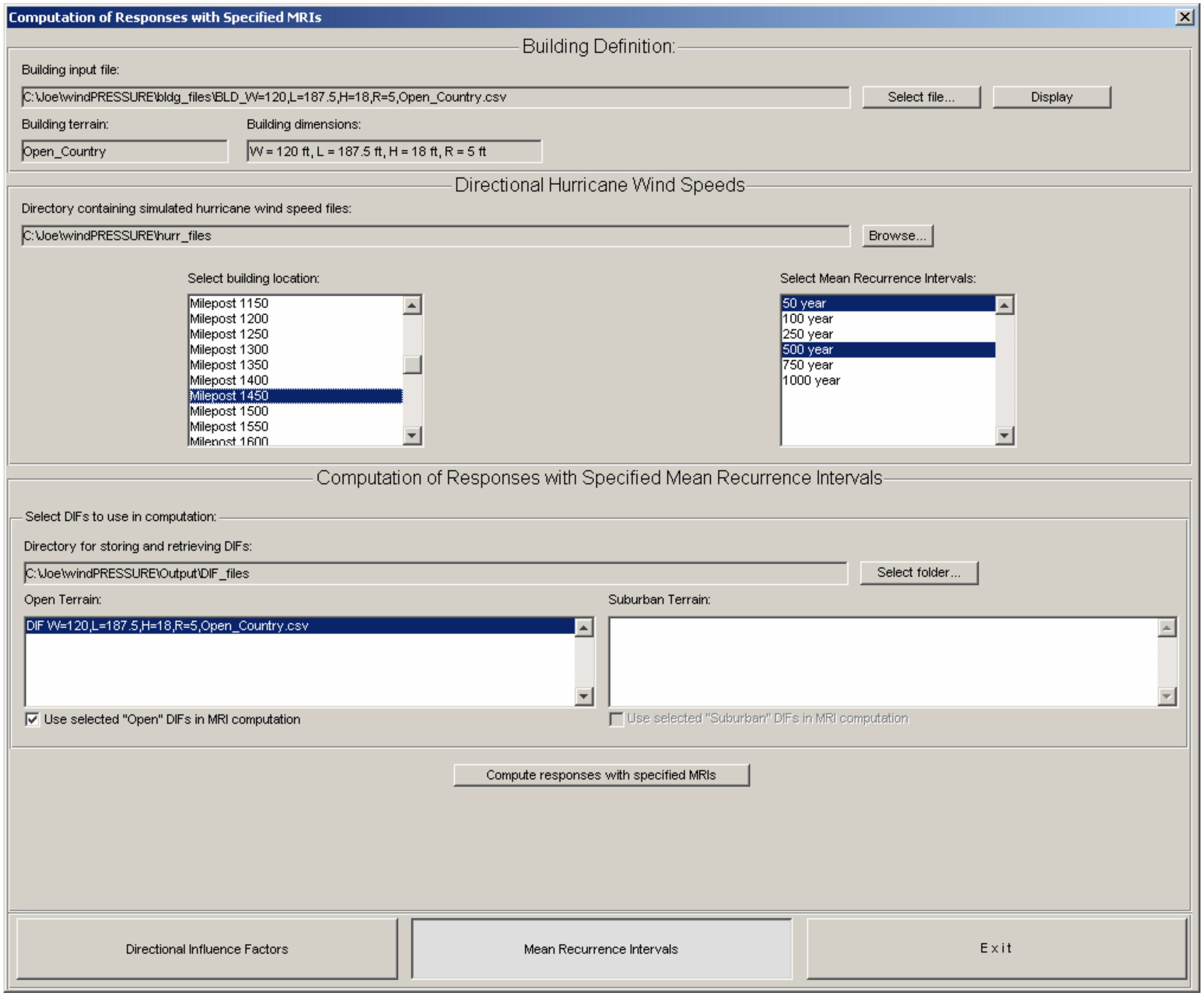

Figure 8. Graphical interface for computing responses with specified Mean Recurrence Interval.

then be selected from the list of available mileposts. The MRIs for which responses are desired can also be selected through the interface, along with the DIF results file(s) to be used, and results can then be computed by pressing the "Compute responses with specified MRIs" button. The results are displayed graphically as shown in Figure 9 and Figure 10, and they can then be saved to an MRI output file, if desired.

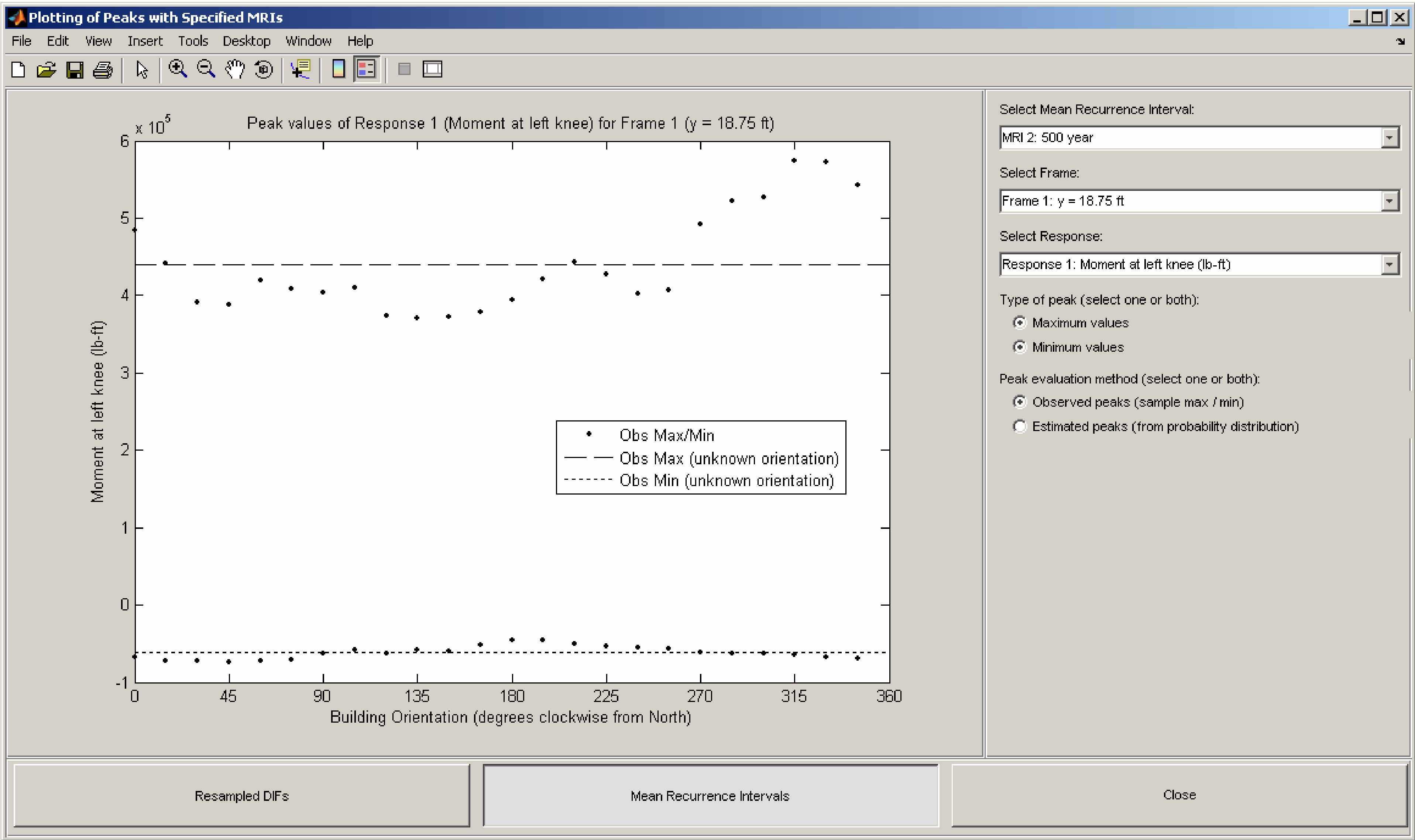

Figure 9. Graphical interface for displaying responses with specified Mean Recurrence Intervals.

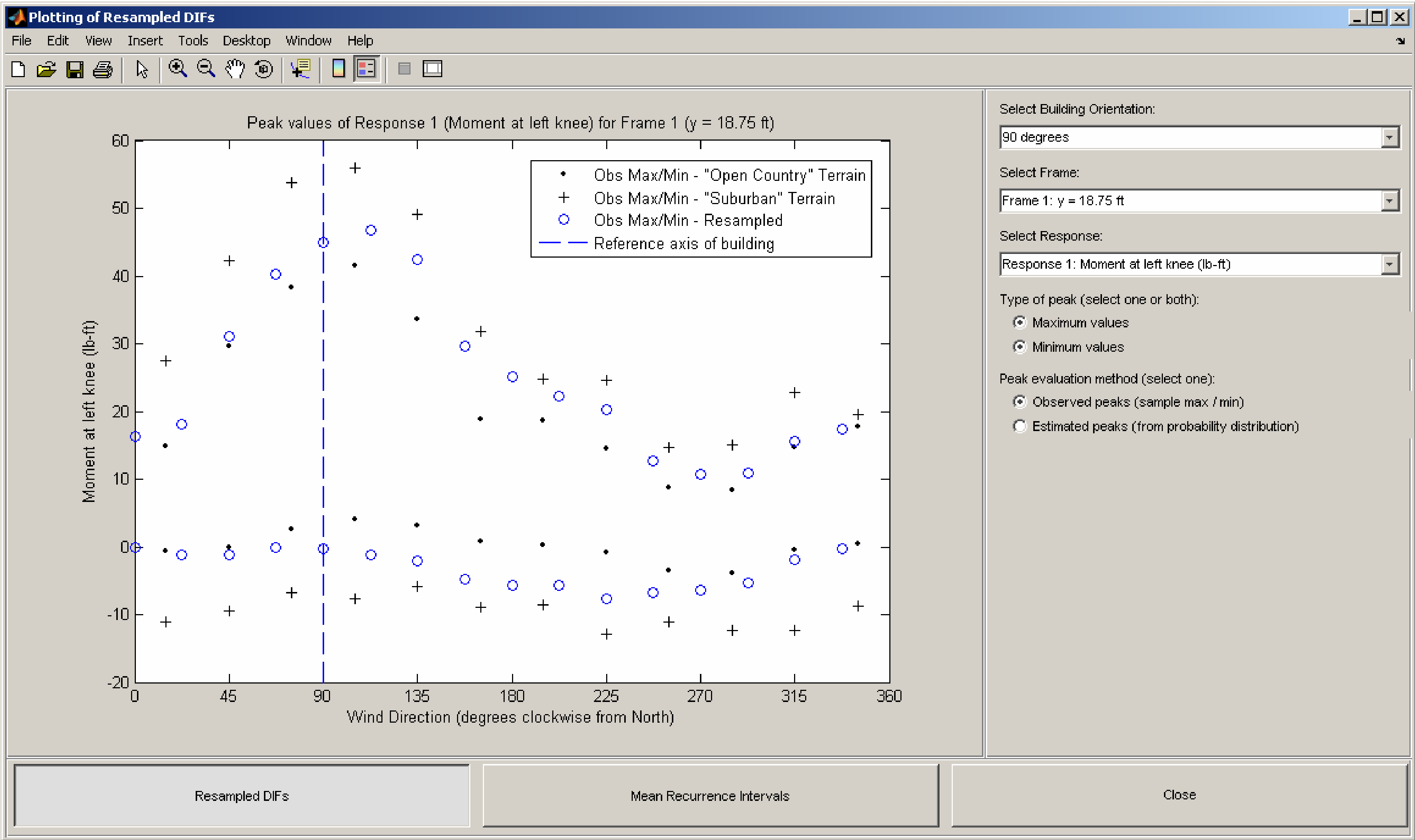

Figure 10. Graphical interface for displaying resampled DIFs used in computing responses with specified MRIs.

Building Input File

This section describes the contents and format of the building input file, a comma-delimited text file that defines the characteristics of the building to be analyzed. The building input file can be created and edited using standard spreadsheet software and must be saved in the comma-separated values (CSV) file format in order to be properly interpreted by the windPRESSURE software. This CSV file can then be selected for analysis through the graphical user interface. A sample building input file is shown in Figure 11.

The building input file consists of keywords followed by tabular input data. Keywords begin with an asterisk[2], and the following keywords are required in each building input file (underscores are used in the keywords rather than spaces):

*UNITS
*BUILDING_DIMENSIONS
*TERRAIN
*FRAME_LOCATIONS
*ATTACHMENT_LOCATIONS
*RESPONSE_NAMES
*INFLUENCE_COEFFICIENTS

Input data begins on the row immediately following each keyword, and the purpose and format of the input data corresponding to each keyword are described in the following sections. The keywords and corresponding input data can be entered in the input file in any order, but no extraneous rows are permitted. Errors will result if the input data does not match the expected format for the specified keyword. Header rows are included with the input data for most keywords, so that columns can be labeled, making the input file easier to read. These header rows must not be omitted, or the input data will not be properly read and errors will result. Suggested column labels for the header rows are indicated in the following sections. However, the entries in the header rows are not actually read by the software, and alternative column labels can be used, or these rows can simply be left blank. Additional annotation can be added to the input file by using the % symbol: lines beginning with % are treated as comments and are ignored in reading the building input file.

---

[2] Any line that begins with an asterisk will be interpreted as a keyword, and an error will result if the text following the asterisk is not a recognized keyword.

	A	B	C	D	E
1	*UNITS				
2	Length	Force	Wind Speed		
3	ft	lb	ft/s		
4	*BUILDING_DIMENSIONS				
5	Width	Length	Height	Roof Rise	
6	120	187.5	18	5	
7	*TERRAIN				
8	Open_Country				
9	*FRAME_LOCATIONS				
10	Number	Previous y	Current y	Next y	
11	1	0	18.75	37.5	
12	2	18.75	37.5	56.25	
13	*ATTACHMENT_LOCATIONS				
14	Index	Face	s-coordinate		
15	1	1	0		
16	2	1	3.9628		
17	3	1	7.9255		
18	4	1	11.8883		
19	5	1	15.851		
20	6	2	2.4459489		
21	7	2	6.47024981		
22	8	2	10.4945507		
23	9	2	14.518952		
24	10	2	18.5432529		
25	11	2	22.5675538		
26	12	2	26.5918547		
27	13	2	30.7938695		
28	14	2	34.9958842		
29	15	2	39.197899		
30	16	2	43.3999138		
31	17	2	47.6019286		
32	18	2	51.8039433		
33	19	2	56.0059581		
34	20	2	60.2079729		
35	21	3	2.4459489		
36	22	3	6.47024981		
37	23	3	10.4945507		
38	24	3	14.5188516		
39	25	3	18.5432529		
40	26	3	22.5675538		
41	27	3	26.5918547		
42	28	3	30.7938695		
43	29	3	34.9958842		
44	30	3	39.197899		
45	31	3	43.3999138		
46	32	3	47.6019286		
47	33	3	51.8039433		
48	34	3	56.0059581		
49	35	3	60.2079729		
50	36	4	0		
51	37	4	3.9627		
52	38	4	7.9255		
53	39	4	11.8883		
54	40	4	15.851		
55	*RESPONSE_NAMES				

continued on next column...

...continued from previous column:

	A	B	C	D	E
54	40	4	15.851		
55	*RESPONSE_NAMES				
56	Number	Name	Units		
57	1	Moment at left knee	lb-ft		
58	2	Moment at left pinch	lb-ft		
59	3	Moment at ridge	lb-ft		
60	*INFLUENCE_COEFFICIENTS				
61	Index	Response 1	Response 2	Response 3	
62	1	0	0	0	
63	2	2.329420753	1.21937469	-0.1936405	
64	3	4.671338512	2.45359782	-0.3701987	
65	4	7.025427709	3.70228257	-0.5301197	
66	5	9.389759981	4.96313775	-0.6760393	
67	6	1.889956502	0.99903698	-0.1359321	
68	7	0.27035551	2.29715756	-0.2705476	
69	8	-1.337309219	3.60888028	-0.3892217	
70	9	-2.929570639	4.94016138	-0.4860298	
71	10	-4.498361784	6.29836218	-0.55138	
72	11	-6.032809156	7.69736889	-0.5697854	
73	12	-7.865522007	8.96619818	-0.4857403	
74	13	-9.277245595	6.43755353	-0.2531691	
75	14	-10.51706029	4.11316423	0.21438615	
76	15	-11.58179296	1.99680046	0.92126281	
77	16	-12.46827048	0.09223242	1.87179825	
78	17	-13.17331971	-1.5967697	3.07032988	
79	18	-13.69376754	-3.0664358	4.52119506	
80	19	-14.02644084	-4.3129955	6.22873119	
81	20	-14.16816646	-5.3326788	8.19727564	
82	21	-1.232504702	-0.8181609	-0.1359321	
83	22	-2.766216957	-1.8218584	-0.2705476	
84	23	-4.288008409	-2.8115395	-0.3892217	
85	24	-5.794363054	-3.78256	-0.4860298	
86	25	-7.277273191	-4.7259702	-0.55138	
87	26	-8.725839557	-5.6285745	-0.5697854	
88	27	-9.87711152	-6.3047615	-0.4857403	
89	28	-11.19951629	-7.0247001	-0.2531691	
90	29	-12.35001216	-7.5403832	0.21438615	
91	30	-13.32542601	-7.8480409	0.92126281	
92	31	-14.12258471	-7.9439028	1.87179825	
93	32	-14.73831512	-7.8241988	3.07032988	
94	33	-15.16944413	-7.4851588	4.52119506	
95	34	-15.4127986	-6.9230124	6.22873119	
96	35	-15.46520541	-6.1339896	8.19727564	
97	36	0	0	0	
98	37	-1.549064236	-1.0378109	-0.1936405	
99	38	-3.085631467	-2.0607734	-0.3701987	
100	39	-4.61002726	-3.0692743	-0.5301197	
101	40	-6.124179976	-4.0656047	-0.6760393	
102					

Figure 11. Sample building input file (BLD_W=120,L=187.5,H=18,R=5,Open_Country.csv).

*UNITS

Purpose: Define units used in the building input file and in the output of results.

Format of Input Data:

Length	*Force*	*Wind Speed*	← header row
length_units	**force_units**	**ws_units**	← text entries

Currently, only the units shown in the following table are supported, and the units must be typed in the input file exactly as shown in the second column of the table.

Quantity	Units
Length	ft
Force	lb
Wind Speed	ft/s

The length units specified here apply to the building dimensions specified in the *BUILDING_DIMENSIONS section, the roughness lengths specified in the *TERRAIN section, the *y*-coordinates specified in the *FRAME_LOCATIONS section, and the *s*-coordinates specified in the *ATTACHMENT_LOCATIONS section. The force units specified here apply to the unit force used in evaluating the influence coefficients specified in the *INFLUENCE_COEFFICIENTS section. The units of the influence coefficients themselves are specified in the *RESPONSE_NAMES section and do not need to match the units specified here, as long as the influence coefficients result from a unit force with the force units specified here. The wind speed units apply to the Directional Influence Factors (DIFs) that are output by the software: these DIFs give the peak values of each response quantity of interest corresponding to unit wind speeds with the units specified here, from different directions.

*BUILDING_DIMENSIONS

Purpose: Define the dimensions of the building to be analyzed. The building dimensions are defined using four length dimensions: the width W_0, length L_0, eave height H_0, and roof rise R_0, as shown in Figure 12. The length units specified in the *UNITS section must be used to define these dimensions.

Format of Input Data:

Width	*Length*	*Height*	*Roof Rise*
W0	**L0**	**H0**	**R0**

← header row
← numerical values

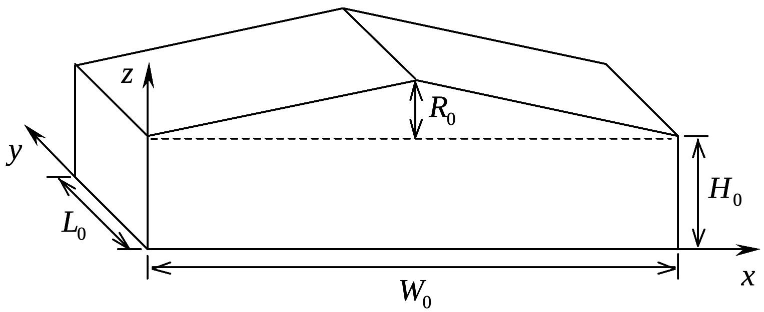

Figure 12. Definition of building dimensions

*TERRAIN

Purpose: Define roughness of the terrain surrounding the building to be analyzed, which may vary with wind direction.

Format of Input Data:

terrain	← text entry								
N	*NE*	*E*	*SE*	*S*	*SW*	*W*	*NW*	← header row	included only in “Directional” case
z0(1)	**z0(2)**	**z0(3)**	**z0(4)**	**z0(5)**	**z0(6)**	**z0(7)**	**z0(8)**	← numerical values	

The **terrain** entry in the first row specifies the type of terrain, and must be one of the following:

Open_Country	Suburban	Directional

The second and third rows of input data should be included only if “Directional” terrain is specified in the first row. “Open_Country” terrain corresponds to a roughness length of z_0 = 0.03 m (0.1 ft) for winds from all directions. “Suburban” terrain corresponds to a roughness length of z_0 = 0.3 m (1 ft) for winds from all directions. Specifying “Directional” terrain requires that roughness lengths be defined for winds from each of eight different wind directions. These directions begin with the north and increase by 45° increments in the clockwise direction, as indicated by the column labels in the header row above (the second row of input data). The roughness lengths corresponding to each of these directions are specified in the third row of input data, and the length units specified in the *UNITS section must be used to define these roughness lengths.

*FRAME_LOCATIONS

Purpose: Define the location of each structural frame to be analyzed, along with the locations of its neighboring frames, and assign an identifying number to each frame to be analyzed, for use in the output of results.

Format of Input Data:

Number	*Previous y*	*Current y*	*Next y*	← header row
`1`	`frame_coords(1,1)`	`frame_coords(1,2)`	`frame_coords(1,3)`	← numerical values
`2`	`frame_coords(2,1)`	`frame_coords(2,2)`	`frame_coords(2,3)`	← numerical values
`...`	`...`	`...`	`...`	
`f`	`frame_coords(f,1)`	`frame_coords(f,2)`	`frame_coords(f,3)`	← numerical values

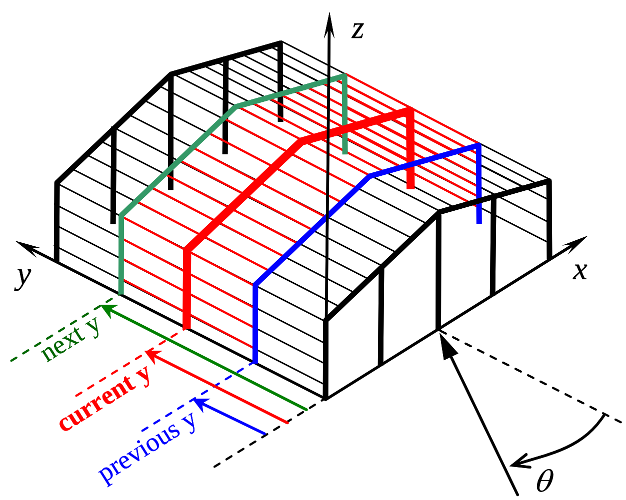

Figure 13. Definition of frame locations

The input data consists of *f* rows (preceded by one header row), where *f* is the number of frames to be analyzed, which can be as few as one. Each of these *f* frames must be identical. If more than one type of structural frame is to be used in the building (e.g., if some frames have interior columns or if the section properties of the frames differ), then separate building input files must be created for each distinct type of structural frame, and separate analyses must be performed for each type of frame, using these different building input files. The frames to be analyzed do not need to be adjacent. Each frame to be analyzed is assigned a number in the first column of the input data. These frame numbers, which are used in the output of results, must start at 1 and increment by 1, ending with *f*. For each frame to be analyzed, it is necessary to define the *y*-coordinates of three frames: the previous frame, the current frame, and the next frame, as illustrated in Figure 13 (the frames span in the *x*-direction). These coordinates are defined in the second, third, and fourth columns of the input data, respectively. The "current" frame is the frame to be analyzed, which is shown in red in Figure 13. The "previous" frame and the "next" frame are the neighboring frames, which shown are blue and green in Figure 13. The positions of these neighboring frames are required in order to determine the lengths of the girts and purlins that span between the current frame and the neighboring frames. The girts and purlins spanning between the current frame and the neighboring frames are highlighted in red in Figure 13, spanning in the *y*-direction. If there is no "previous frame" (i.e., if the current frame is at the end of the building near y = 0) then the *y*-coordinate of the current frame should be specified for both the "Current y" and the "Previous y" (i.e., in both the second and third columns of the input data). Similarly, if there is no "next frame" (i.e., if the current frame is at the end of the building near $y = L_0$), then the y-coordinate of the current frame should be specified for both the "Current y" and the "Next y" (i.e., in both the third and fourth columns of the input data). As shown in Figure 13, y = 0 corresponds to the windward face of the building for a wind direction of θ = 0°. It is noted that the origin of the coordinate system shown in Figure 13 is at the opposite corner of the building from the origin used in defining the pressure tap coordinates in the standard HDF pressure database file.

*ATTACHMENT_LOCATIONS

Purpose: Define the locations at which girts and purlins are attached to the structural frames.

Format of Input Data:

Index	*Face*	*s-coordinate*	
1	attach_pts(1,1)	attach_pts(1,2)	← header row
2	attach_pts(2,1)	attach_pts(2,2)	← numerical values
...	...	...	← numerical values
m	attach_pts(m,1)	attach_pts(m,2)	← numerical values

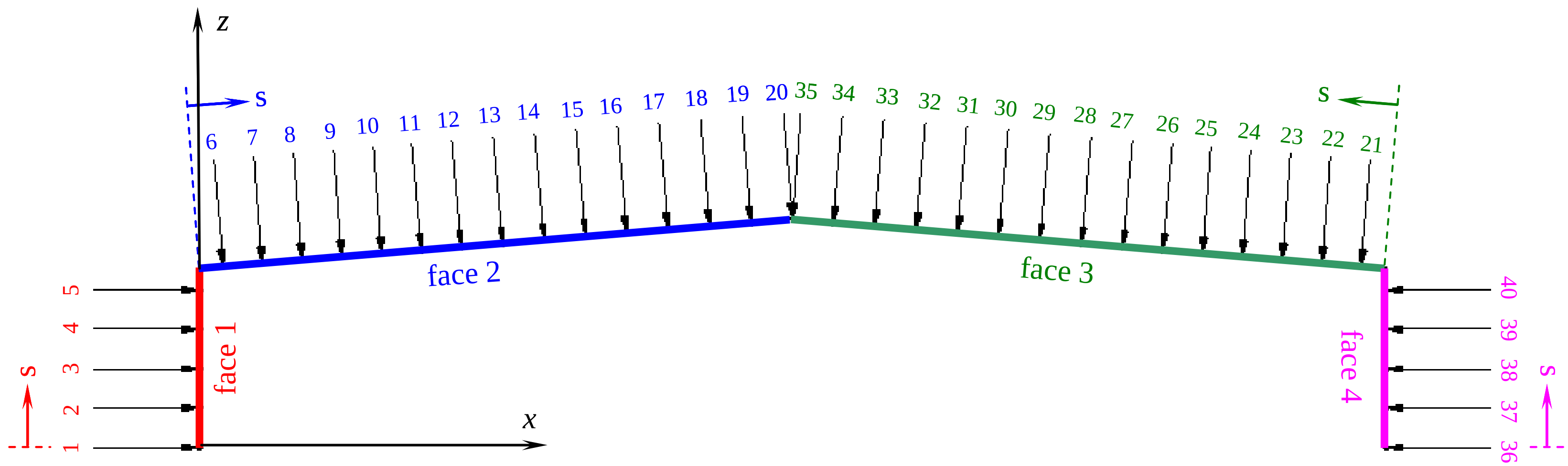

Figure 14. Definition of girt and purlin attachment locations

The input data consists of *m* rows (preceded by one header row), where *m* is the number of locations at which girts and purlins are attached. Each attachment location is assigned an index in the first column of the input data, and these indices must start at 1 and increment by 1, ending with *m*. These indices are used in the *INFLUENCE_COEFFICIENTS section to define the influence coefficients corresponding to a unit force at each attachment location. The location of each attachment point is defined by specifying the face number (in the second column of the input data) and a local "*s*-coordinate" in the plane of that face (in the third column of the input data). The face numbers and *s*-coordinates are defined as shown in Figure 14, in which the attachment locations are indicated by arrows normal to each face. The *x*- and *y*-coordinates in Figure 14 correspond to the global coordinate system shown in Figure 13, and it is noted that face 1 corresponds to *x* = 0. The indices of the attachment locations must be assigned in order of increasing face number and then – for each face – in order of increasing values of the *s*-coordinate. This ordering is illustrated in Figure 14, in which the arrows indicating the attachment locations are labeled with the index number, using the same color as the corresponding face. If an attachment location coincides with the boundary between two faces, then separate indices must be defined for the attachment location on each of the adjoining faces. This is illustrated at the ridge of the building in Figure 14, where index 20 is used to denote the ridge location on face 2, and index 35 is used to denote the ridge location on face 3. It is noted that if the attachment locations are symmetric about the ridge, then the *s*-coordinates of the attachment locations on faces 1 and 2 are equivalent to the *s*-coordinates of the attachment locations on faces 4 and 3, respectively.

*RESPONSE_NAMES

Purpose: Assign numbers to the response quantities to be computed, which must coincide with the response numbers used in the *INFLUENCE_COEFFICIENTS section, and provide descriptive names (e.g., “Moment at left knee”, “Vertical displacement at ridge”) and units (e.g., “lb-ft”, “in”) for these response quantities, for use in labeling of results.

Format of Input Data:

Number	*Name*	*Units*
1	**resp_names{1}**	**resp_units{1}**
2	**resp_names{2}**	**resp_units{2}**
...	**...**	**...**
r	**resp_names{r}**	**resp_units{r}**

← header row

numerical · text entries · text entries

The input data consists of *r* rows (preceded by one header row), where *r* is the number of response quantities to be computed, which can be as few as one. Each response to be computed is assigned a number in the first column of the input data, for use in the output of results. These response numbers must start at 1 and increment by 1, ending with *r*. For each of these response quantities, a descriptive name must be provided in the second column of the input data, and the corresponding units must be provided in the third column. Influence coefficients for each of these response quantities must also be provided in the *INFLUENCE_COEFFICIENTS section, and the units of the influence coefficients must be consistent with the units provided in this section. Apart from this requirement of consistency, there are no restrictions on the units that can be used, as the units provided here are not actually interpreted by the software. The response names and units are used only for labeling of the results, as a convenience to the user.

*INFLUENCE_COEFFICIENTS

Purpose: Define influence coefficients for each of the responses to be computed, for which descriptive names and units are provided in the *RESPONSE_NAMES section. The influence coefficients define the value of each response quantity resulting from a unit force at each of the girt and purlin attachment locations, defined in the *ATTACHMENT_LOCATIONS section. The unit forces used to evaluate these influence coefficients must have the force units specified in the *UNITS section.

Format of Input Data:

Index	*Response 1*	*Response 2*	...	*Response r*	← header row
1	**N(1,1)**	**N(1,2)**	**...**	**N(1,r)**	← numerical values
2	**N(2,1)**	**N(2,2)**	**...**	**N(2,r)**	← numerical values
...	**...**	**...**	**...**	**...**	
m	**N(m,1)**	**N(m,2)**	**...**	**N(m,r)**	← numerical values

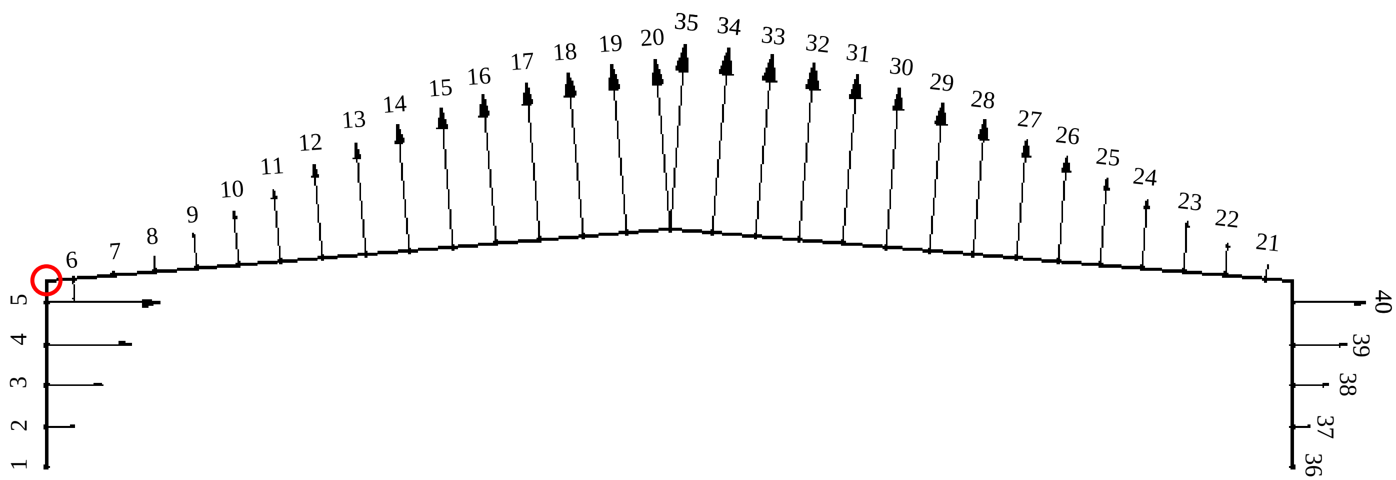

Figure 15. Influence coefficients associated with bending moment at left knee (Response 1). Attachment indices, as defined in Figure 14, are labeled.

The input data consists of *m* rows (preceded by one header row), where *m* is the number of attachment locations. The first column of the input data specifies the attachment index, as defined previously in the *ATTACHMENT_LOCATIONS section, and the attachment indices must start at 1 and increment by 1, ending with *m*. The next *r* columns, where *r* is the number of responses to be computed, define the value of each response quantity resulting from a unit force at each attachment location. These unit forces act normal to the corresponding face in the direction of positive pressure (i.e., towards the center of the building) as illustrated by the arrows at each attachment point shown in Figure 14. The unit forces used to evaluate these influence coefficients must have the force units specified in the *UNITS section. There are no restrictions on the units of the resulting influence coefficients, but the units must be consistent with those indicated in the *RESPONSE_NAMES section.

Directional Influence Factor (DIF) Output Files

This section describes the contents and format of DIF output files, which are comma-delimited text files in which computed Directional Influence Factors are saved. DIF output filenames must begin with “DIF” to be recognized by the windPRESSURE software. DIF output files contain the following sections.

*UNITS
*BUILDING_DIMENSIONS
*MODEL_DIMENSIONS
*WEIGHTING_FACTORS (included only the results were obtained by interpolation)
*MODEL_TERRAIN
*FRAME_LOCATIONS
*ATTACHMENT_LOCATIONS
*RESPONSE_NAMES

If “Observed peaks” are selected in the output options (Figure 4), then the following sections will be included:

*DIF_OBS_MAX *DIF_OBS_MIN

If both “Observed peaks” and “Store multiple peaks for each wind direction” are selected in the output options (Figure 4), then the following sections will be included:

*DIF_OBS_MAX_ALL *DIF_OBS_MIN_ALL

If the DIFs were obtained by interpolation and “observed peaks” were contained in the original DIF files used in interpolation, then “bounding” results from each original DIF file will be included in the following sections:

*DIF_OBS_MAX_BND *DIF_OBS_MIN_BND

If “Estimated peaks” are selected in the output options (Figure 4), then the following sections will be included:

*DIF_EST_MAX *DIF_EST_MIN

If both “Estimated peaks” and “Store multiple peaks for each wind direction” are selected in the output options (Figure 4), then the following sections will be included:

*DIF_EST_MAX_ALL *DIF_EST_MIN_ALL

If the DIFs were obtained by interpolation and “estimated peaks” were contained in the original DIF files used in interpolation, then “bounding” results from each original DIF file will be included in the following sections:

*DIF_EST_MAX_BND *DIF_EST_MIN_BND

If “Store load distributions producing peak responses” is selected in the output options (Figure 4), then the following sections will be included:

*LOAD_DISTRIBUTION_MAX   *LOAD_DISTRIBUTION_MIN

If both “Store load distributions producing peak responses” and “Store multiple peaks for each wind direction” are selected in the output options (Figure 4), then the following sections will be included:

*LOAD_DISTRIBUTION_MAX_ALL   *LOAD_DISTRIBUTION_MIN_ALL

If the DIFs were obtained by interpolation and load distributions were contained in the original DIF files used in interpolation, then “bounding” results from each original DIF file will be included in the following sections:

*LOAD_DISTRIBUTION_MAX_BND   *LOAD_DISTRIBUTION_MIN_BND

The purpose and format of each of the preceding sections are described in the following.

*UNITS

Format and Purpose are the same as in the building input file.

*BUILDING_DIMENSIONS

Format and Purpose are the same as in the building input file.

*MODEL_DIMENSIONS

Purpose: Provide the dimensions of the wind tunnel models used in computing the DIFs.

Format: 4 columns; 1 header line, *b* lines of data, where *b* is the number of building models. *b*=1 unless the results were obtained by interpolation:

Width	*Length*	*Height*	*Roof Rise*	(header)
W1	**L1**	**H1**	**R1**	
W2	**L2**	**H2**	**R2**	
...	**...**		**...**	
Wb	**Lb**	**Hb**	**Rb**	

*WEIGHTING_FACTORS

This section is included only if the DIF results were obtained by interpolation.

Purpose: Report the weighting factors for each model used in computing DIFs by interpolation.

Format:

Model 1	*Model 2*	...	*Model b*	(header)
WF1	**WF2**	**...**	**WFb**	

The output data consists of 1 row with *m* columns, where *m* is the number of models used in interpolation.

*MODEL_TERRAIN

Purpose: Report the terrain of pressure database files used to compute the DIFs.

Format: The output data consists of one entry (1 row, 1 column), which specifies type of terrain and may be either “Open_Country” or “Suburban”.

*FRAME_LOCATIONS

Format and Purpose are the same as in the building input file.

*ATTACHMENT_LOCATIONS

Format and Purpose are the same as in the building input file.

*RESPONSE_NAMES

Format and Purpose are the same as in the building input file.

*DIF_OBS_MAX

Observed maximum values of each response for a unit wind speed from each direction. If multiple results are obtained for some wind directions (by symmetry), then only the averaged results are reported here.

*DIF_OBS_MIN

Observed minimum values of each response for a unit wind speed from each direction. If multiple results are obtained for some wind directions (by symmetry), then only the averaged results are reported here.

*DIF_OBS_MAX_ALL

Observed maximum values of each response for a unit wind speed from each direction. All results obtained by symmetry are reported, with each tested wind direction resulting in results for four different wind directions, denoted Wind Direction A, B, C, and D.

*DIF_OBS_MIN_ALL

Observed minimum values of each response for a unit wind speed from each direction. All results obtained by symmetry are reported, with each tested wind direction resulting in results for four different wind directions, denoted Wind Direction A, B, C, and D.

*DIF_OBS_MAX_BND

This section is included only if the DIF results were obtained by interpolation, and it reports the *DIF_OBS_MAX values from each model used in interpolation, if "observed" peaks were available.

*DIF_OBS_MIN_BND

This section is included only if the DIF results were obtained by interpolation, and it reports the *DIF_OBS_MIN values from each model used in interpolation, if "observed" peaks were available.

*DIF_EST_MAX

Estimated maximum values of each response for a unit wind speed from each direction. If multiple results are obtained for some wind directions (by symmetry), then only the averaged results are reported here.

*DIF_EST_MIN

Estimated minimum values of each response for a unit wind speed from each direction. If multiple results are obtained for some wind directions (by symmetry), then only the averaged results are reported here.

*DIF_EST_MAX_ALL

Estimated maximum values of each response for a unit wind speed from each direction. All results obtained by symmetry are reported, with each tested wind direction resulting in results for four different wind directions, denoted Wind Direction A, B, C, and D.

*DIF_EST_MIN_ALL

Estimated minimum values of each response for a unit wind speed from each direction. All results obtained by symmetry are reported, with each tested wind direction resulting in results for four different wind directions, denoted Wind Direction A, B, C, and D.

*DIF_EST_MAX_BND

This section is included only if the DIF results were obtained by interpolation, and it reports the *DIF_EST_MAX values from each model used in interpolation, if "estimated" peaks were available.

*DIF_EST_MIN_BND

This section is included only if the DIF results were obtained by interpolation, and it reports the *DIF_EST_MIN values from each model used in interpolation, if "estimated" peaks were available.

*LOAD_DISTRIBUTION_MAX

This section reports the load distribution producing the maximum observed value of each response quantity for each wind direction. Load values are given for each index defined in the *ATTACHMENT_LOCATIONS section, and the units of these load values are given by the force units in the *UNITS section. If multiple results are obtained for some wind directions (by symmetry), then averaged peak load distributions are reported here.

*LOAD_DISTRIBUTION_MIN

This section reports the load distribution producing the minimum observed value of each response quantity for each wind direction. Load values are given for each index defined in the *ATTACHMENT_LOCATIONS section, and the units of these load values are given by the force units in the *UNITS section. If multiple results are obtained for some wind directions (by symmetry), then averaged peak load distributions are reported here.

*LOAD_DISTRIBUTION_MAX_ALL

This section reports the load distribution producing the maximum observed value of each response quantity for each wind direction. All results obtained by symmetry are reported, with each tested wind direction resulting in results for four different wind directions, denoted Wind Direction A, B, C, and D. Load values are given for each index defined in the *ATTACHMENT_LOCATIONS section, and the units of these load values are given by the force units in the *UNITS section.

*LOAD_DISTRIBUTION_MIN_ALL

This section reports the load distribution producing the minimum observed value of each response quantity for each wind direction. All results obtained by symmetry are reported, with each tested wind direction resulting in results for four different wind directions, denoted Wind Direction A, B, C, and D. Load values are given for each index defined in the *ATTACHMENT_LOCATIONS section, and the units of these load values are given by the force units in the *UNITS section.

*LOAD_DISTRIBUTION_MAX_BND

This section is included only if the DIF results were obtained by interpolation, and it reports the *LOAD_DISTRIBUTION_MAX values from each model used in interpolation, if load distributions were available.

*LOAD_DISTRIBUTION_MIN_BND

This section is included only if the DIF results were obtained by interpolation, and it reports the *LOAD_DISTRIBUTION_MIN values from each model used in interpolation, if load distributions were available.

Response Time Series Output Files

If “Display time series during analysis” is selected in the output options (Figure 4), then response time series can be saved through the graphical interface shown in Figure 5. Time series can only be saved for one frame and one response at a time (each response can be saved in turn, if desired), and responses are automatically saved for the four different wind directions obtained by symmetry (Wind Directions A, B, C, and D). As shown in the dialog of Figure 16, the time series can be saved in one of two formats: in comma-delimited text format (*.csv) or in MATLAB format (*.mat).

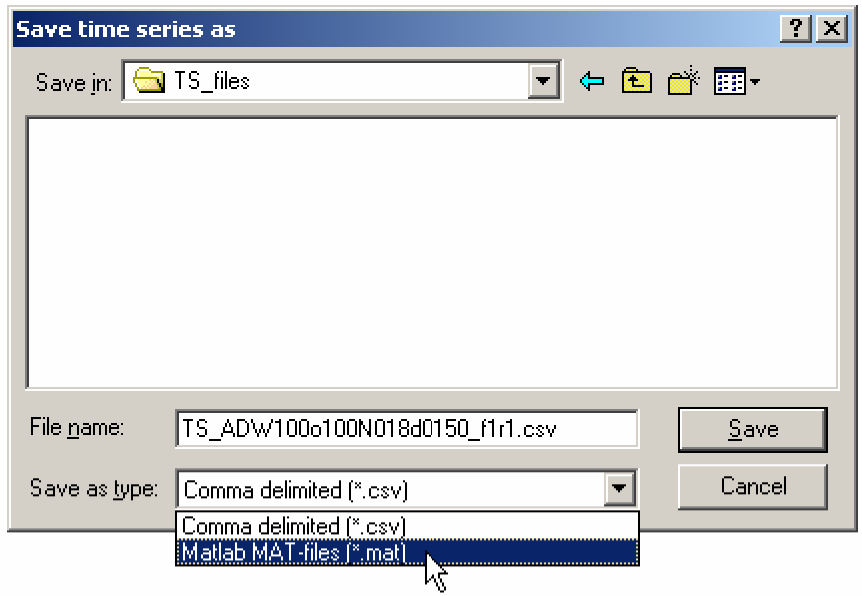

Figure 16. Dialog box for saving of time series.

A portion of a time series output file in CSV format is shown in Figure 17. As shown, identifying information is written in header rows at the top of the CSV file.

If the time series is saved in MATLAB format (*.mat), then the time series and identifying information are stored in a structure array named “TS_structure” in a MATLAB file with the specified name. The file can be loaded within MATLAB using the syntax shown in the following example:

load 'TS_ADW100o100N018d0150_f1r1.mat'

	A	B	C	D
1	HDF pressure file: ADW100o100N018d0150.HDF			
2	Frame 1: y = 18.75 ft			
3	Response 1: Moment at left knee (lb-ft)			
4	Number of samples: 49792			
5	Wind Dir A	Wind Dir B	Wind Dir C	Wind Dir D
6	15	345	165	195
7	Time Series A	Time Series B	Time Series C	Time Series D
8	10.401	9.40555	1.41843	1.05829
9	10.5932	9.59051	1.63415	1.13809
10	10.1893	9.15111	1.2277	0.777493
11	9.70398	8.59027	1.02474	0.708408
12	9.19046	8.13591	0.470464	0.025218
13	9.56308	8.54659	0.776976	0.45033
14	10.4377	9.27259	1.58364	1.0993
15	10.7204	9.66025	2.00571	1.35543
16	10.0225	8.88006	1.62351	1.14902
17	9.04601	7.82999	0.406228	0.00721043
18	8.60808	7.49577	-0.078962	-0.477685
19	9.0158	7.81092	0.541478	0.113351

Figure 17. Portion of sample time series output file.

The times series and identifying information given in the headers of the CSV file shown in Figure 17 are stored in fields with the following names:

TS_structure.HDF_filename	'ADW100o100N018d0150.HDF'	(HDF pressure file)
TS_structure.frame_label	'Frame 1: y = 18.75 ft'	
TS_structure.resp_label	'Response 1: Moment at left knee (lb-ft)'	
TS_structure.n_s	49792	(Number of samples)
TS_structure.theta_a	15	(Wind Dir A)
TS_structure.theta_b	345	(Wind Dir B)
TS_structure.theta_c	165	(Wind Dir C)
TS_structure.theta_d	195	(Wind Dir D)
TS_structure.ts_a	[1x49792 double]	(Time Series A)
TS_structure.ts_b	[1x49792 double]	(Time Series B)
TS_structure.ts_c	[1x49792 double]	(Time Series C)
TS_structure.ts_d	[1x49792 double]	(Time Series D)

Mean Recurrence Interval (MRI) Output Files

The MRI output files contain the following sections.

*UNITS

Format and Purpose are the same as in the building input file.

*BUILDING_DIMENSIONS

Format and Purpose are the same as in the building input file.

*MODEL_DIMENSIONS

Format and Purpose are the same as in the DIF output files.

*FRAME_LOCATIONS

Format and Purpose are the same as in the building input file.

*MODEL_TERRAIN

Format and Purpose are the same as in the DIF output files.

*RESPONSE_NAMES

Format and Purpose are the same as in the building input file.

*MRI_LIST

Purpose: Define the Mean Recurrence Intervals for which peak responses where

Format: One row with values in one or more columns giving the Mean Recurrence Intervals for which responses were requested.

*MRI_MAX_OBS

This section is included if “observed” peaks were available in the selected DIF file(s), and it gives the maximum values of each response quantity corresponding to the specified return periods, computed using “observed” peaks.

*MRI_MIN_OBS

This section is included if “observed” peaks were available in the selected DIF file(s), and it gives the minimum values of each response quantity corresponding to the specified return periods, computed using “observed” peaks.

*MRI_MAX_EST

This section is included if “estimated” peaks were available in the selected DIF file(s), and it gives the maximum values of each response quantity corresponding to the specified return periods, computed using “estimated” peaks.

*MRI_MIN_EST

This section is included if “estimated” peaks were available in the selected DIF file(s), and it gives the minimum values of each response quantity corresponding to the specified return periods, computed using “estimated” peaks.

Log of Software Updates

The following is a log of major updates to the **windPRESSURE** software since the initial version was made publicly available on February 8, 2006.

- March 15, 2006: The function plotHDF.m was updated to enable plotting of pressure time series for selected pressure taps and saving of these pressure time series in either comma-delimited text format (*.csv) or in MATLAB format (*.mat).