



Sparrowhawk3D

Cumulus S3D

for CARRARA

Version 0.21

CumulusS3D is a Volumetric Cloud shape for Carrara. The cloud form contains up to 9 cumulus clouds in rows. Animated clouds will roll continuously and can be set to evolve, grow and fade.

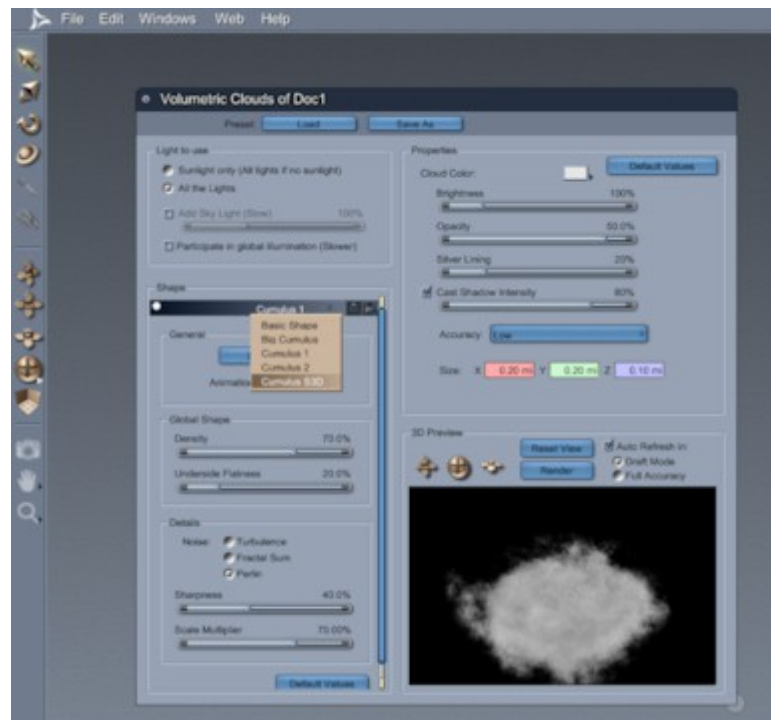
To install the plugin extract the contents of the compressed zip package into the Carrara\Extensions sub-folder. Optionally create a \Sparrowhawk3D\ subfolder to manage all the plugins. To remove the CumulusS3D plugin users must delete the CumulusS3D.mcx,CumulusS3D.dat CumulusS3D.txt files.

Macintosh users should open the Carrara installation folder (typically /Applications/Carrara). Right-click on the Carrara application and then choose "Show Package Contents". Navigate to "Contents/MacOS/Extensions" then copy the the CumulusS3D.mcx,CumulusS3D.dat and the CumulusS3D.txt files into that folder.

Extract presets into any folder or under ../Carrara/Presets/VolumetricClouds. In the Browser tray with the Objects tab open choose Add Folder from the File/Folder Menu icon and locate the extracted folder. Choose Clouds as the display type when prompted by the dialog.

Using the CumulusS3D Plugin

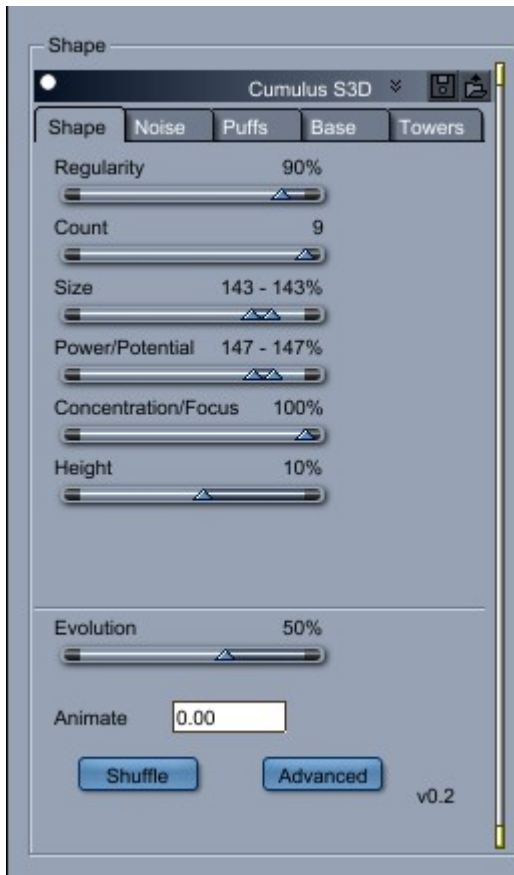
Add a volumetric cloud to the scene. Select Cumulus S3D from the Shape list (where the default cloud is Cumulus 1).



Double click on the Volumetric Clouds window title to reduce the size for a faster preview in the model room. Turn off the Auto Refresh while adjusting multiple settings to prevent frequent updates in the preview window.

For realistic world altitudes cumulus clouds should be raised so the base of the cloud volume is around 2,500ft (750m). Altitudes can range from 1,500 to 10,000 ft. Change the size from the default 0.2x0.2x0.1 mi to 1.0x1.0x.05mi for the Cumulus S3D cloud form which creates 3x3 rows.

Parameters



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[Puffs](#)
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The **Evolution** setting controls how the clouds grow from nothing to reach their full density and potential. At Evolution 0% the clouds will barely be visible. When the Evolution is at 50% the clouds will reach full density and size. When the Evolution is at 100% the clouds will fade to nothing. Key frame the Evolution within the range during animations. Typically set the Evolution at 50% for stills. The Concentration/Focus setting allows for individual clouds to evolve earlier or later within the Evolution range.



Evolution 5% (Concentration Focus 100%)



Evolution 50% (Concentration Focus 100%)

The **Animate** value sets the 4th dimension for the Noise and the movement speed of the puffs within the cloud form. For realistic results and normal cloud movement over time the animate value should be equal to the number of seconds that have passed in the scene. Set the animation to double the scene time in seconds for more active clouds or to half the scene time for slow moving still clouds. For a time lapse effect use 10 times the number of seconds in the scene timeline. A difference in speed between the noise and the rolling clouds can be set in the Advanced settings.

The **Shuffle** button can be used to fully change all of the random values that shape the clouds in the form.

The **Advanced** button opens up a dialog with additional settings for the cloud form. (*see below*)

Shape Parameters

The Shape Parameters control how the clouds are arranged in the volume and how large and varied they are formed.

Regularity is used to control how neatly the clouds form into rows. Values towards 100% Regularity will line the clouds up into perfect rows. Values with low Regularity towards 0% will move into a more random arrangement.



Regularity 100%



Regularity 0%

There is a maximum **Count** of 9 cumulus clouds in the form. The number of clouds can be reduced to 1. The placement of the clouds is random. The Position Override in the Advanced dialog can be used to create a custom cloud pattern.



Count 6



Position Override

The **Size** sets the random range of how small or large each cloud can be. At 100% the clouds will be touching each other with no gaps between the rows. Cloud sizes above 100% merge the clouds into a larger mass. Where there is a size range each individual cloud in the form will be randomly assigned a value somewhere within that range. Reducing the range will keep the clouds at the same size. *The*

profile curve in the advanced tab will override the size settings.

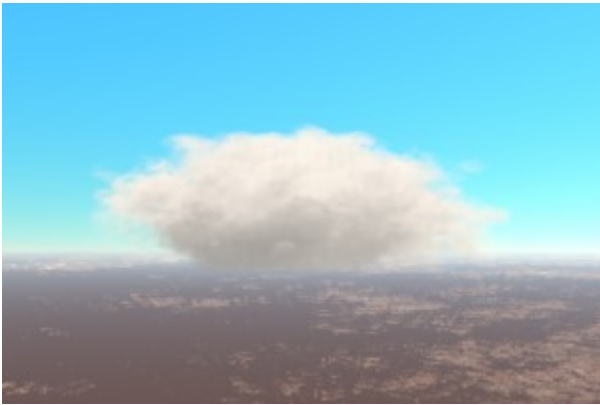


Size 25-50%



Size 75-100%

The **Power/Potential** setting works with the *Size* to change the vertical proportion of the clouds. Low Potential settings flatten the clouds and higher values will make the clouds rise higher into the volume. Potential values of 100% will give a rounded cloud form.



Potential 0%



Potential 200%

Concentration/Focus controls how the individual clouds evolve over time. When the Concentration is set to 100% all of the clouds reach their full size and density when the Evolution setting is at 50%. When the concentration is set toward 0% the clouds will form to reach their full potential and fade at different times.



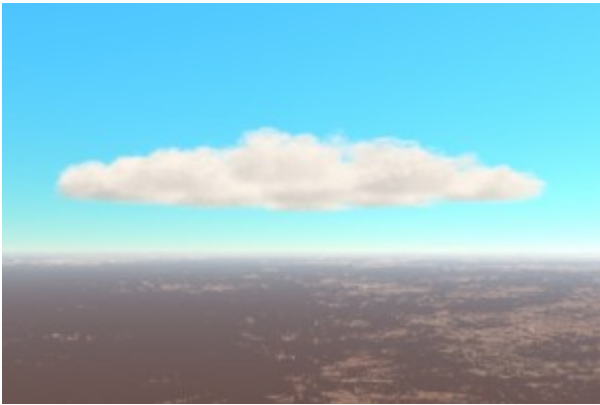
Concentration/Focus 0% Evolution 25%



Concentration/Focus 0% Evolution 100%

The **Height** adjusts the clouds rounded centre within the volume. At a height of 0% the clouds will be

centred at the base of the volume. Using heights below zero will reveal less of the cloud shape and create smaller clouds. Using heights above zero will raise the clouds into the volume and cause their bases to become rounded rather than flat. The bottom of the volume or the Flat Base Height setting shapes the base of the cloud.



Height 0%



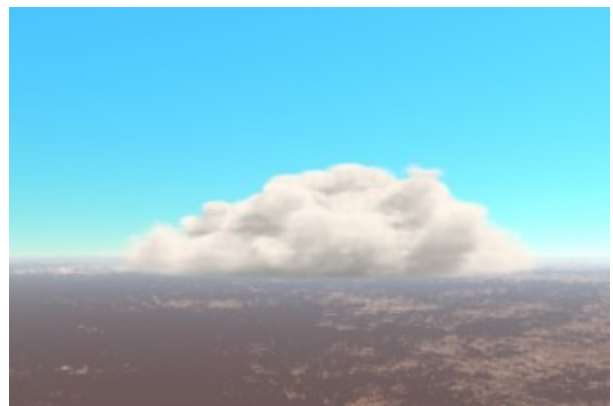
Height 25%

Noise Parameters

The noise parameters allow for more control over how the Perlin Noise is applied to the cloud shape. The **Density** is applied to control the final thickness of the cloud. Values of 50% work well with the other default volumetric cloud properties. A higher Density will create a thicker whiter cloud. Use a lower Density to create softer clouds and very low values for wispy clouds. The Density is also effected by the Evolution setting.



Density 25%

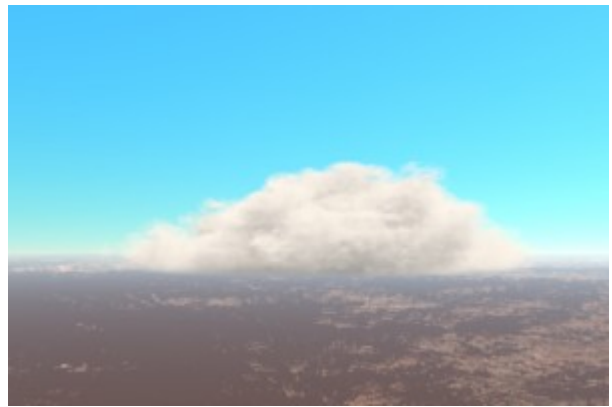


Density 100%

The **Perlin Detail** value effects the sharpness of the noise detail at the edges of the cloud puffs. A 0% detail value will create a softer blurry cloud. 100% detail will create a rougher sharper looking cloud. The default 50% value gives the best results for realistic clouds.

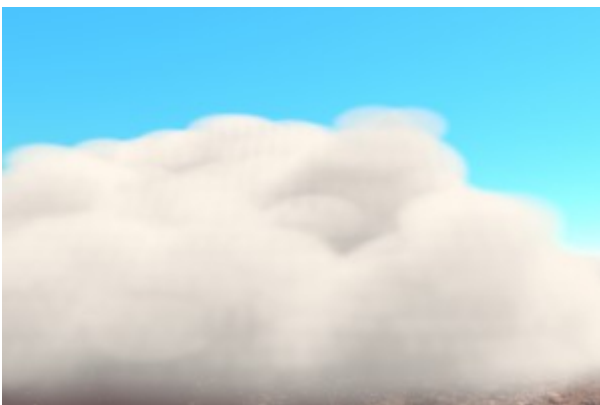


Perlin Detail 0%

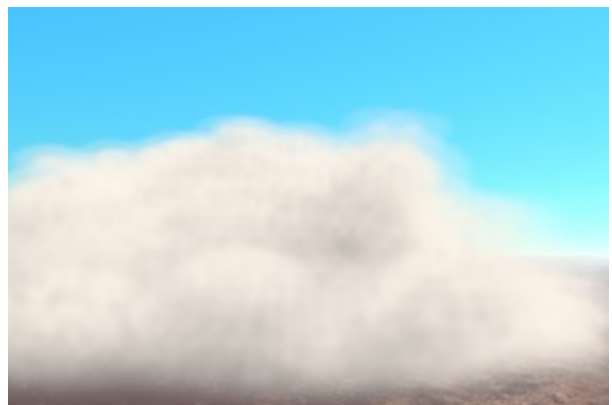


Perlin Detail 100%

The **Perlin Scale** controls how the noise octaves are multiplied. Values below 100% will create lumpier and more solid noise lacking detail. Values higher than 100% will create increasingly finer detail but with less form.

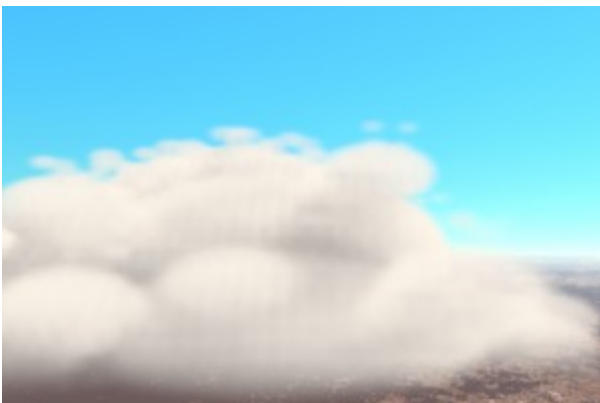


Perlin Scale 0%

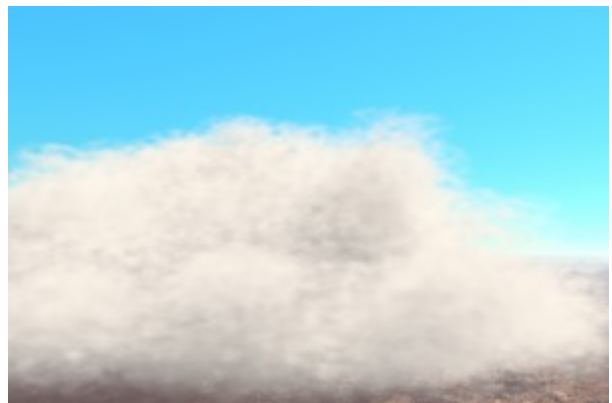


Perlin Scale 1000%

The **3D Scale** can be used to adjust the relative scale of the noise to the cloud puffs. Values below 100% will give lumpy noise and higher values will become fleecy.

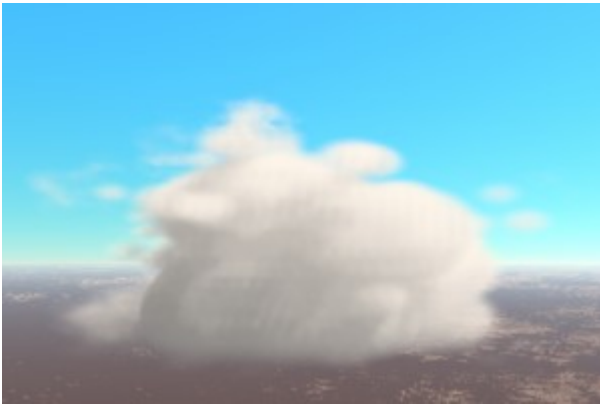


3D Scale 0%



3D Scale 1000%

The **Quality** setting can be used to select the range of octaves applied to the noise. Raising the lower value will hide the large scale octaves. Lowering the upper octaves will take out the finer details in the cloud. The Perlin Hole Filler value In the Advanced settings has a similar effect of taking out the lower octaves and overrides the Quality setting.

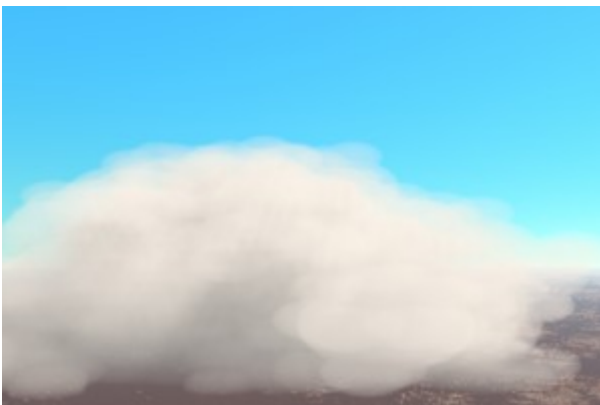


Quality 4 to 10



Quality 0-5

The **Limits** are applied to the input noise to set an upper and lower values before being multiplied to be within the Density. Any noise value lower than the minimum will be set to the minimum and any value greater than the maximum will be set to the maximum. This is more useful for cartoon effects. Raising the lower limit will fill out the cloud and increase the density. Dropping the upper limit will thin out and reduce the density of the cloud.



Limits 10 to 100%



Limits 0 to 80%

The **Thresholds** are applied to the input noise before being multiplied by the Density. Any value below the lower limit will be set to 0% and invisible and any value above the upper limit will be set to 100% and be fully opaque.

Puff Parameters

The puffs settings adjust how the smaller rounded puffy forms in the cloud appear and how the noise is applied inside them..

Puffness/Sharpness adjusts the amount of noise used at the edges of the rounded puffs in the clouds. Higher values give much puffier 'cauliflower' clouds. Lower values will result in less puffy to more ragged clouds at 0%. At puffness 100% no noise will be used resulting in a more cartoon like puffy cloud.

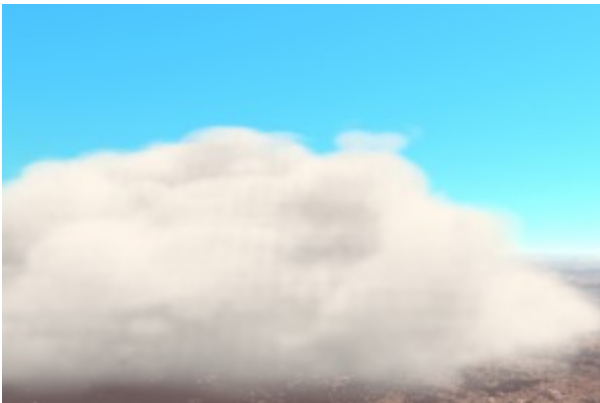


Puffness 0%

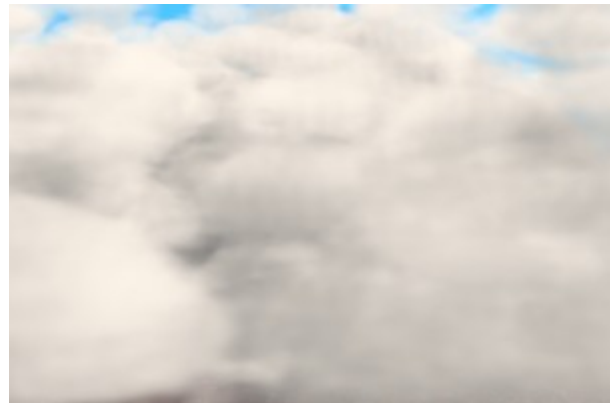


Puffness 100%

The **Prominence** controls how compact or loose the puffs are within the cloud. A higher Prominence value pushes the puffs away from the centre of the cloud creating larger looser forms. Low Prominence values produce a smaller and more compact cloud.



Prominence 0%



Prominence 100%

The **Freedom** setting works to randomly allow the puffs to move within the prominence. Individual puffs are randomly assigned a lesser prominence value. With a Freedom setting of 0% all the puffs will be pushed out to the maximum Prominence. A Freedom setting of 100% will result in an uneven and more random cloud shape.



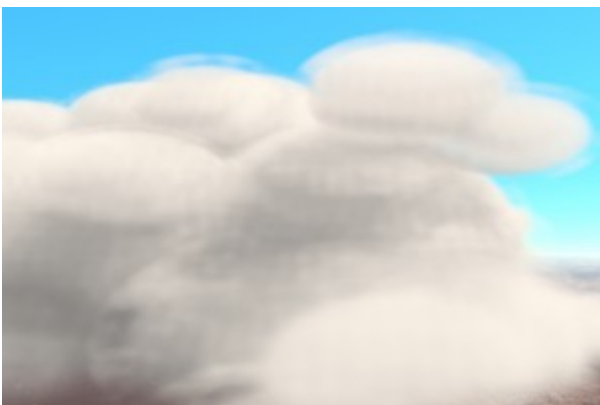
Freedom 50% (Prominence 50%)



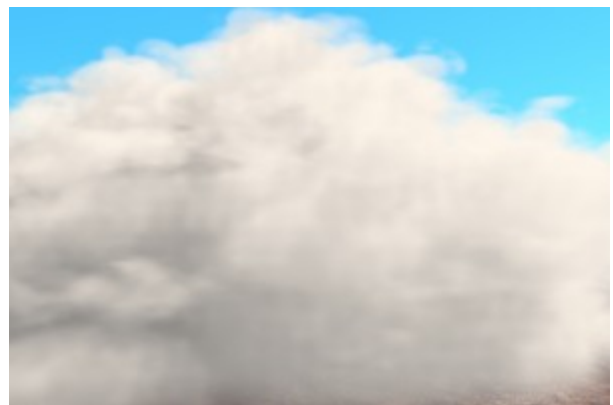
Freedom 100% (Prominence 50%)

Softness on Descent is a control factor that effects the density of the puffs as they roll within the cloud. Puffs lose density as they are absorbed back into the cloud.

Generations set the number of puffs within puffs in the cloud forms. Using a lower number of generations will reduce the amount of detail and render time. A higher number of generations will produce a more complex cloud at the cost of a significantly slower rendering time. Larger more complex and filled out cloud forms will look better with more generations. More generations will also cause a longer delay before the cloud form is rendered as the lighting cache is built.



Generations 1

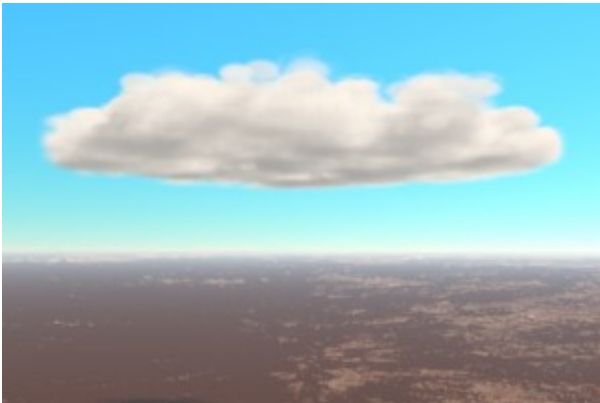


Generations 3

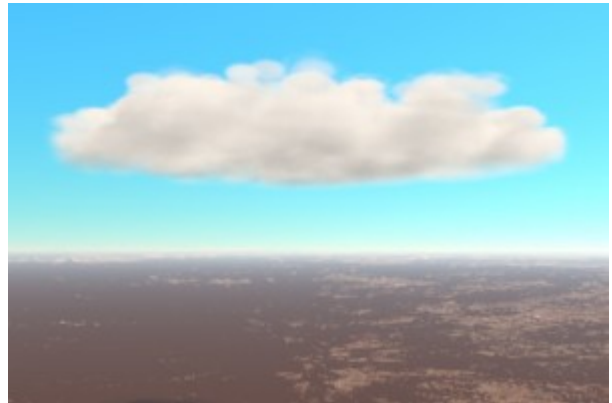
Base Parameters

The Base Parameters control how the bottom of the cloud is shaped allowing for a range of flatness or undulations. Most of the parameters are applied to the whole volume and are best suited for use with a larger sizes and merged cloud masses rather than smaller spaced out clouds in rows. Mix the filters applied to the base for more random shapes under the cloud.

The **Flat Base Height** relates to where 0% is at the bottom and 100% is the top of the cloud volume. Any parts of the cloud that are below the minimum height will be hidden unless the rolls, undulation or curve are used. Parts of the cloud below the maximum height will fade toward the minimum. Setting a higher maximum will soften the base of the cloud.

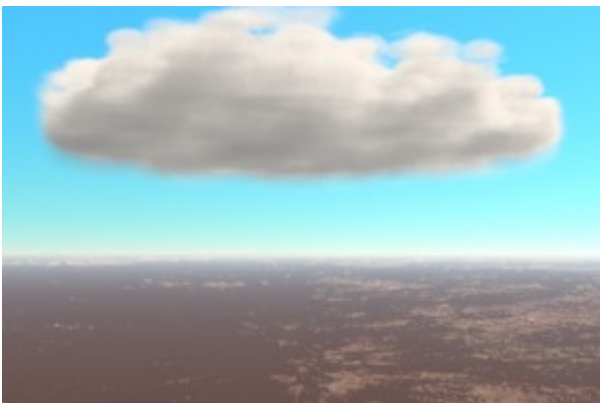


Flat Base Height 0-5%

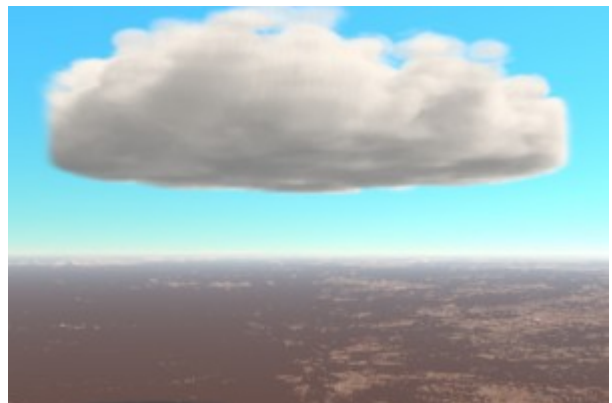


Flat Base Height 0-20%

Flat Base Falloff controls the rate at which the parts of the cloud below the Flat Base Height maximum fade toward the minimum. A Flat Base Falloff of 1 gives a linear response, although visually the cloud density tends to suddenly fade. Values less than 1 will give a softer base to the cloud and values greater than one will create a thicker darker cloud base. Using a value of 0 creates a hard flat base effectively ignoring the Flat Base Height maximum.



Flat Base Falloff 0.1



Flat Base Falloff 10.0

The **Flatness** value is not currently used.

A **Rolling Base** works with a larger sized clumpy cloud form mass to push up the base in even waves. The **Rolls Count** sets the number of rolls. The amplitude of the roll waves is the Flat Base Height maximum value. The rolls run parallel to the X axis of the local space of the cloud volume. The Flat Base Height minimum should be raised above 0 for distinct rolls to be visible.

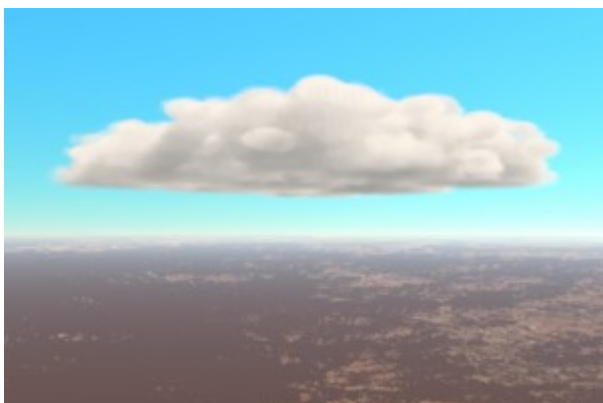


Rolling Base 50%, Rolls Count 3



Rolling Base 100%, Rolls Count 5

Base Undulation creates random lumps under the cloud base within the Flat Base Height maximum. The Flat Base Height minimum should be raised well above 0 and is best set equal to the Height for distinct undulations. The undulations use random Perlin noise and depending on the shuffle may have full or no effect.

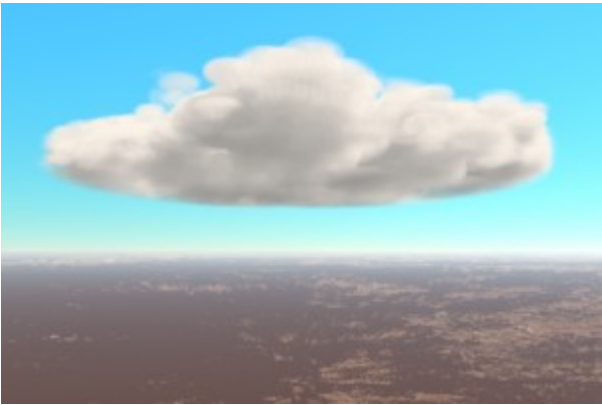


Base Undulation 0%, Flat Base Height=Height

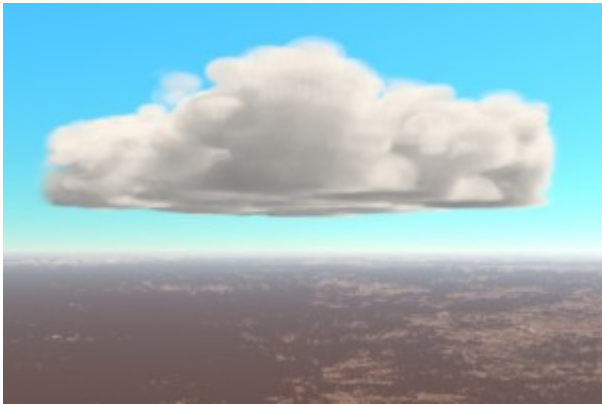


Base Undulation 100%, Flat Base Height=Height

Use the **Base Curve** to create a bulge beneath the middle of the cloud form when a value greater than 0% is used. Values less than zero create a bulge up into the clouds. The Flat Base Height minimum should be raised above 0 for a distinctly visible curve.



Base Curve 100%



Base Curve -100%

Tower Parameters

Towers can rise up from within each cumulus humilis in the cloud form to become a cumulus mediocris. The towers will rise and dissipate at different times within the form. At the normal animation rate the tower will rise and fall over 60 seconds.

The **Growth** controls the number of towers in the cloud form. When the Growth is set to 0% there will be no towers and at 100% every cloud will have a tower. With a Growth of 50% then half of the clouds will randomly be given a tower.



Towers 25%



Towers 100%

Set the towers **Height** value to 100% to place the peak of the towering cloud puffs above the cloud form below. Values below 100% will place the tower deeper into the cloud form and values greater than 100% will raise it higher, possibly creating a gap between the tower and the mass of the cloud. Height values are in proportion to the main cloud.



Height 100%



Height 200%

Set the tower **Size** range to create similar or randomly sized puffs in the cloud. At 100% the tower will be in proportion to the puffs in the main mass of the cloud when it has fully formed. At 200% the tower will be much larger than the cloud below.



Size 100%



Size 200%

Use the **Evoluton Offset** to adjust a fixed or random range so the towering puffs can form before or after the base of the cloud beneath it.



Evolution Offset -50% (Evolution 5%)



Evolution Offset+35% (Evolution 50%)

The **Stability** determines the number of towers that rise vertically. At Stability 100% all the towers will rise vertically while at 0% all the towers will collapse toward the centre of the cloud form. Higher values will increase the number of towers that rise vertically and lower values will increase the chance of towers collapsing.



Stability 100%



Stabilty 0%

Advanced Parameters

Advanced Shape

- The Position override can be used to change the total count of clouds in the form and which positions in the 3x3 rows are filled, rather than using a randomly assigned count and placement.
- Use Profile controls the vertical shape of the clouds in the form. It works as a filter applied to the Size settings where the top of the profile curve is the maximum top of the volume. The Size value in the Shape tab must be set to the maximum required height in the profile.

Noise

- Noise Power is used to change how the noise is rendered with 1 giving a linear response. Using a value higher than 1 will make the more dense noise values less dense and reduce the overall density of the cloud. Using a value less than 1 will make the denser values even more dense and increase the overall density of the cloud.
- The compression works on the noise like an audio compressor and can be used to create a more complex response. Given a straight line left to right value out = in. Once a curve is applied if the input value is below the line it will be increased and if the value is above the line it will be reduced. This can be used to lift the lower noise levels up to become more visible and the more dense noise values to become less dense with a curve above the line.
- Perlin Hole Filler removes the lower octaves from the noise function in an attempt to reduce the instance of large empty holes in the noise. If the clouds are rendering with isolated spots increase this setting. (*this feature may be removed since the noise quality can be used to do this or its function may be changed*)
- The Noise Animation Ratio can be used to change the speed of the rolling puffs within the clouds to be at a different rate from the 4D Perlin Noise. A Noise Animation Ratio less than 100% will slow down the speed of the 4D noise relative to the movement of the cloud puffs. A ratio greater than 100% will speed up the 4D noise relative to the animation of the puffs.

Zero Edge

- The zero edge settings reduce the density of the clouds in the entire form outside of a set radius in the XY (horizontal) plane. This can be used to prevent clouds from running up against the sides of the volume.
- Any cloud parts that are inside the minimum radius will have their full possible density. Any cloud parts that are outside the maximum radius will be invisible. Cloud parts that are between the minimum and maximum radius are faded toward being invisible. The Edge Falloff Radius values are set where 100% is equal to the middle of each of the box side faces of the volume.
- The Edge Falloff perturb uses 2D noise around the circumference of the zero edge radius. Large values will produce jagged edges.

Putting It All Together

The parameters and random nature of the Cumulus S3D cloud can produce a wide range of clouds within the form.

Small and Soft



To create smaller softer and loose clouds raise the Height to 20% and the Flat Base Height range from 5-20% with 100% Undulcation to have a soft base. Reduce the Puffiness to 25% for soft clouds and increase the prominence to 50% to tease them away from the cloud core.

Low and Flat



For a flat base cloud lower the Height to 0% and set the Flat Base Height range from 0-5% and set the Flat Base Falloff to 2.0. As the cloud Size and Potential is increased the base will get darker.

Tall Tower



Set a single cloud in the middle of the form using the Position Override. Use a large Size at 150% and Power/Potential of 200%. Add a tower with 100% Growth and Stability. Increase to 3 Generations to get more detail in the cloud. Change the Size in the general volumetric cloud settings to 1.0x1.0x1.0mi.

Larger Heaped



To create a larger cloud form set a Size range from 75-125% and raise the Power/Potential to 100-150%. Set the Height to 0% and the Flat Base Height to a range 5-10% with 100% Base Undulation to stop it from being perfectly flat. Add 100% Towers Growth with a size of 125-150% and Evolution offset of -25 to +25% to spread them out with a Stability of 50%. Increase the Height in the Shape tab to raise the cloud. In the general volumetric cloud settings change the size to 1.0x1.0x0.75mi.

Larger Towers

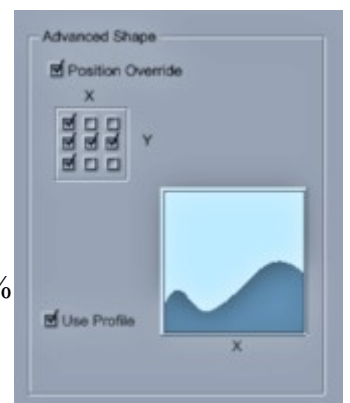


Increase the Size range from 100-125% with a Power/Potential of 100-125%. Set a height of 0% and a Flat Base Height of 5-10% with a Flat Base Falloff of 2 and Base Undulation 100%. Set Towers Growth to 100% at a Height of 150% and Size range 150-175%. Set an Evolution range of -50 to 50% so there are towers rising and falling at different rates. Set Stability at 75%. Use Profile with a bell curve shape to make the larger clouds near the centre of the form. Set the general volumetric cloud Size to 1.0x1.0x0.75mi. Increase the Generations to 3 for more detail in the tower. For a less compact cloud reduce the size and increase the Prominence to 25% with 100% Freedom.

Whale



To make a cloud that looks a bit like a whale use the Position Override and the Profile with settings for large Size and Potential. Use 3 generations of puffs to get more detail in the cloud. Set the Flat Base Height to 5-10% range and use a +100% Base Curve.



Donut



For a cloud that looks like a donut set a custom shape with a hole in the middle of the Position Override. Use a Size range of 75 to 125% so the clouds come into contact with each other. Reduce the Regularity so the shape is not so perfect. Raise the Height to keep the clouds rounded. Add in a small chance for a low tower to form with 0 Stability and small size.

Points

- The global scale of a volumetric cloud effects the rendering results. A cloud which is scaled in the scene, or in the primitive, will not render the same when it is significantly scaled up and viewed from a distance . This does not appear to be due to the perlin noise scale. Sizes need to be close to real world individual cumulus humilis clouds which are normally about .25 of a mile for the best results.
- Render quality and other quality settings can be pushed very high and render the clouds at about the same rate as Global Illumination. Using GI (or the Sky Light) on clouds will gain very little improvement.
- Intersection of cloud volumes causes artefacts, particularly when viewed from below but less so when from above. This makes overlapping clouds problematic in most cases.

Known Issues

- Very rarely the cloud form will fail to render fully and only the central core of each cloud will be seen.
- 3D Perlin Noise can have large holes in the volume and these will cause some puffs to render without visible noise and to appear only as a solid looking spheroid.

Tips and Tricks

- There will be a delay when the cloud first renders and Carrara builds the lighting cache and for a scene with lots of clouds a longer delay
- Turn off and resize the UI in the modeler room. A full screen preview will be slower to render.
- Turn off the Auto Refresh before selecting the cloud type and while changing multiple parameters.
- If more than one cloud is open in the modeler room and Auto Refresh is on, all open windows will auto update when one is changed.
- Don't switch to the Objects tab in the Properties tray when there are a large number of clouds as the previews will take a long time to generate and it's hard to abort.

Planned Improvements

- changes to the shape filters and puffs formula
- adding a larger rounded puffy congestus in the middle of the cloud form
- add noise controls for Base Undulation which uses Perlin Noise and possibly its own seed
- more control over tower growth and appearance for use with stills and custom shapes

Support

The CumulusS3D plug-in is part of the user supported Patreon project <https://www.patreon.com/Sparrowhawke3D> . Any new version with improved features will be available with a subscription. A free version of CumulusS3D will be released on my website.

You can use it in any project, commercial or otherwise. You may not repackage, redistribute or sell the CumulusS3D plugin.

For bug reports, comments, feedback and suggestions email me, Jeremy@Sparrowhawke3D.com.