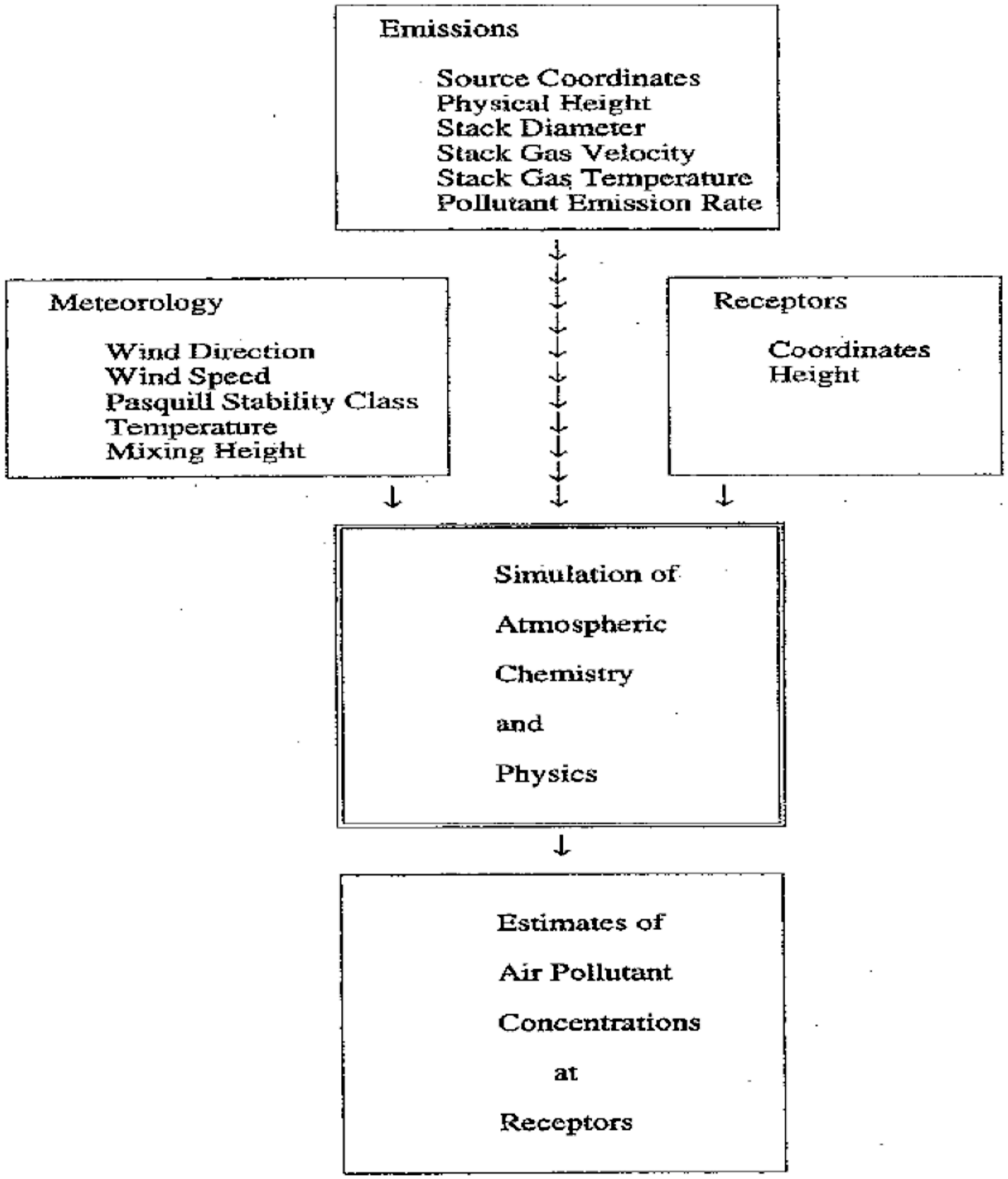
Comparison of Gaussian and Lagrangian dispersion model

Mentor: Prof. Koraļ in, DRI ,Reno, Nevada
Thanks to the student Jerrold McAlpine for Edu-plume toy model
Student: Tamara Hunjak

SWAP, BRAĻ , 2010


Emissions
Source Coordinates
Physical Height
Stack Diameter
Stack Gas Velocity
Stack Gas Temperature
Pollutant Emission Rate
Meteorology
Wind Direction
Wind Speed
Pasquill Stability Class
Temperature
Mixing Height
Receptors
Coordinates
Height
Simulation of
Atmospheric
Chemistry
and
Physics
Estimates of
Air Pollutant
Concentrations
at
Receptors

Gaussian model

- Assumptions in Gaussian modeling
  - Continuuos emission
  - Conservation of mass
  - Steady-state conditions
  - Crosswind and vertical concentration distributions

- Continuous Emissions

The emissions of pollutant in mass per time are taking place continuously and the rate of these emissions are not variable over time.

- Conservation of Mass

During the transport of pollutants from source to receptor, the mass that is emitted from the source is assumed to remain in the atmosphere. None of the material is removed through chemical reaction nor is lost at the ground surface through reaction, gravitational settling, or turbulent impaction. It is assumed that any of the released pollutant that is dispersed close to the ground surface by turbulent eddies is again dispersed away from the ground surface by other subsequent turbulent eddies. This is called eddy reflection.

- Steady-State Conditions

The meteorological conditions are assumed to persist unchanged with time, at least over the time period of transport (travel time) from source to receptor. It is very easy to satisfy this assumption for close in receptors under usual conditions. However, for light wind conditions or receptors at great distances, this assumption may not be satisfied.

- Crosswind and Vertical Concentration Distributions

It is assumed that the time averaged (over about one hour) concentration profiles at any distance in the crosswind direction, horizontal (perpendicular to the path of transport) are well represented by a Gaussian, or normal, distribution and, similarly, concentration profiles in the vertical direction (also perpendicular to the path of transport) are also well represented by a Gaussian, or normal, distribution.

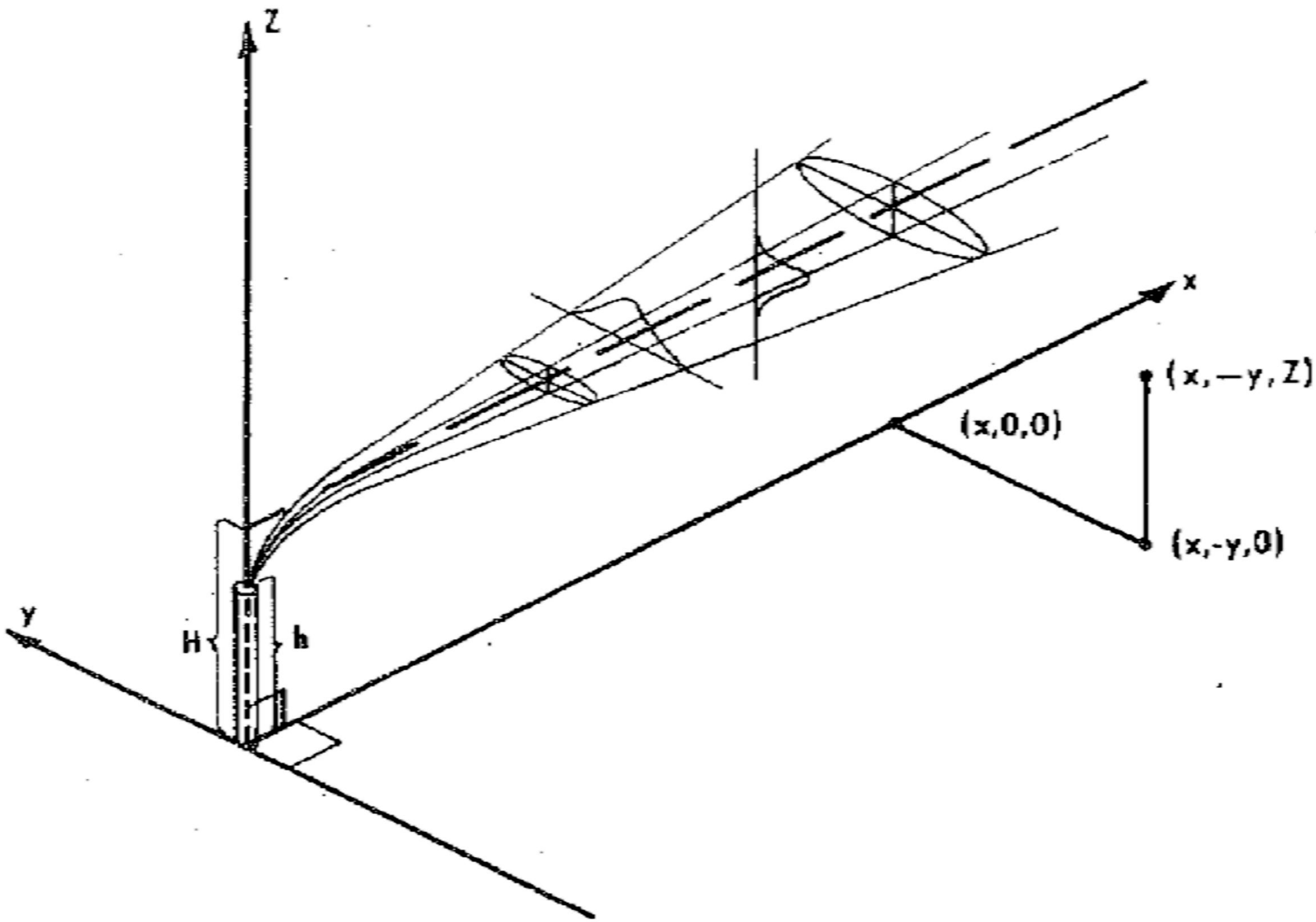


Figure 2.2 Coordinate system showing Gaussian distributions in the horizontal and vertical.

The variables are:

χ	Air pollutant concentration in mass per volume, usually g m^{-3}.
Q	Pollutant emission rate in mass per time, usually g s^{-1}.
u	Wind speed at the point of release, m s^{-1}.
σ_y	The standard deviation of the concentration distribution in the crosswind direction, m, at the downwind distance x.
σ_z	The standard deviation of the concentration distribution in the vertical direction, m, at the downwind distance x.
π	The mathematical constant pi equal to 3.1415926... .
H	The effective height of the centerline of the pollutant plume.

$$\chi(x,y,z;H) =$$

Emissions factor

$$Q$$

Downwind factor

$$\frac{1}{u}$$

Crosswind factor

$$\frac{1}{(2\pi)^{1/2}\sigma_y} \exp\left[-\frac{y^2}{2\sigma_y{}^2}\right]$$

Vertical factor

$$\frac{1}{(2\pi)^{1/2}\sigma_z}\left\{\exp\left[-\frac{(H-z)^2}{2\sigma_z{}^2}\right] + \exp\left[-\frac{(H+z)^2}{2\sigma_z{}^2}\right]\right\}$$

Pasquill stability categories

Surface wind speed (at 10 m) $m\ s^{-1}$	Insolation			Night	
	Strong	Moderate	Slight	Thinly overcast or > 4/8 low cloud	< 3/8 cloud
< 2	A	A - B	B	—	—
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	D	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

Lagrangian particle dispersion model (LAP)

- The main concept of LAP
- The partice are released at the time t at prescribed rate and there new position is determined at time (t+Δt) by relations:

$$x(t+\Delta t) = x(t) + [u(t) + u_{r'}(t)]\Delta t$$

$$y(t+\Delta t) = y(t) + [v(t) + v_{r'}(t)]\Delta t$$

$$z(t+\Delta t) = z(t) + [w(t) + w_{r'}(t)]\Delta t$$

Where u_r, v_r and w_r are the corresponding subgrid-scale velocity components.
The subgrid-scale velocity components are iteratively determined as:

$$u_r(t) = u_r(t - \Delta t)R_u(\Delta t) + u_s(t - \Delta t)$$
$$v_r(t) = v_r(t - \Delta t)R_v(\Delta t) + v_s(t - \Delta t)$$
$$w_r(t) = w_r(t - \Delta t)R_w(\Delta t) + w_s(t - \Delta t)$$

where R_u, R_v, and R_w are the Lagrangian autocorrelation functions for each velocity component, and u_s, v_s, and w_s are the random fluctuations of the velocity components.

The Lagrangian correlation functions are calculated from:

$$R_u(\Delta t) = e^{-\Delta t / T_{Lu}}$$

$$R_v(\Delta t) = e^{-\Delta t / T_{Lv}}$$

$$R_w(\Delta t) = e^{-\Delta t / T_{Lw}}$$

where T_{Lu}, T_{Lv} and T_{Lw} are the Lagrangian time scales for the corresponding velocity components.

After that the calculations of the Lagrangian time scale, the autocorrelation functions, and the range of velocity fluctuations as Gaussian standard deviations from a mean, are determined.

For each particle a random velocity fluctuation is generated and used to calculate the new particle velocity, and then the new particle position is calculated by applying the velocity over the time interval (φt).

Edu-plume

Edu-plume is a toy model created by Prof.Koracins student

The Gaussian plume model used is the standard model using P-G stability classes and plume spread equations. The equations used are those estimated from the P-G curves and commonly used in EPA screening dispersion models.

The Lagrangian particle model used is a statistical displacement model using a simplified lagrangian timescale estimate using the equation:

Tl= 2*sigma^2/Co*epsilon

where sigma is the standard deviation of u, v, and w wind components, Co is an empirical constant (5.7) and epsilon is the dissipation rate of turbulent kinetic energy.

Sigmas for the different P-G stability classes are estimated using linear relations to friction velocity.

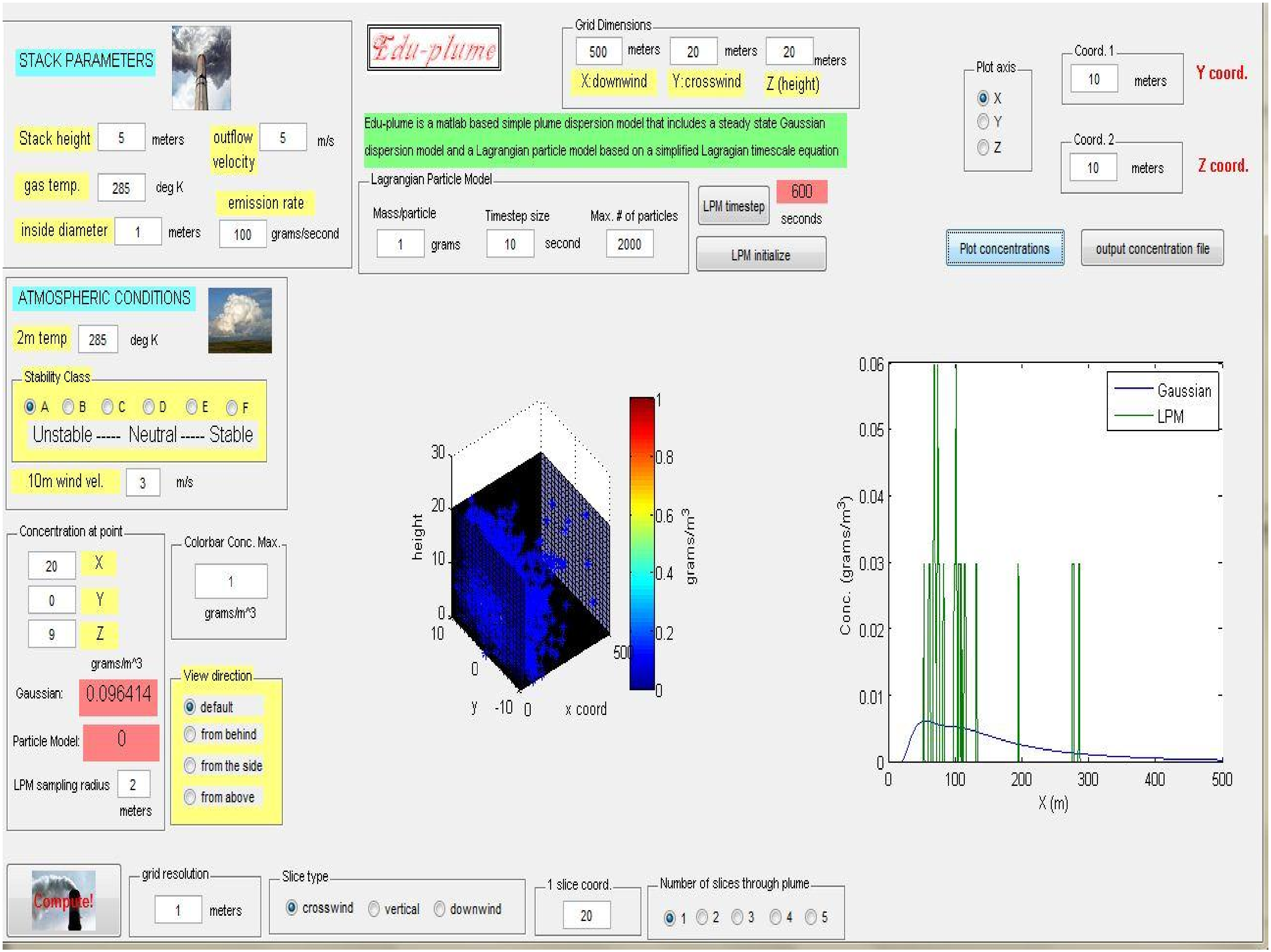
Future versions of this model should include a more sophisticated method of computing the sigmas using Monin-Obukov similarity theory and one of the standard particle model turbulence equation sets used in the DRI particle model.

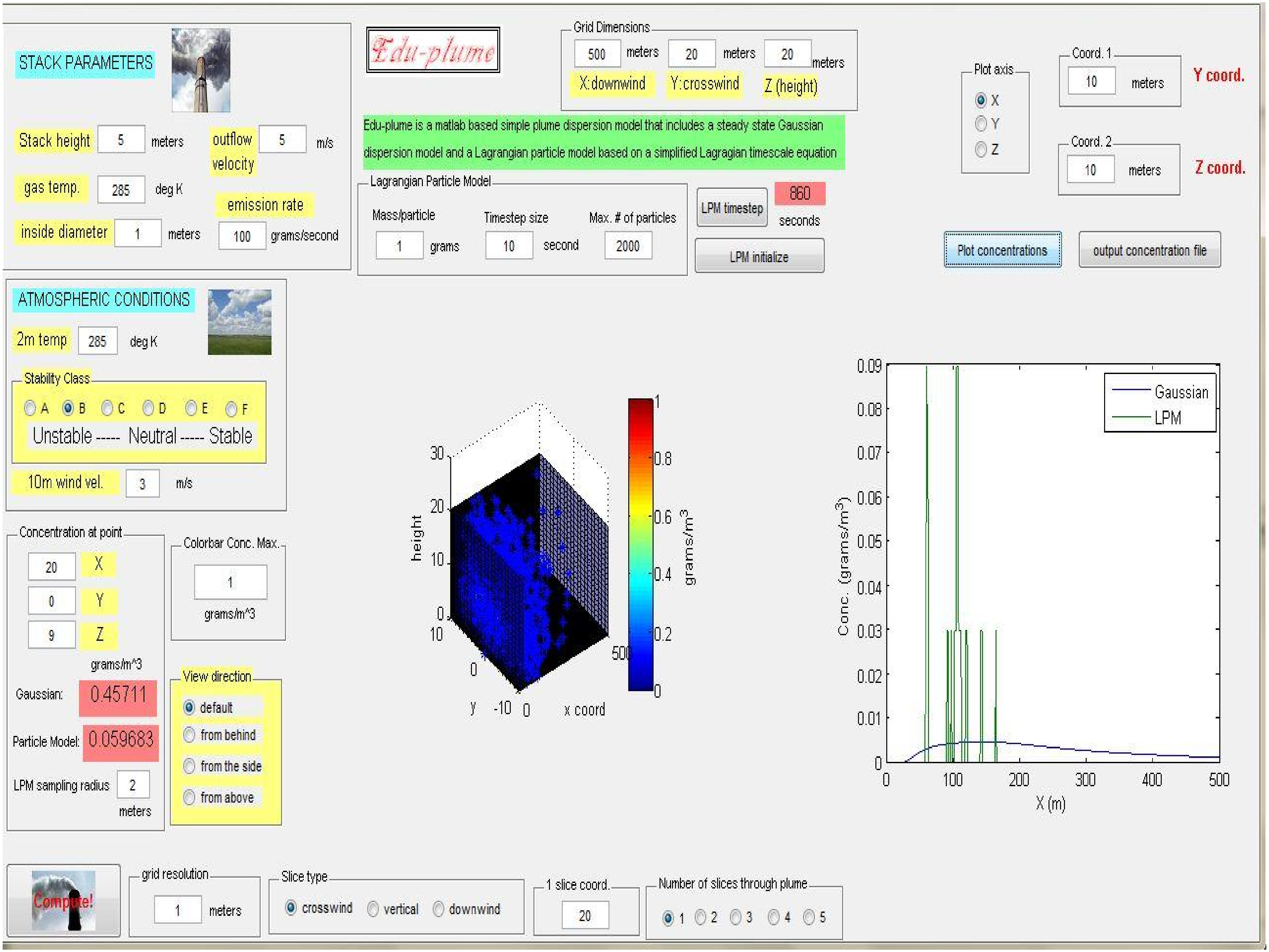
More realistic atmospheric inputs using a M-O based equation set would be beneficial also.

The wind profile equation used in this model is a simple exponential equation used a different exponent for each stability class.

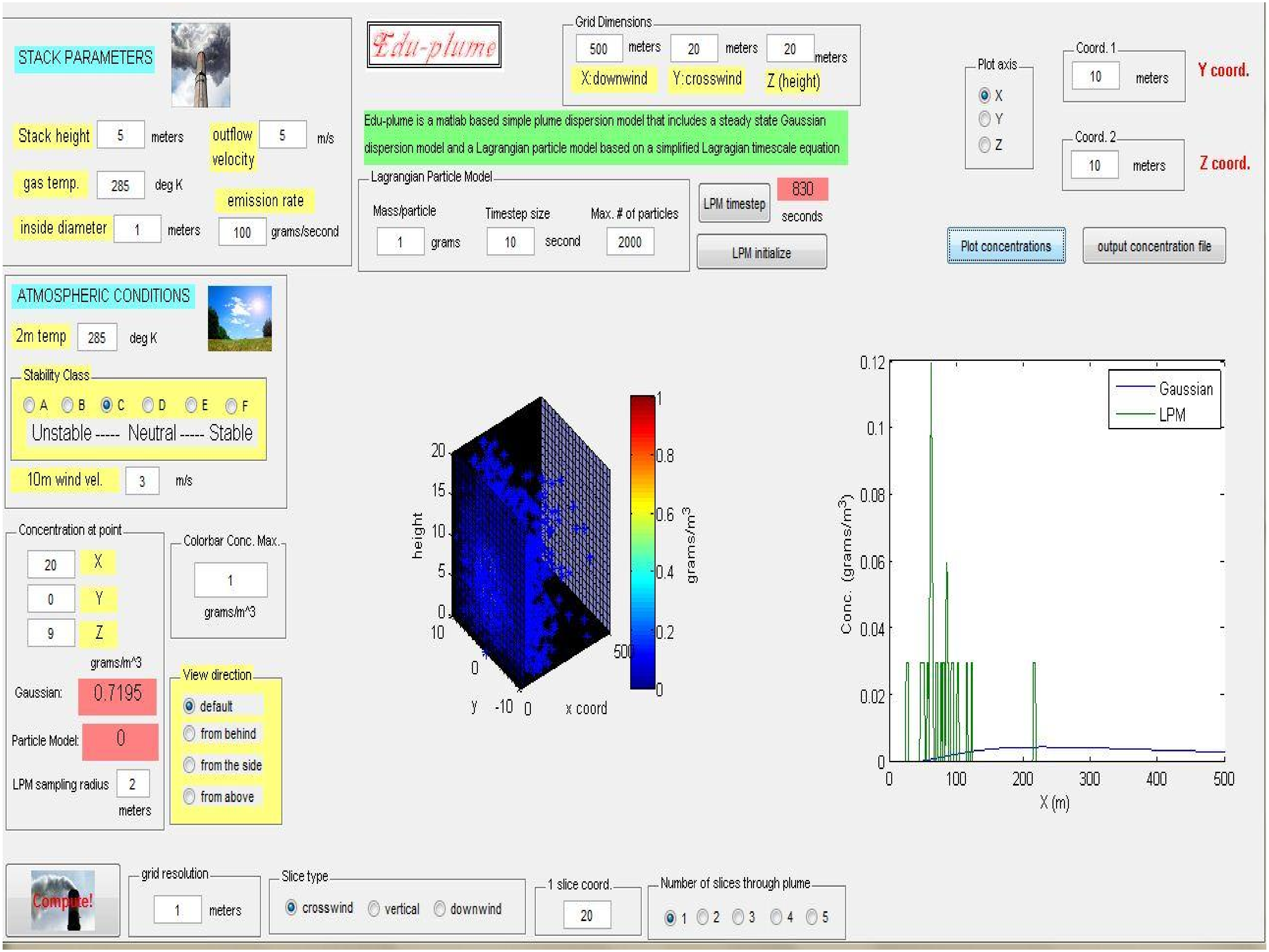
Friction velocity and epsilon are estimated using the neutral log-law-of the wall equation set and a friction length of 0.01 meters.

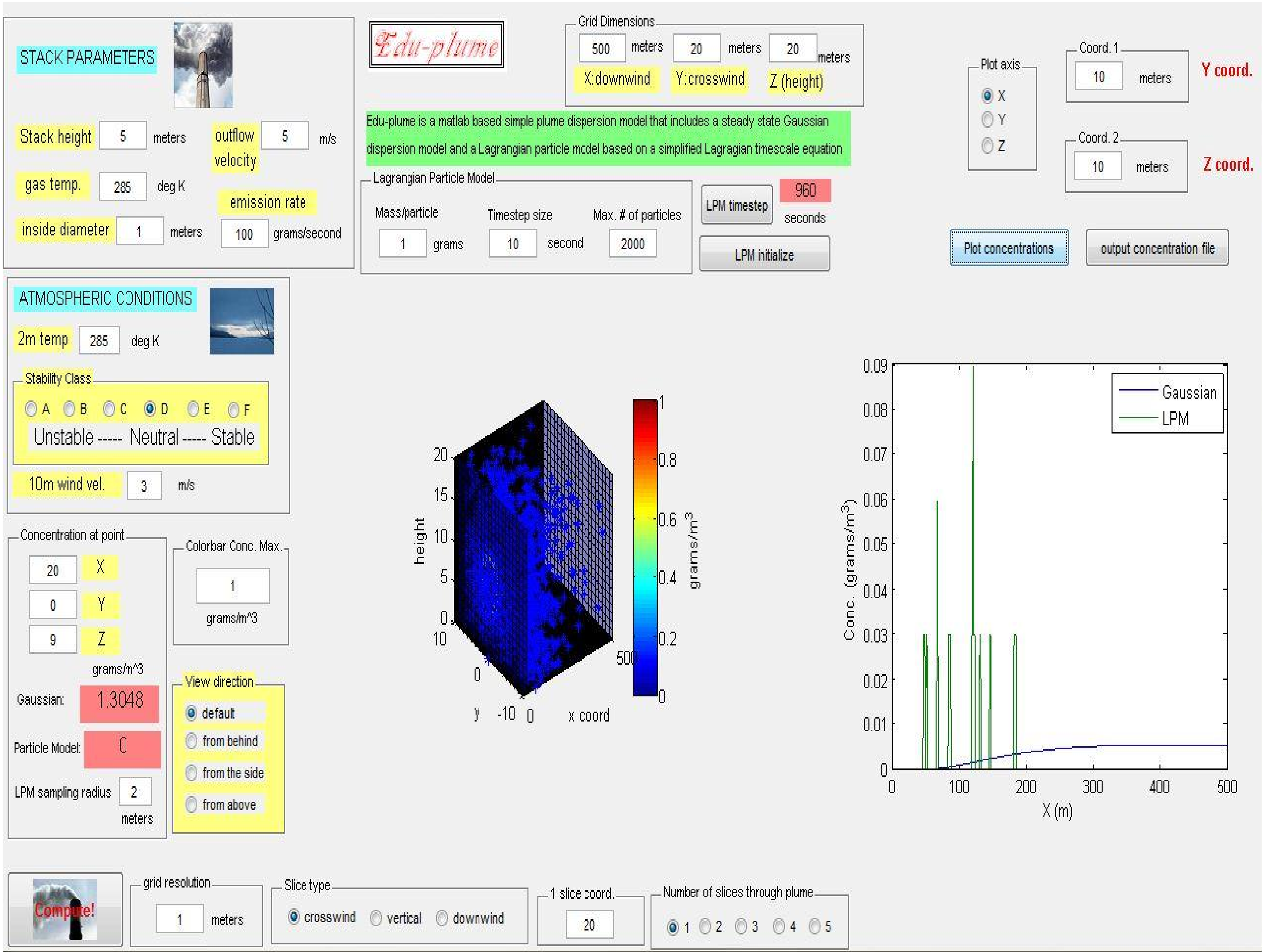
The model also includes Brigg's plume rise equation and a plume reflection scheme for both the Gaussian and LPM models.


STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
100
grams/second
Edu-plume
Grid Dimensions
500
meters
20
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
600
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A
B
C
D
E
F
Unstable ----- Neutral ----- Stable
10m wind vel.
3
m/s
Concentration at point
20
X
0
Y
9
Z
grams/m^3
Gaussian:
0.096414
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Conc. (grams/m^3)
X (m)
Gaussian
LPM
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1
2
3
4
5

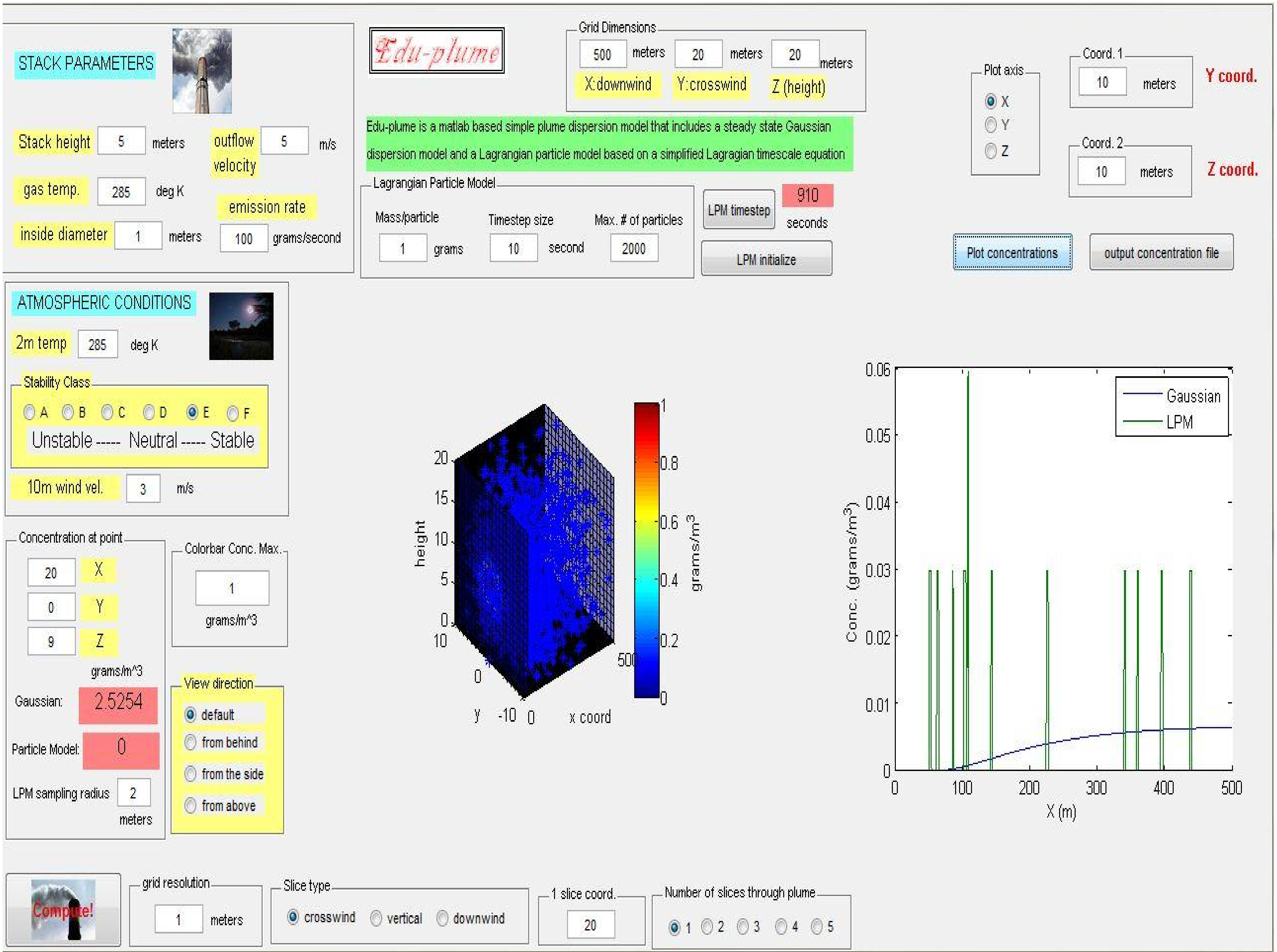


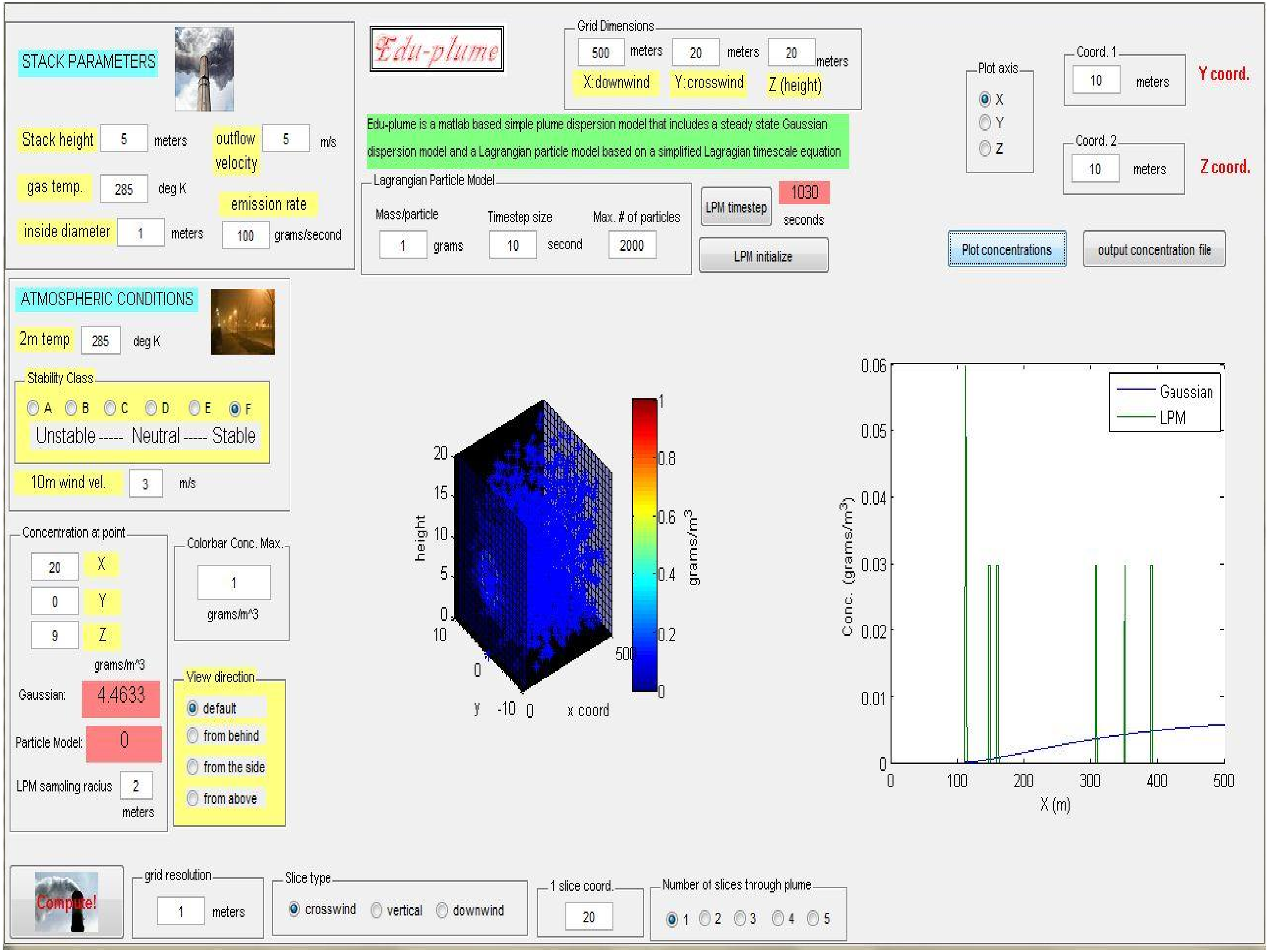
STACK PARAMETERS
Stack height 5 meters
outflow velocity 5 m/s
gas temp. 285 deg K
emission rate
inside diameter 1 meters
100 grams/second
Edu-plume
Grid Dimensions
500 meters 20 meters 20 meters
X:downwind Y:crosswind Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle 1 grams
Timestep size 10 second
Max. # of particles 2000
LPM timestep
860 seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1 10 meters
Y coord.
Coord. 2 10 meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp 285 deg K
Stability Class
A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel. 3 m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian: 0.45711
Particle Model: 0.059683
LPM sampling radius 2 meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m³
Gaussian
LPM
Conc. (grams/m³)
X (m)
Compute!
grid resolution 1 meters
Slice type
crosswind vertical downwind
1 slice coord.
20
Number of slices through plume
1 2 3 4 5


STACK PARAMETERS
Stack height 5 meters
outflow velocity 5 m/s
gas temp. 285 deg K
emission rate
inside diameter 1 meters
100 grams/second
Edu-plume
Grid Dimensions
500 meters 20 meters 20 meters
X:downwind Y:crosswind Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle 1 grams
Timestep size 10 second
Max. # of particles 2000
LPM timestep 830 seconds
LPM initialize
Plot axis X Y Z
Coord. 1 10 meters Y coord.
Coord. 2 10 meters Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp 285 deg K
Stability Class
A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel. 3 m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian: 0.7195
Particle Model: 0
LPM sampling radius 2 meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution 1 meters
Slice type
crosswind vertical downwind
1 slice coord. 20
Number of slices through plume
1 2 3 4 5

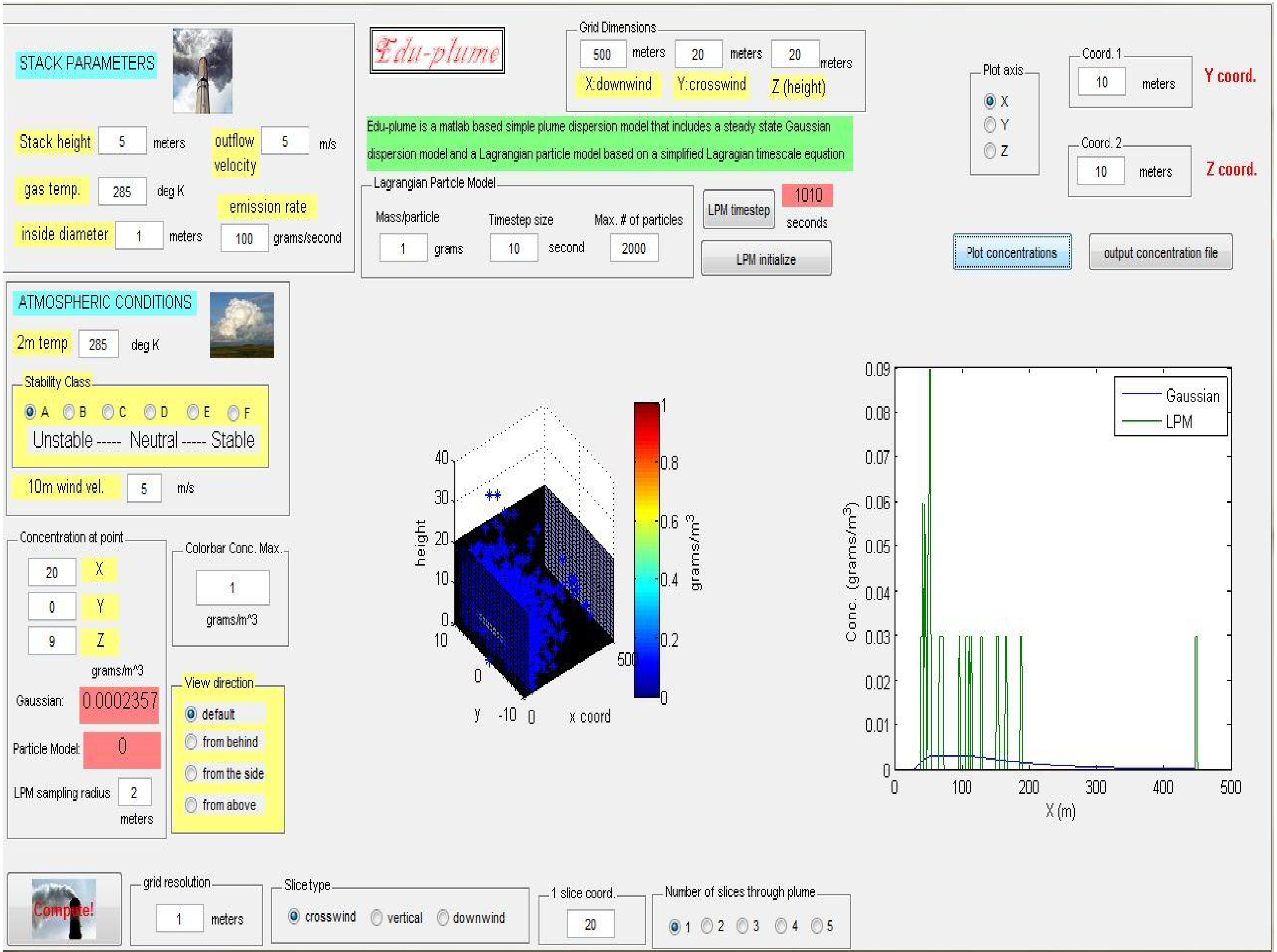


STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
100
grams/second
Edu-plume
Grid Dimensions
500
meters
20
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
960
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel.
3
m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian:
1.3048
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1 2 3 4 5


STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
100
grams/second
Edu-plume
Grid Dimensions
500
meters
20
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
910
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A
B
C
D
E
F
Unstable ----- Neutral ----- Stable
10m wind vel.
3
m/s
Concentration at point
20
X
0
Y
9
Z
grams/m^3
Gaussian:
2.5254
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Conc. (grams/m^3)
X (m)
Gaussian
LPM
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1
2
3
4
5



STACK PARAMETERS
Stack height 5 meters
outflow velocity 5 m/s
gas temp. 285 deg K
emission rate
inside diameter 1 meters
100 grams/second
Edu-plume
Grid Dimensions
500 meters 20 meters 20 meters
X:downwind Y:crosswind Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle 1 grams
Timestep size 10 second
Max. # of particles 2000
LPM timestep
1030 seconds
LPM initialize
Plot axis X Y Z
Coord. 1 10 meters
Y coord.
Coord. 2 10 meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp 285 deg K
Stability Class A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel. 3 m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian: 4.4633
Particle Model: 0
LPM sampling radius 2 meters
Colorbar Conc. Max. 1 grams/m^3
View direction
default
from behind
from the side
from above
height
grams/m^3
y
x coord
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution 1 meters
Slice type crosswind vertical downwind
1 slice coord. 20
Number of slices through plume 1 2 3 4 5



STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
100
grams/second
Edu-plume
Grid Dimensions
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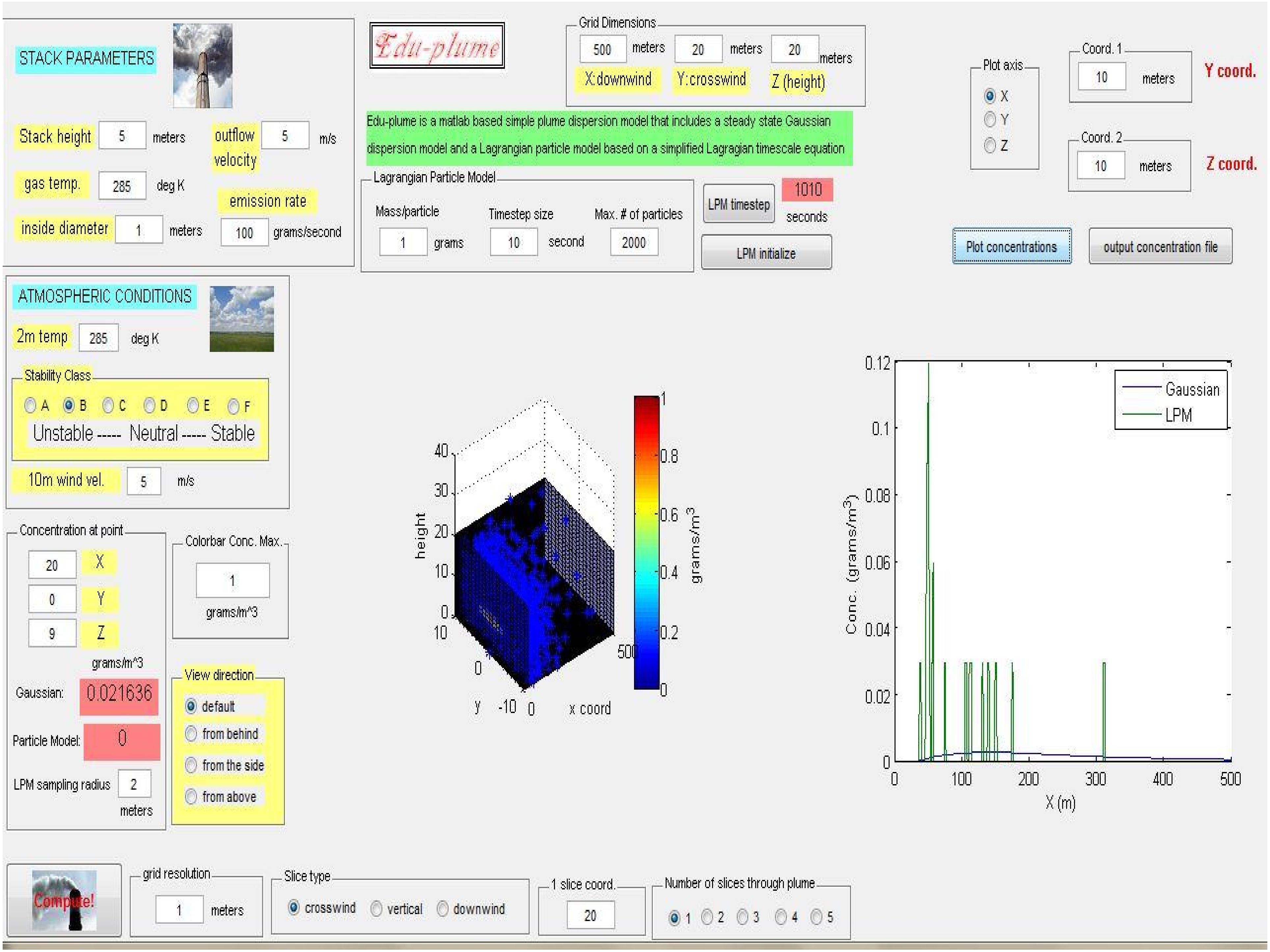
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
1010
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A
B
C
D
E
F
Unstable ----- Neutral ----- Stable
10m wind vel.
5
m/s
Concentration at point
20
X
0
Y
9
Z
grams/m^3
Gaussian:
0.0002357
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Conc. (grams/m^3)
X (m)
Gaussian
LPM
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1
2
3
4
5



STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
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meters
100
grams/second
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X:downwind
Y:crosswind
Z (height)
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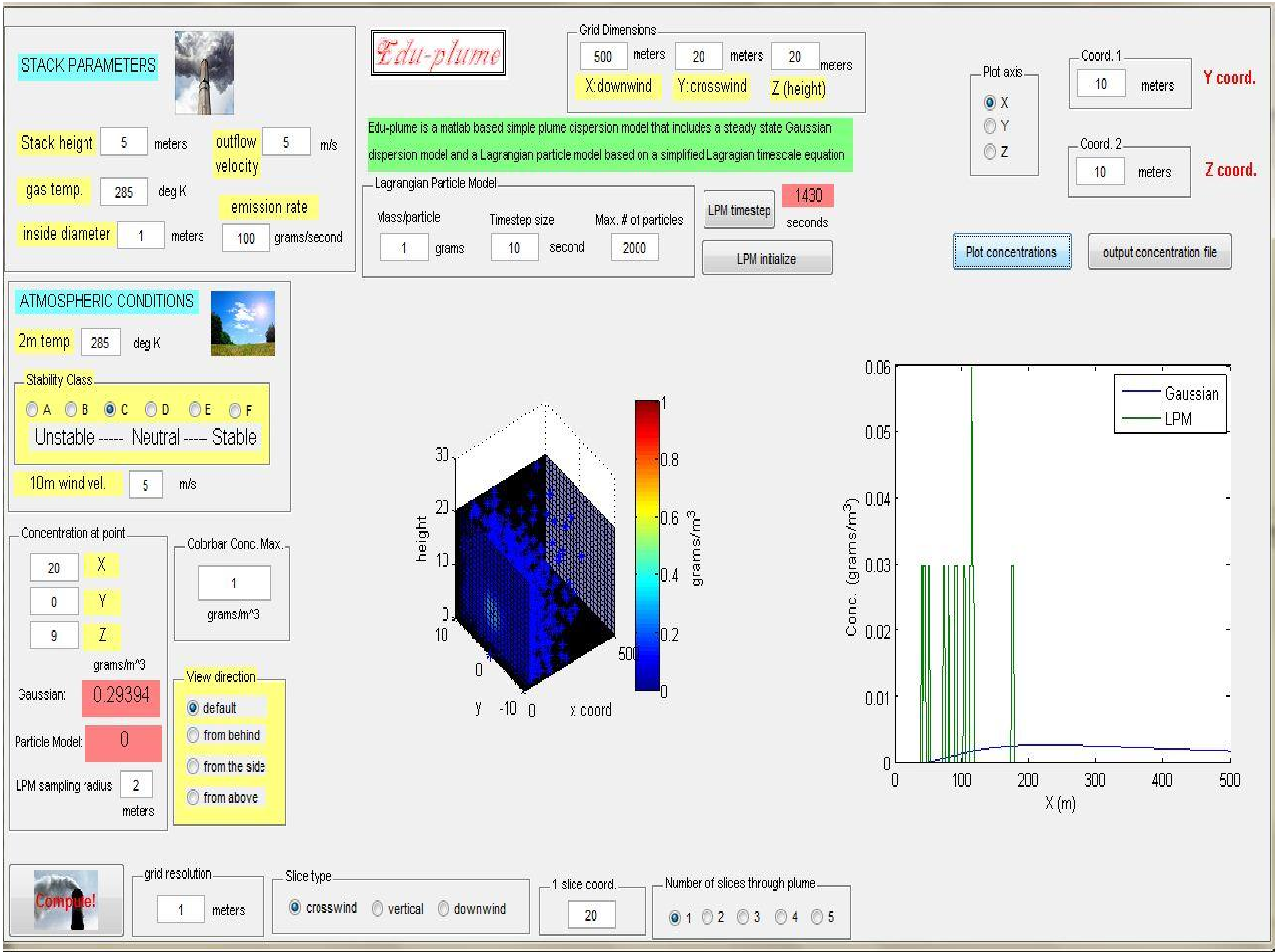
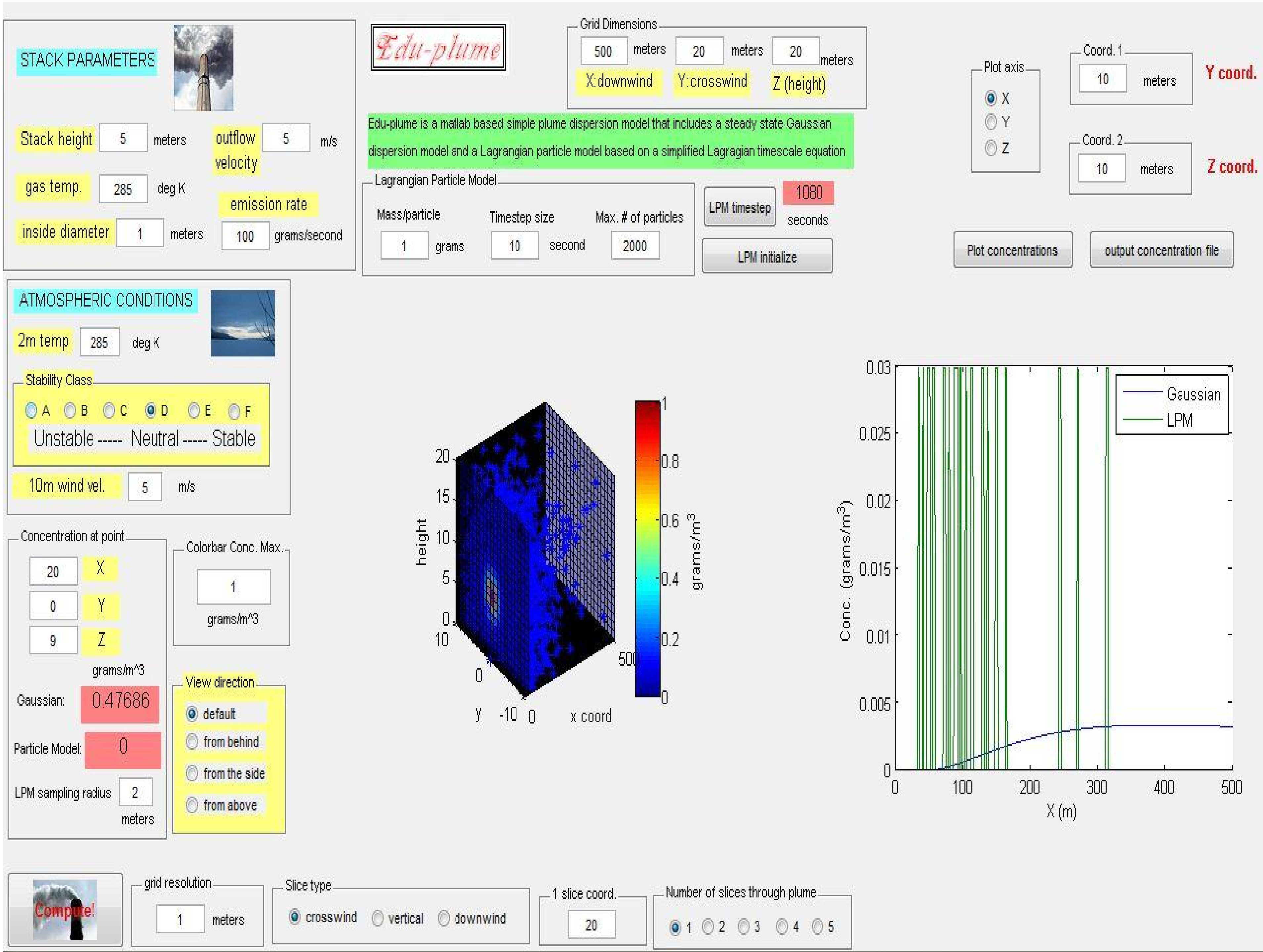
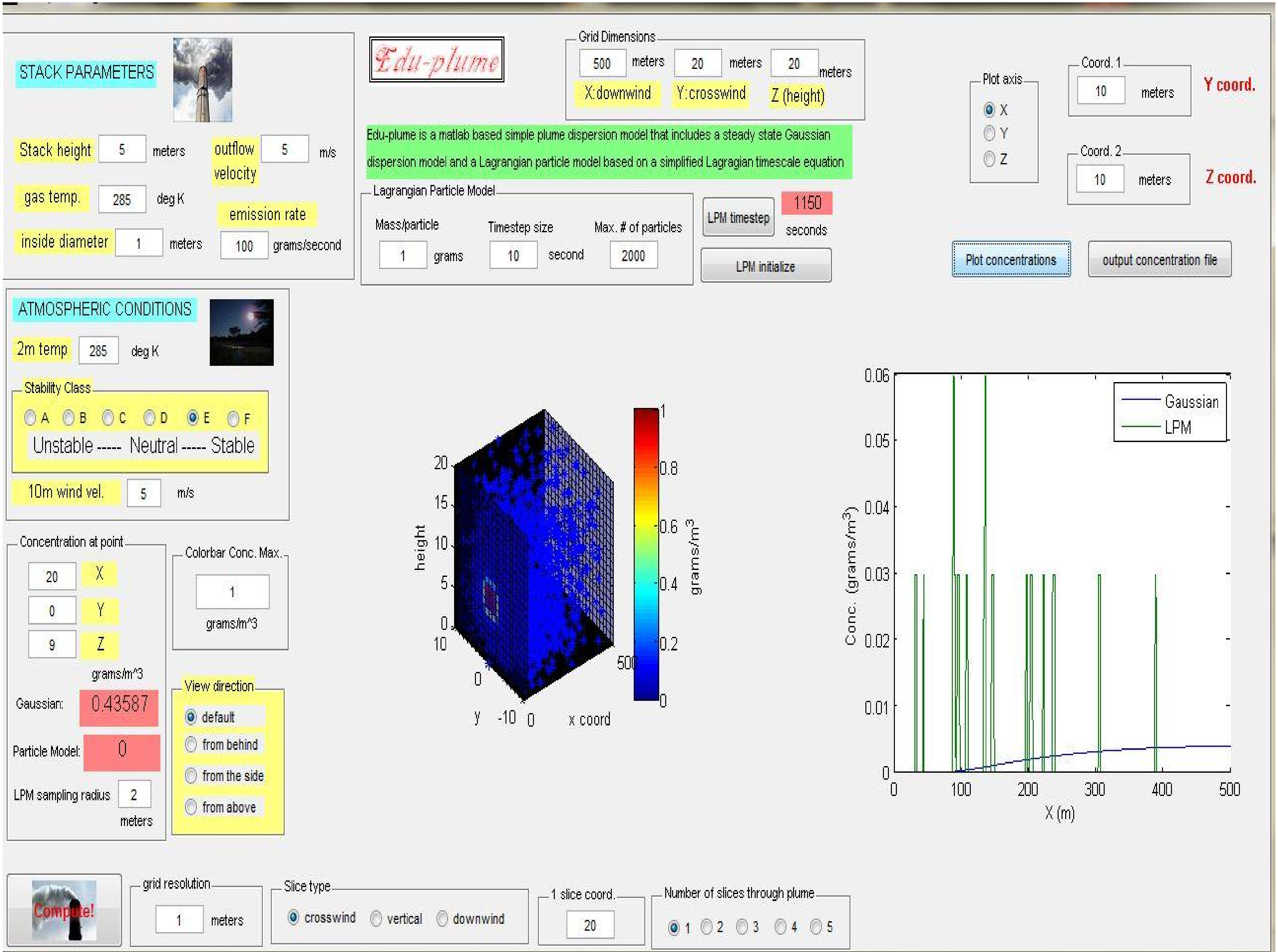
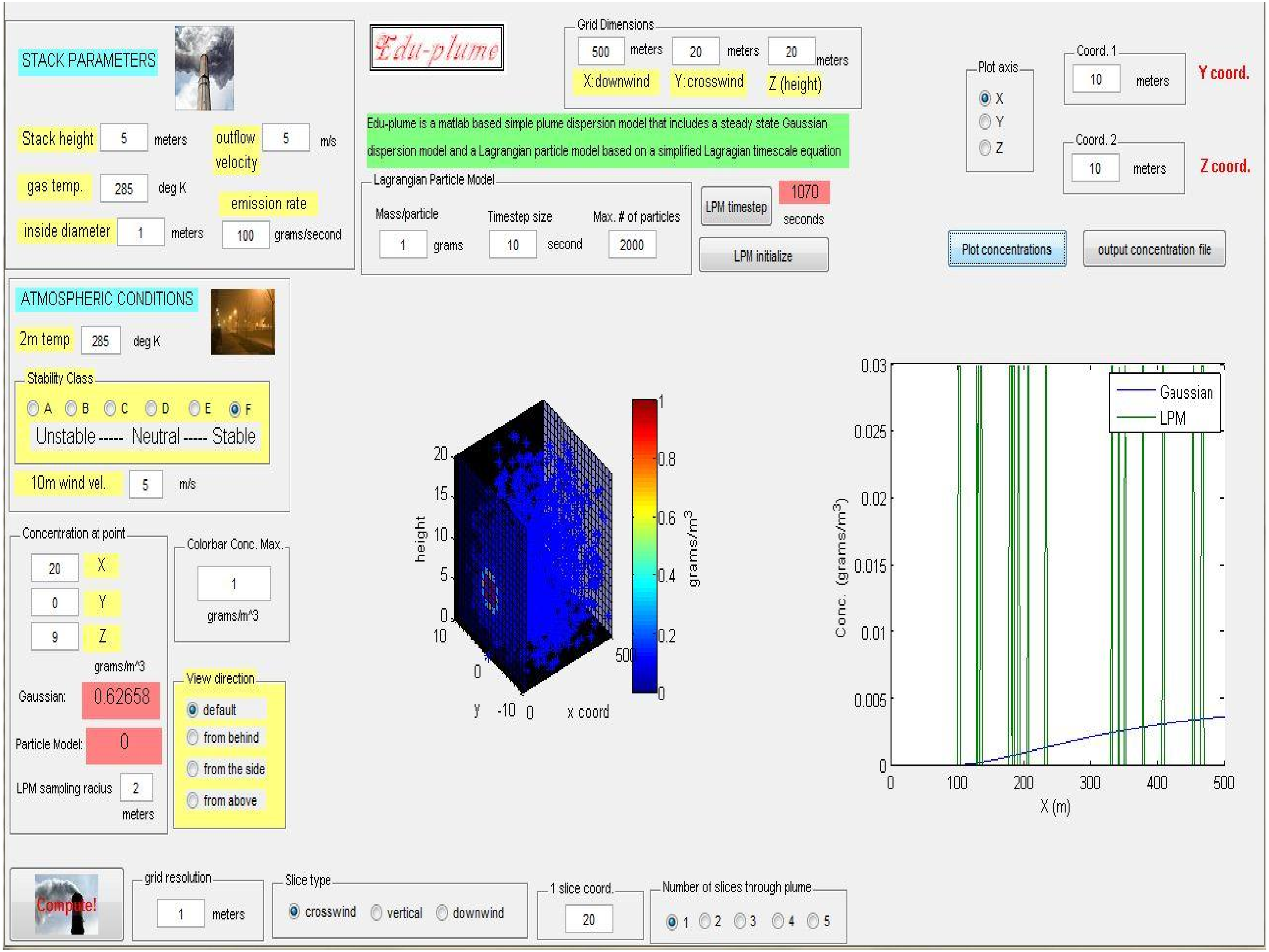
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
1010
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel.
5
m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian:
0.021636
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1 2 3 4 5

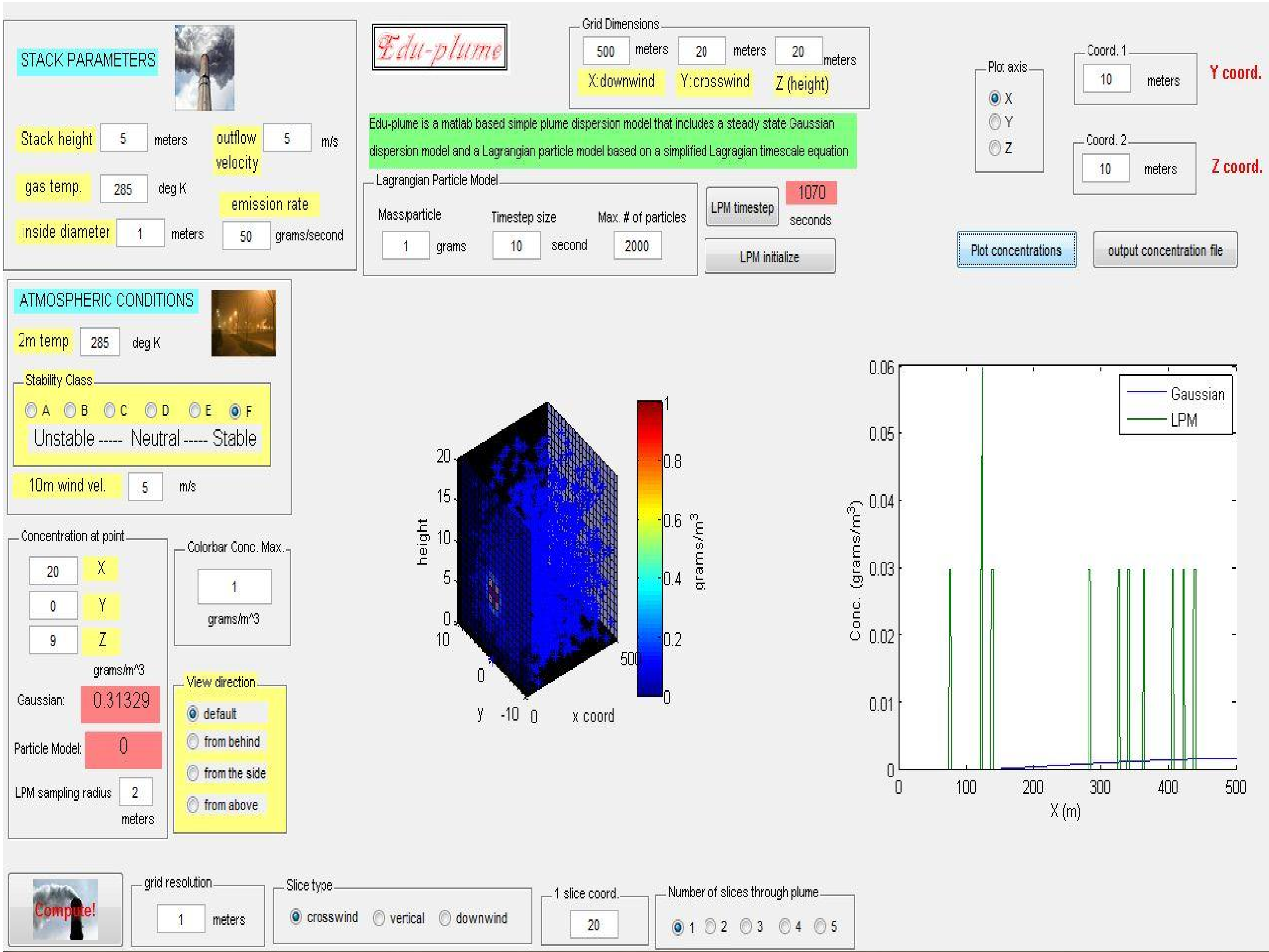

STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
100
grams/second
Edu-plume
Grid Dimensions
500
meters
20
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
1430
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel.
5
m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian:
0.29394
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Conc. (grams/m^3)
X (m)
Gaussian
LPM
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1 2 3 4 5


STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
100
grams/second
Edu-plume
Grid Dimensions
500
meters
20
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
1080
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel.
5
m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian:
0.47686
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1 2 3 4 5



STACK PARAMETERS
Stack height 5 meters
outflow velocity 5 m/s
gas temp. 285 deg K
emission rate
inside diameter 1 meters
100 grams/second
Edu-plume
Grid Dimensions
500 meters 20 meters 20 meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle 1 grams
Timestep size 10 second
Max. # of particles 2000
LPM timestep
1150 seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1 10 meters
Y coord.
Coord. 2 10 meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp 285 deg K
Stability Class
A B C D E F
Unstable ----- Neutral ----- Stable
10m wind vel. 5 m/s
Concentration at point
20 X
0 Y
9 Z
grams/m^3
Gaussian: 0.43587
Particle Model: 0
LPM sampling radius 2 meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution 1 meters
Slice type
crosswind vertical downwind
1 slice coord.
20
Number of slices through plume
1 2 3 4 5


STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
100
grams/second
Edu-plume
Grid Dimensions
500
meters
20
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
Lagrangian Particle Model
Mass/particle
1
grams
Timestep size
10
second
Max. # of particles
2000
LPM timestep
1070
seconds
LPM initialize
Plot axis
X
Y
Z
Coord. 1
10
meters
Y coord.
Coord. 2
10
meters
Z coord.
Plot concentrations
output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A
B
C
D
E
F
Unstable ----- Neutral ----- Stable
10m wind vel.
5
m/s
Concentration at point
20
X
0
Y
9
Z
grams/m^3
Gaussian:
0.62658
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1
2
3
4
5


STACK PARAMETERS
Stack height
5
meters
outflow velocity
5
m/s
gas temp.
285
deg K
emission rate
inside diameter
1
meters
50
grams/second
Edu-plume
Grid Dimensions
500
meters
20
meters
20
meters
X:downwind
Y:crosswind
Z (height)
Edu-plume is a matlab based simple plume dispersion model that includes a steady state Gaussian dispersion model and a Lagrangian particle model based on a simplified Lagragian timescale equation
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Coord. 1
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output concentration file
ATMOSPHERIC CONDITIONS
2m temp
285
deg K
Stability Class
A
B
C
D
E
F
Unstable ----- Neutral ----- Stable
10m wind vel.
5
m/s
Concentration at point
20
X
0
Y
9
Z
grams/m^3
Gaussian:
0.31329
Particle Model:
0
LPM sampling radius
2
meters
Colorbar Conc. Max.
1
grams/m^3
View direction
default
from behind
from the side
from above
height
y
x coord
grams/m^3
Gaussian
LPM
Conc. (grams/m^3)
X (m)
Compute!
grid resolution
1
meters
Slice type
crosswind
vertical
downwind
1 slice coord.
20
Number of slices through plume
1
2
3
4
5

THANK YOU !!!