

Raw Data Application

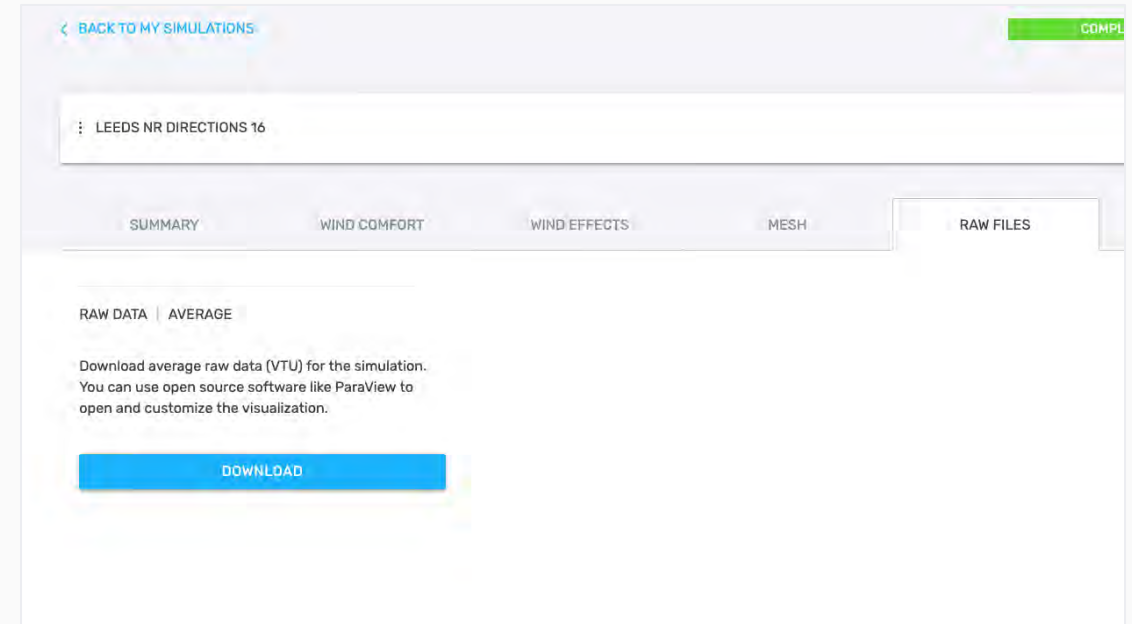
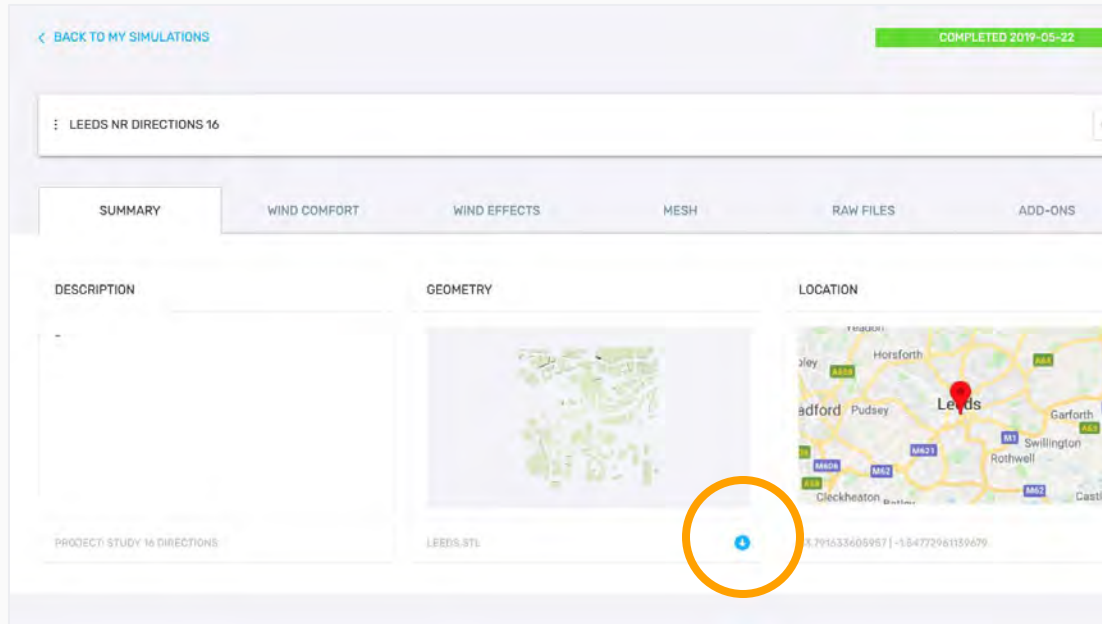
Instruction on how to use a .VTU file to generate additional visualizations and analysis for Wind Simulations with Ingrid Cloud.



Software Requirement

- We recommend 2 open source software for visualizing simulation's raw file: VisIt and ParaView. This instructions use Paraview Version 5.4.1. [Free download link](#). We recommend it because it's easier to install, has an intuitive interface and better documentation.
- Alternatively, you can also use VisIt (<https://wci.llnl.gov/simulation/computer-codes/visit>). VisIt has a bigger capacity and is more appropriate for bigger data and super computers.
- Both software are open source and enable to save all the settings so that the same images can be re-created (Paraview: .pvsm , VisIt: .session). This means you can setup once the visualization property and use multiple raw files to apply the same setups (In Paraview got to File > Save Session > Reload Session)
- For detailed tutorial go to: <https://www.paraview.org/tutorials/>

Get raw data and 3D model



1. Log in to your Ingrid Cloud account

2. Summary > Download .STL

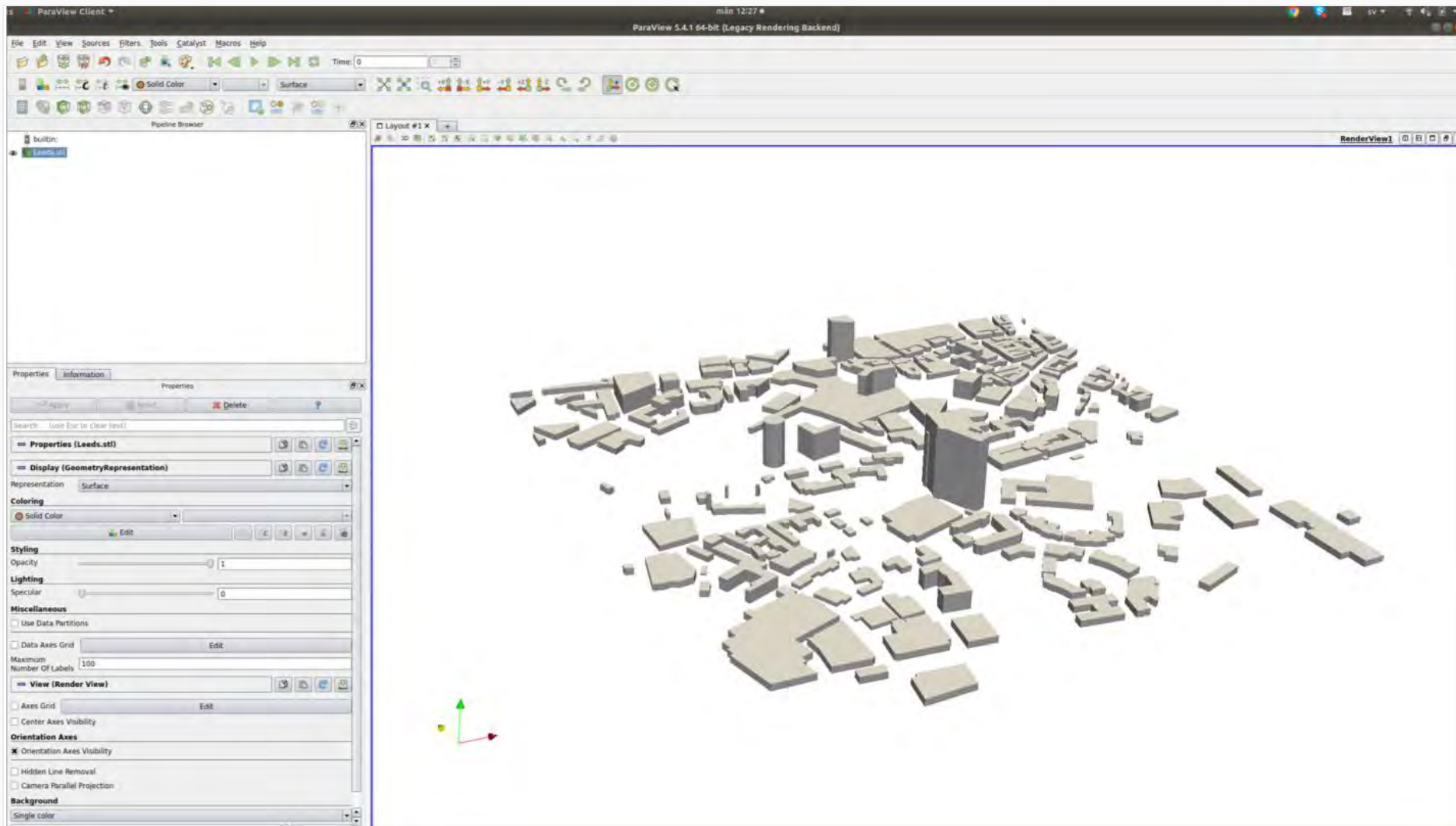
Note: Note: Since the normalized velocity field is calculated, the model is scaled. Therefore, you have to download the model from Ingrid Cloud, instead of using the original geometry. Please contact support@ingridcloud.com to get the normalization parameters for your model.

3. Raw Files > Download .VTU

1

2

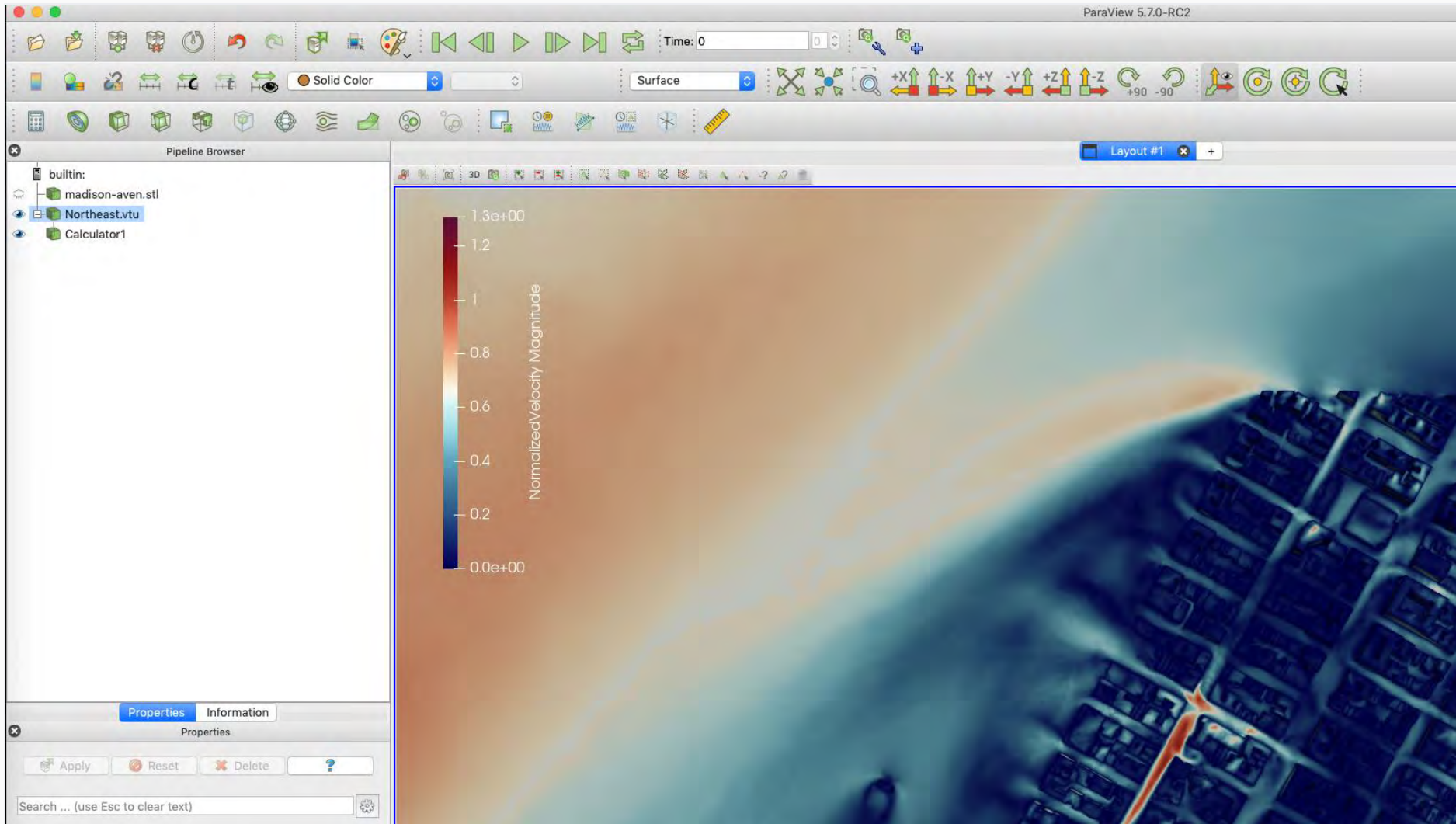
3



In Paraview's user interface, it will be needed to navigate through:

1. Menu Bar
2. Pipeline Brower
3. Properties

1



2

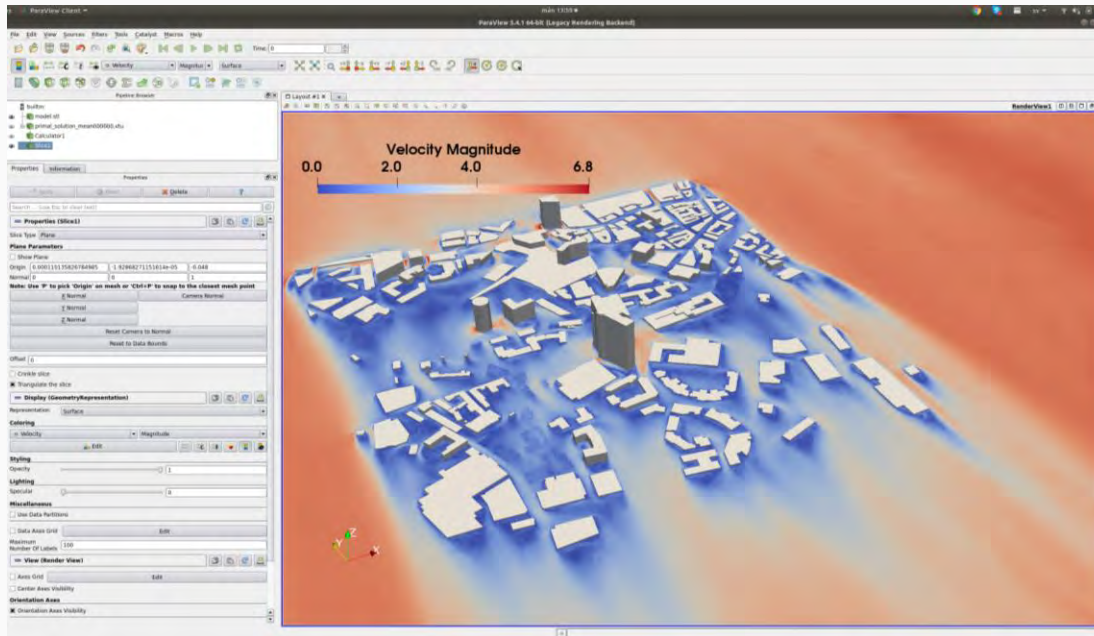
Add Slices to show the velocity magnitude

1. File > Open
Choose the .VTU file you want to analyze.

Note: for simulations with multiple wind directions, one file per wind direction will be found in the raw data folder. You have to know upfront, which direction you want to analyze.

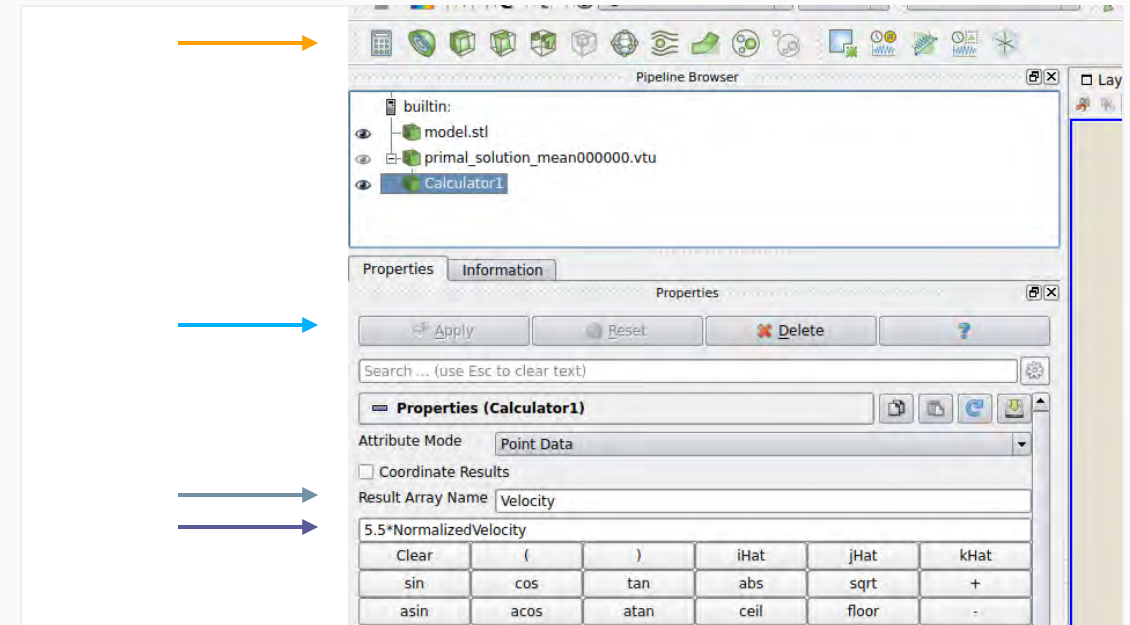
2. Click Apply to load the file.

Calculate the velocity of interest

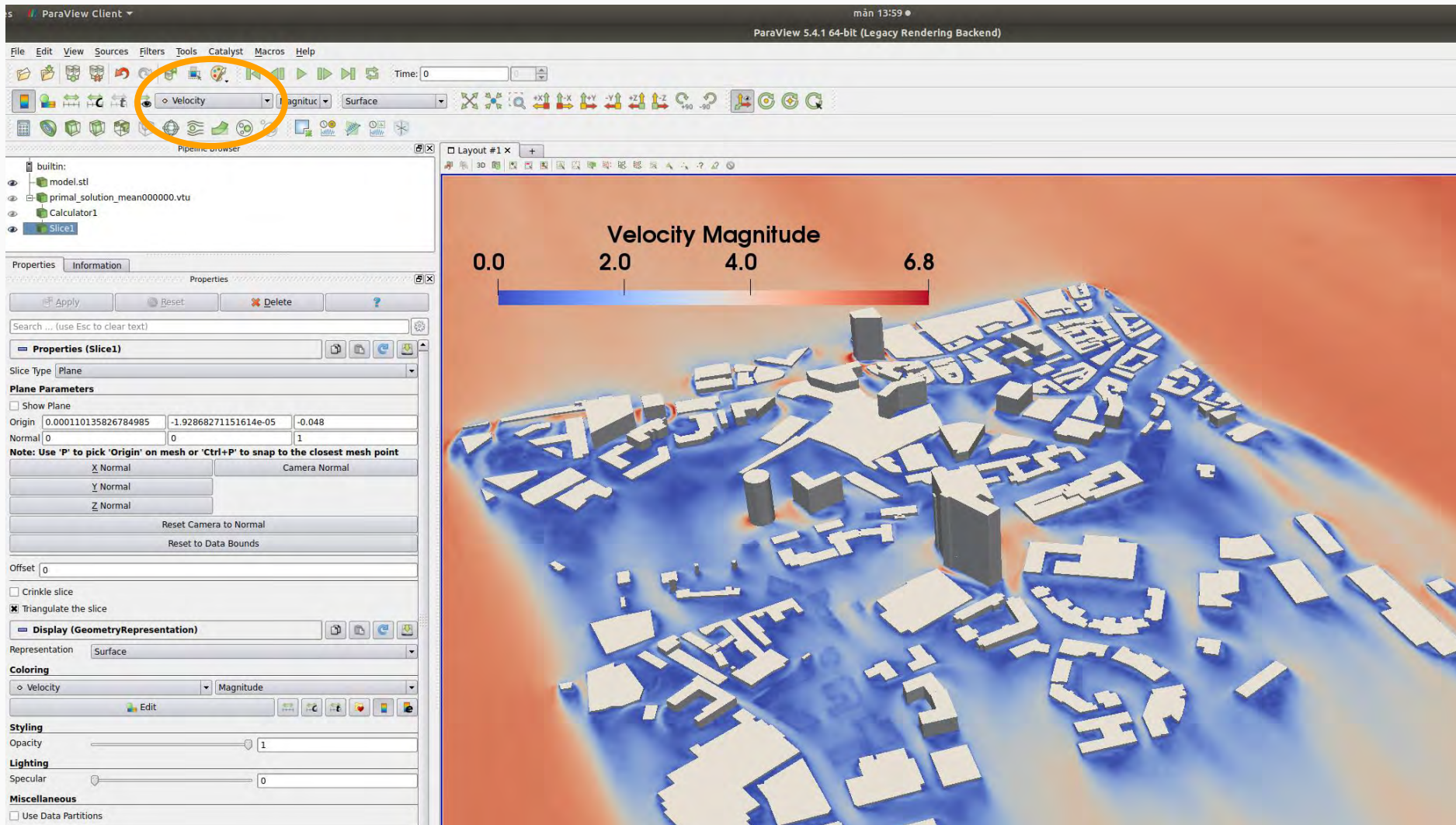


You must know in advance which is your velocity of interest for this analysis (e.g. max. velocity or mean velocity in the field). To retrieve the velocity of interest's magnitude, go back to your Ingrid Cloud report page and read the summary of your simulation.

- Wind Comfort App > Summary > Wind Data > Read the Graph and retrieve the velocity of interest.
- Wind Tunnel and Wind Load App > Summary > Input Parameters



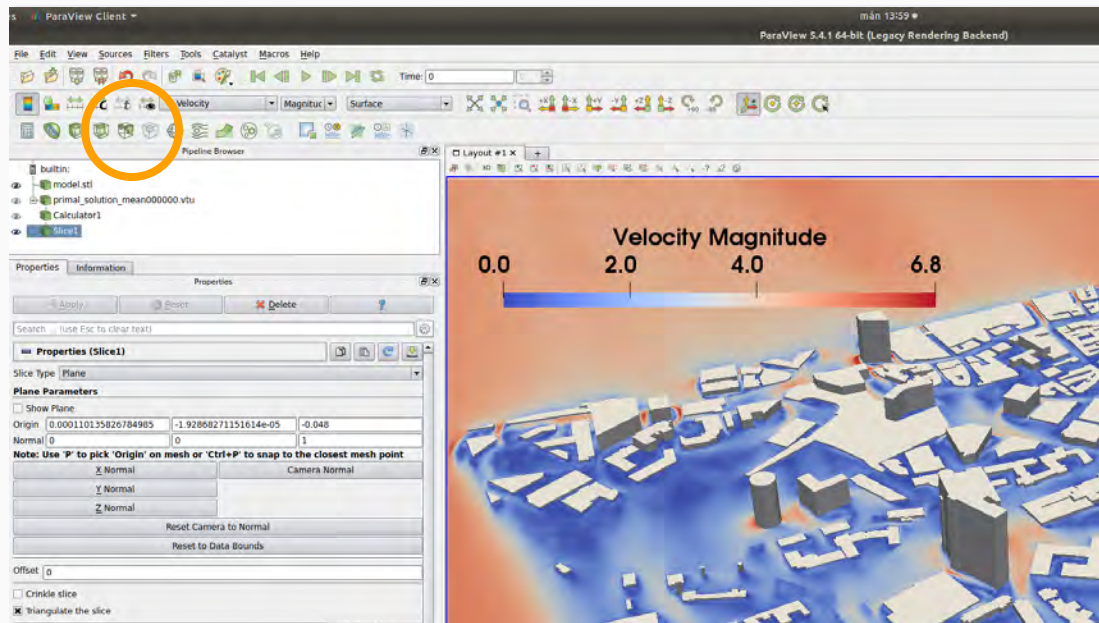
2. In Paraview choose **Calculator**. Multiply the **Velocity of Interest** for the **Normalized Velocity**, chose a **Result Array Name** (e.g. "Velocity") and click **Apply**.



Select which property to visualize.

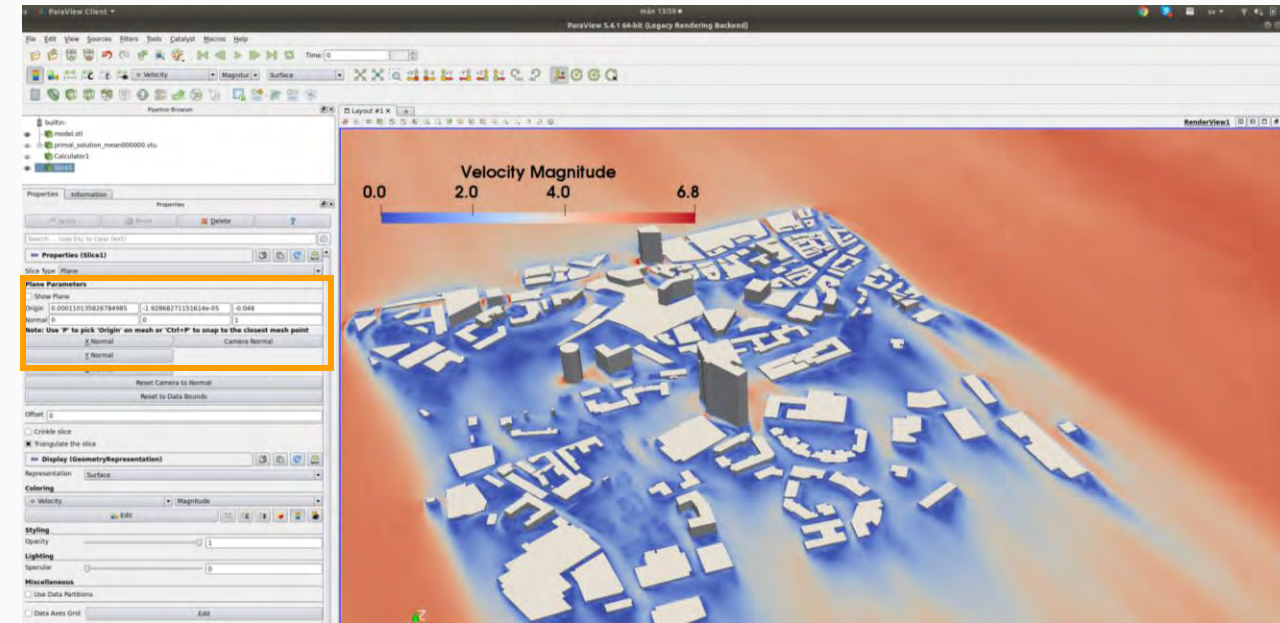
Choose your newly created velocity from the dropdown list.

Insert Slice



Slices will be used to show the velocity magnitude.

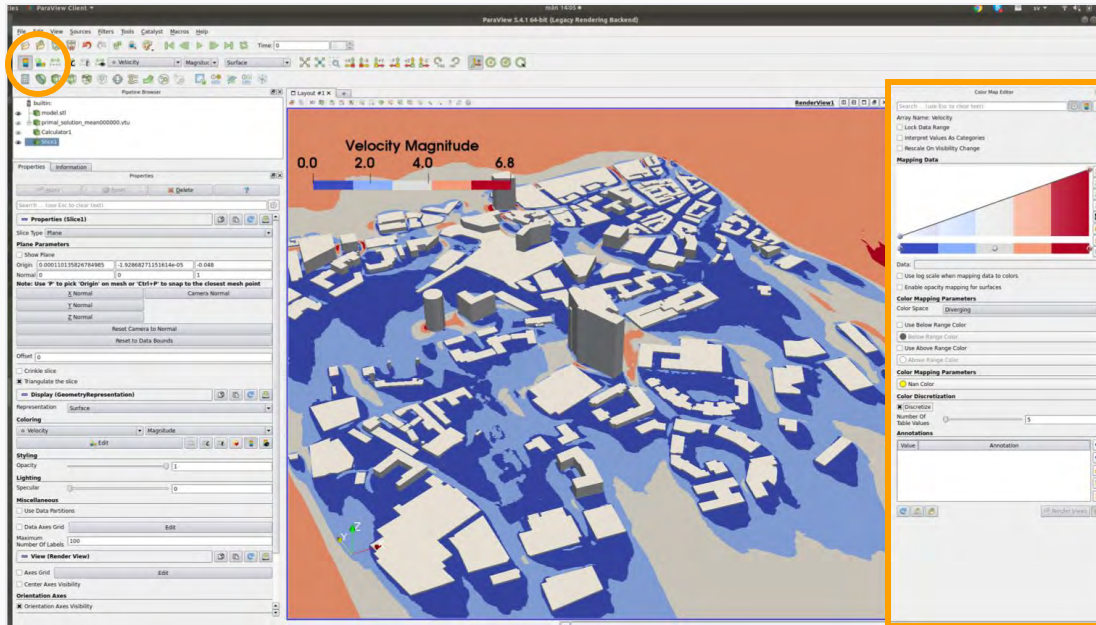
In the properties for Slice, the height of the slice and its normal can be adjusted.



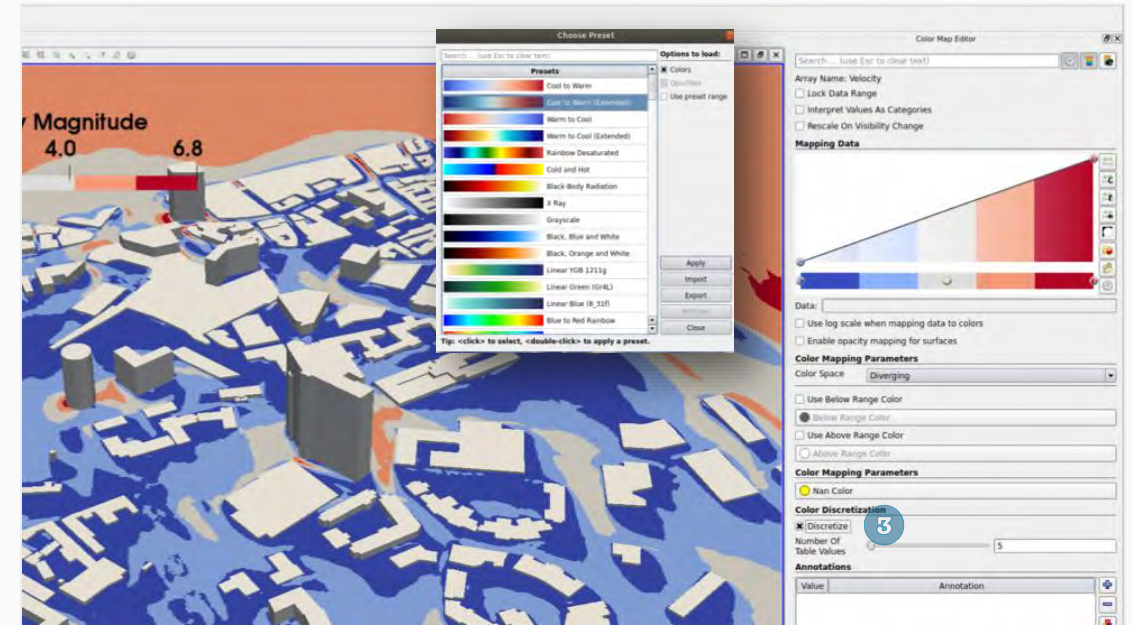
Since the model is scaled and the bottom of the model is not necessary 0 due to the automatization, the following conversion is needed: $x = z_{min} + \text{height} * (1/\text{scale})$

- HEIGHT is the height of the actual level of interest (e.g. pedestrian height: 1.75m)
- ZMIN is the bottom of the simulation model
- SCALE is the size of the scaling

Discrete Magnitude to visualize area of high velocity



Chose Edit Color Map (upper left corner) to enable the Color Map Editor screen.



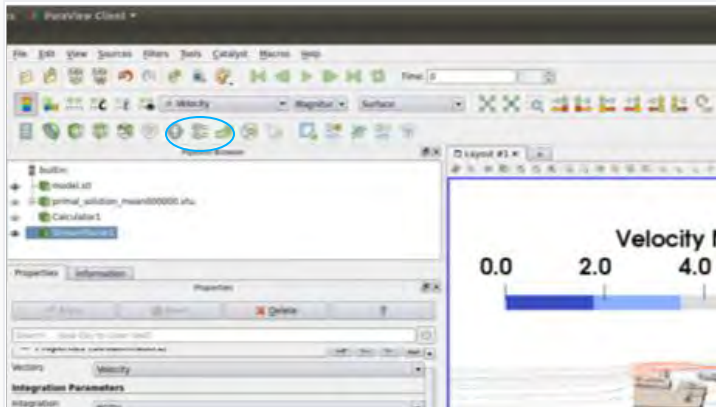
Edit the following properties to personalize your visualization

1. Edit Color Legend
2. Choose Preset to choose from different color schemas
3. Discretize to choose the number of discrete colors

Various color tables can be chosen

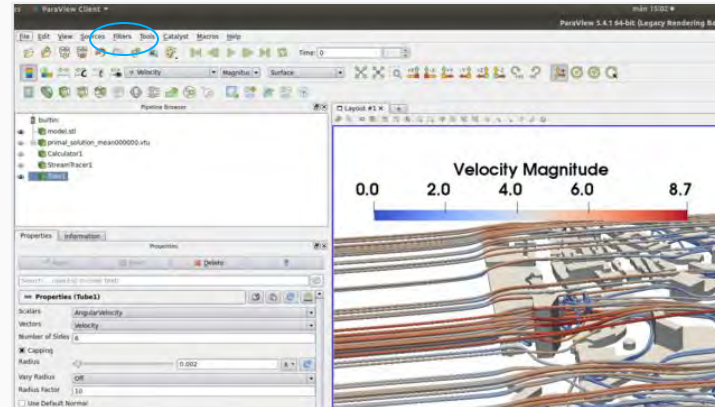
Number of discrete colors can be chosen

Streamlines

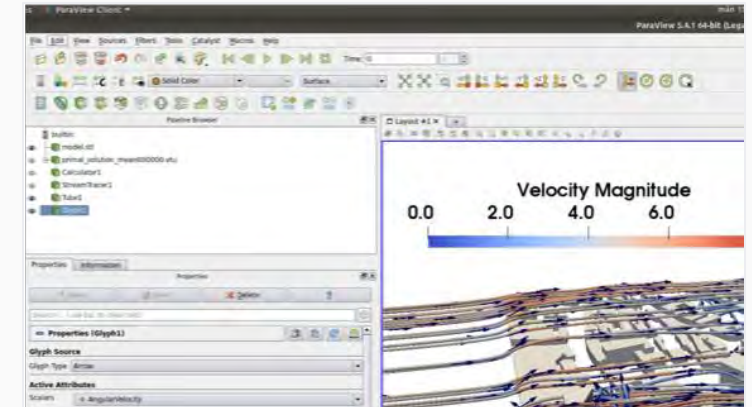


For visualizing instantaneous pathways of wind particles, Streamlines can be used, with which particles on a line are seeded and followed.

In the Menu Bar, click on Stream Tracer.

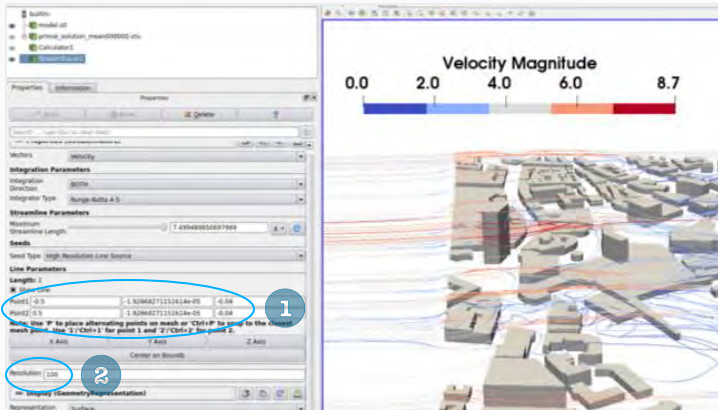


Go to Filter > Alphabetical > Tube to enable editing streamlines thickness



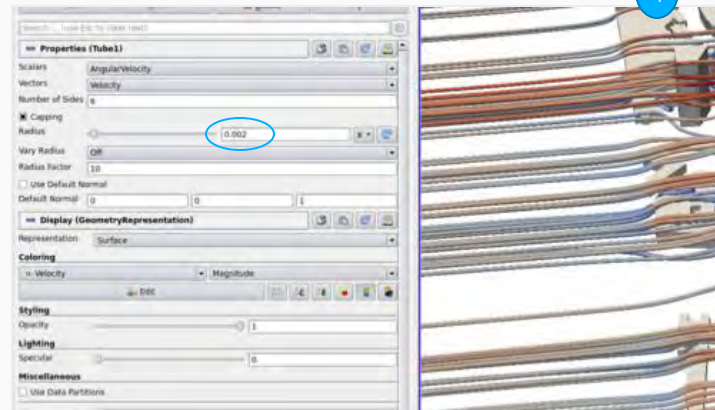
Go to Filter > Alphabetical > Glyphs to indicate direction of velocity

Streamlines

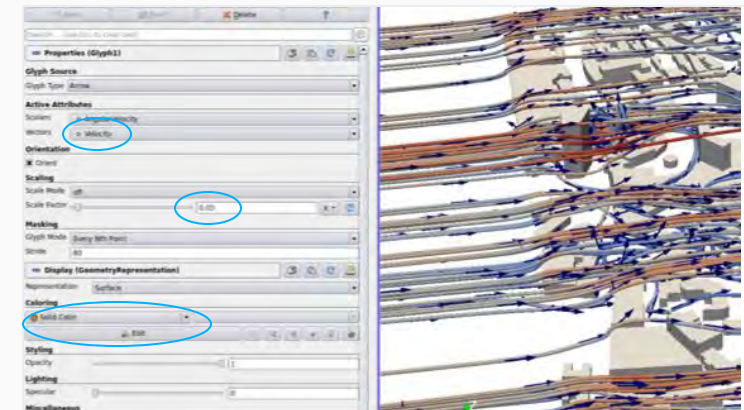


1. Find the the two points which define the line for seeding the points.

2. Number of Streamlines. We can recommend something within the range of 20 and 80.



Edit thickness of streamlines.



Choose quantity and size of vectors.



Appendix

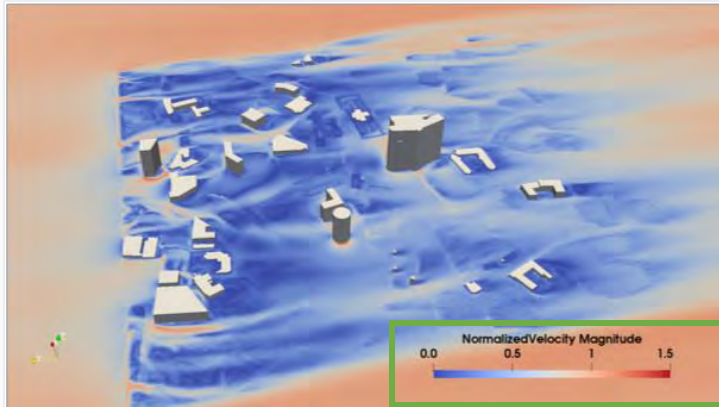
Normalized Velocity

- The velocity u is visualized with the Normal Velocity (i.e. u at the reference height 10m is 1 m/s).
- This makes it possible to adjust the results to different cases as yearly mean velocity, mean velocity during summer, velocity when it rains etc).
- The visualization stays the same, but the interval for the color table needs to be adjusted as illustrated in the example below, where
the mean velocity during the year is 8.5 m and during spring 10.5 m

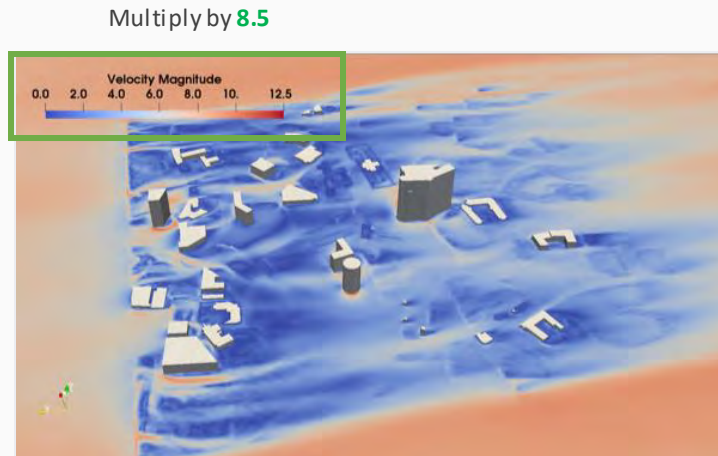
www.ingridcloud.com
support@ingridcloud.com
Malmskillnadsgatan 32



Normalized Velocity



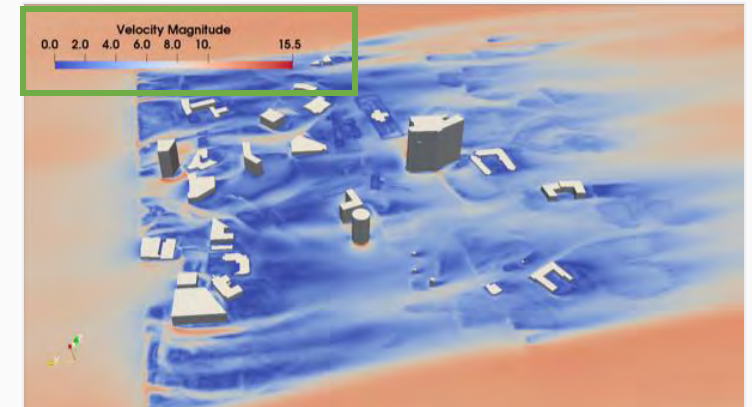
Normalized Velocity: $U(10m)=1$ m/s,
color table interval = $[0, 1.5]$



Mean Velocity: $U(10m)=8.5$ m/s, color table interval = $[0, 12.5]$.

It the average, it can blow up to **8.5** m/s from north.

Multiply by **10.5**



Mean Velocity in spring: $U(10m)=10.5$ m/s, color table interval = $[0, 15.5]$.

During spring, it the average, it can blow up to **10.5** m/s from north.

Disclaimer

- This document is an overview, it does not intend to be an in-depth tutorial. If you have no-knowledge within Wind Simulations or Scientific Visualization, results generated can be false and non-reliable.
- Ingrid Cloud offers consultation services to generate extra visualizations or analyse raw data from CFD Simulations.
- Please, contact us if you want to learn more about this instructions or need an extra help with your simulation process.