Description of InputSetup

# Function

*INPUTSETUP* is used to set up input folders and files for HiPIMS

# Calling format

*InputSetUp(caseFolder,Z,R)* set up input files for a case. *caseFolder* is the location of the folder storing input and output files. *Z* is a matrix storing elevation value of DEM file. *R* is a 3\*2 matrix of DEM spatial-reference information, including the coordinate of the original points of the raster and the size of the grid. *Z* and *R* could be created separately (*makerefmat*) or read from existing Arc ascii files via *arcgridread*. All other parameters of HiPIMS are default values if the input parameters are as listed above.

*InputSetUp (caseFolder, Z, R, Name, Value) caseFolder* is the location of the folder storing input and output files. Z is a matrix of elevation value. R is a spatial-reference matrix of DEM. Name-Value Pair Arguments are listed as Table 1.

Table 1 Name-Value pair arguments

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter Type** | **Name**  (Case sensitive) | **Default | Alternative Values** | **Value Format** | **Note** |
| Decision Flags | h\_Eta | ‘h’| ‘eta’ | string | simulation with water depth (h) or water elevation (eta) |
| WriteAllFiles | false| true | logical | Whether to generate all the input files |
| Gauge coordinates | GaugeCoor | [ ] | 2-column numeric array | Coordinates of the gauge points inside domain |
| Boundary conditions | IO\_BoundFrame | [ ] | 4\*n numeric array | Extent of the input-output boundaries. *n* is the number of IO boundaries |
| BoundType | ‘open’| 'rigid', 'hgiven', 'Qgiven', 'hQgiven' | string or Cell of multiple strings | Type of boundaries. ‘*hgiven’* means water depth /elevation in the bound is pre-defined; ‘*Qgiven’* means the discharge/water velocity in the bound is pre-defined; *'hQgiven'* means both depth and discharge in the bound is predefined. |
| h\_BC\_Source | {[0 0]} | Cell of numeric 2-column arrays | Data of pre-defined water depth/elevation. The number of 2- column arrays should be the same with the number of boundaries that h/eta has been given. The first column of the array is time(s) and the second column is the water depth/elevation (m). |
| hU\_BC\_Source | {[0 0 0]} | Cell of 2-column /3-column numeric arrays | Data of pre-defined water discharge/ water velocity. The number of numeric arrays should be the same with the number of boundaries that discharge/velocity has been given. The first column of the array is time(s) and if the array is 2-col, the second column is the discharge (m3/s) or if the array is 3-col, then the second and third column are water velocity (m/s) in x and y direction respectively. |
| BoundCode  (not recommended) | [2 0 0;  2 1 0] | 2\*3n numeric array | Not recommended unless the alternative bound types cannot fulfil your requirements. It conveys more specific information of BoundType with numeric arrays. |
| Initial conditions | initial\_hE | 0 | scalar or numeric array with the same size of Z | Initial water depth/elevation. If it is a scalar, then all the grids in the domain have the same initial h/eta value. |
| initial\_hU | {0 0} | scalar (0) or cell of two numeric arrays with the same size of Z | Initial water velocity. Two components of the cell represent initial velocity in x and y direction respectively. If it is a scalar, then all the grids in the domain have the same initial water velocity value in both x and y direction. |
| initial\_hE\_hU\_pre  (not recommended) | {0, {0 0}, 0} | cell of three numeric arrays | It is a combination of all initial conditions, including initial h, hU and precipitation. The last one (precipitation) is always 0 at current version. |
| Rainfall | RainMask | 0 | scalar or numeric array with the same size of Z | It is the serial number of rainfall source starting from 0. Grids with the same serial number will have the same rainfall from the same source. |
| RainSource | [0 0;  3600 0] | numeric array or cell of 2-column numeric arrays | To give rainfall value for different region of the domain. If it is a numeric array, the first column is time(s) and the second and right forward columns are the rainfall rate(m/s), and the output rainfall source file will be a single file named ‘precipitation\_source\_all.dat’. The number of the single array column should be in accordance with the number of rainfall source in RainMask. If it is a cell of 2-column numeric arrays, each array conveys the time (s, 1st column) and rainfall rate (m/s, 2nd column) of one single rainfall source. Multiple files of rainfall source will be generated and named as ‘precipitation\_source\_n.dat’. The number of 2-column numeric arrays should be in accordance with the number of rainfall source. |
| Hydro Parameter Values | manning | 0.035 | scalar or numeric array with the same size of Z | It is manning coefficient. If it is a scalar, then all the grids in the domain have the same manning value. |
| sewer\_sink | 0 | scalar or numeric array with the same size of Z | It is sewer sink rate (m/s). If it is a scalar, then all the grids in the domain have the same sewer sink value. |
| cumul\_depth | 0 | scalar or numeric array with the same size of Z | It is one of the infiltration parameters. If it is a scalar, then all the grids in the domain have the same cumulative depth value. |
| hydraulic\_conductivity | 0 | scalar or numeric array with the same size of Z | It is one of the infiltration parameters. If it is a scalar, then all the grids in the domain have the same hydraulic conductivity value. |
| capillary\_head | 0 | scalar or numeric array with the same size of Z | It is one of the infiltration parameters. If it is a scalar, then all the grids in the domain have the same capillary head value. |
| water\_content\_diff | 0 | scalar or numeric array with the same size of Z | It is one of the infiltration parameters. If it is a scalar, then all the grids in the domain have the same water content diff value. |
| hydro\_params\_Value  (not recommended) | {0.035, 0, 0, 0, 0, 0} | scalar or numeric array with the same size of Z | It is a combination of all the six hydro parameter parameters. |

# Example

%% Example to create input files based on a peaks DEM

%% creat a DEM with Z and R

Z = peaks(500); % elevation values of DEM

gridL = 1; % length of each square grid

x11 = 0; % coordinates of the center of the upper left point

y11 = (size(Z,1)-1)\*gridL;

R = makerefmat(x11,y11,gridL,-gridL); %spatial reference of DEM

mapshow(Z,R,'DisplayType','surface'); colorbar; box on;

title('DEM'); xlabel('meter towards east'); ylabel('meter towards north');

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%% define boundary condition

% outline boundary

outlineBoundType = 'open';

% coordinates of the end row/col of Z

x\_end = x11+(size(Z,2)-1)\*gridL;

y\_end = y11+(size(Z,1)-1)\*(-gridL);

% input-output boundary 1

IO\_Bound1\_Frame = [x11-2\*gridL 2\*y11/5, x11+2\*gridL 3\*y11/5];

IO\_Bound1\_Type = 'Qgiven';

dischage = [0 30; 3600 300; 7200 30; 10800 30];

% input-output boundary 2

IO\_Bound2\_Frame = [x\_end-2\*gridL 2\*y11/5, x\_end+2\*gridL 3\*y11/5];

IO\_Bound2\_Type = 'hgiven';

depth = [0 1; 3600 3; 7200 1; 10800 1];

IO\_BoundFrame = [IO\_Bound1\_Frame; IO\_Bound2\_Frame];

boundType = {outlineBoundType,IO\_Bound1\_Type,IO\_Bound2\_Type};

h\_source = depth;

Q\_source = dischage;

% show the IO bound frames

mapshow(Z,R,'DisplayType','surface');box on; axis off

rectangle('Position',[x11-2\*gridL 2\*y11/5 gridL\*4 y11/5],'EdgeColor','r')

rectangle('Position',[x\_end-2\*gridL 2\*y11/5 gridL\*4 y11/5],'EdgeColor','r')

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%% define rainfall condition

% rainfall mask: two rainfall source, north(0) and south(1)

rainMask = zeros(size(Z)); rainMask(round(size(Z,1)/2):end,:) = 1;

rainSource = [0 , 0, 100/3600/4;...

3600, 0, 200/3600/4;...

7200, 0, 100/3600/4;...

7201, 0, 100/3600/4];

%% generate input files

caseFolder = cd;

InputSetup(caseFolder, Z, R,...

'IO\_BoundFrame',IO\_BoundFrame,'BoundType',boundType,...

'h\_BC\_Source',h\_source,...

'hU\_BC\_Source',Q\_source,...

'RainMask',rainMask,'RainSource',rainSource,...

'WriteAllFiles','true');