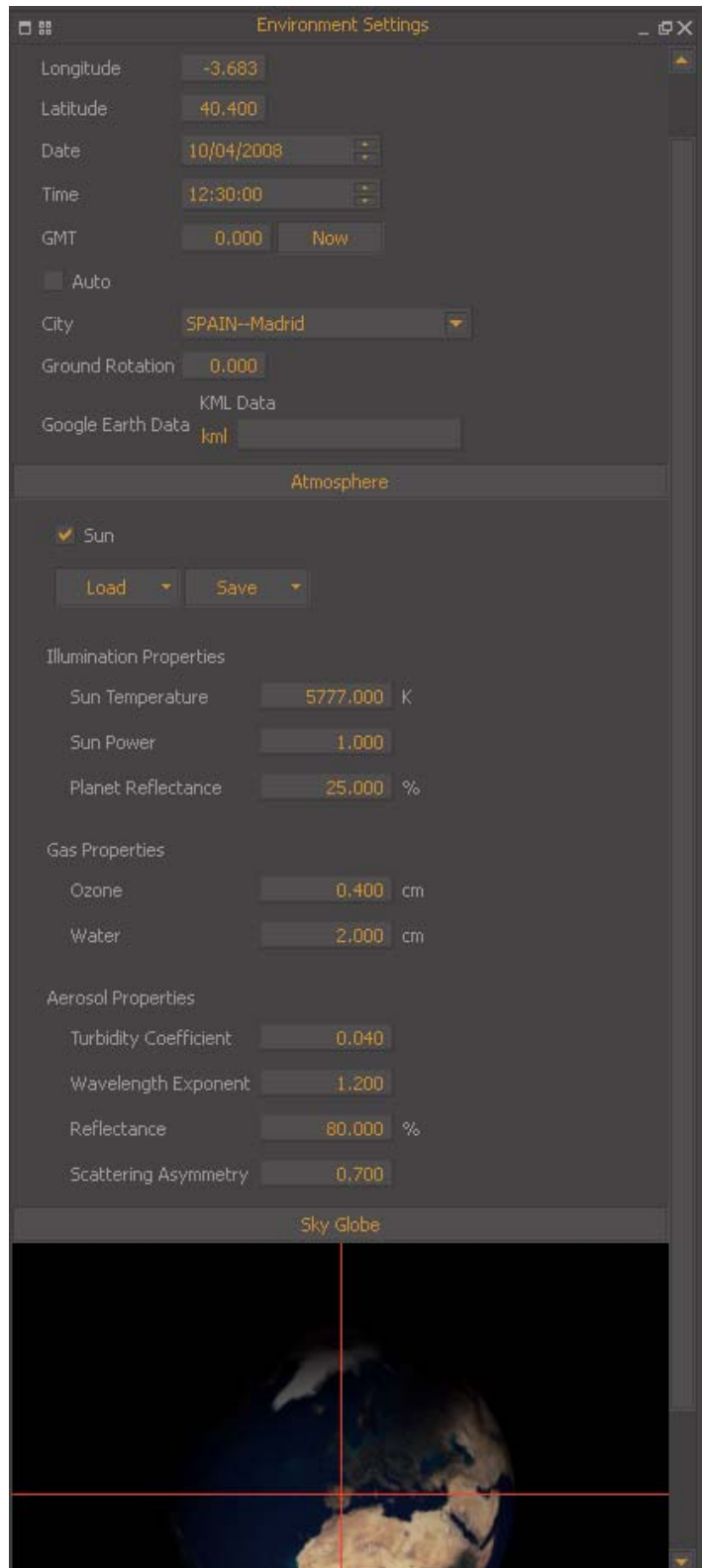




Maxwell Render Physical Sky system

The Physical Sky system in Maxwell Render 1.7 uses an entirely new approach, adding more parameters to control the look of the sky and the resulting light in the scene, ranging from common Earth values to exaggerated fantasy skies. Users can create presets of sky settings to quickly load a new sky, or share their presets with other users. It's also possible to save the current sky as an HDRi map.

The concept of "Aerosols" – particles found in the air that interact with light and influence how lights scatters and reacts in the atmosphere – plays an important role. Aerosols have a big impact on the coloration of the sky and scene illumination.



The Atmosphere section in the Environment Settings window displays the sky parameters:

- **Load:** From Disk: choose a location to load a .sky presets file. Preset: the dropdown menu will list all the saved presets found in the Maxwell/skies folder.
- **Save:** As Preset: save a .sky preset in the Maxwell/skies folder. As HDR: first specify a location for the HDR file and then a resolution. The default format is a longitudinal HDR map (2:1 width to height ratio).

Illumination Properties:

- **Sun Temperature:** this refers to the temperature of the sun's spectral rays which can vary from summer to winter. This parameter is set to a default temperature of 5777 which is the most common value measured outside the Earth's atmosphere. You can change this parameter to get different coloration in the sky and scene illumination: lowering it will give a warmer tint, increasing the value will give a colder tint. However, it's better to change other parameters instead and leave the sun at the set temperature for accurate and predictable results.
- **Sun Power:** this is a multiplier for the amount of light emitted from the sun. By default, it is 1 time the power of the Earth's Sun. Lower values will make the sun emit less light, and higher values will make the sun emit more light. A value of 2 would mean that the sun emits twice as much light as our real sun.
- **Planet Reflectance:** this parameter refers to the percentage of light reflected from the planet surface back into the atmosphere. A normal Earth value is 26-32%. Changing this value can darken or brighten the overall look of the atmosphere with lower values giving a darker result.

The Planet Reflectance parameter is similar to the common term "Planet Albedo", which refers to the light reflected from the planet surface plus the light received from the cloud coverage. Albedo is the ratio of light reflected by an object to the total amount of light it receives. The albedo of an object can range from 0 (0% light reflected back) to 1 (100% light reflected back). The average albedo for the Earth is 0.3, which means on average the Earth reflects 30% of the light it receives back into the atmosphere. The albedo can vary greatly. Fresh snow has an albedo of 0.8; forested areas have an albedo of around 0.05, etc. Regional albedo values can be found on the internet.

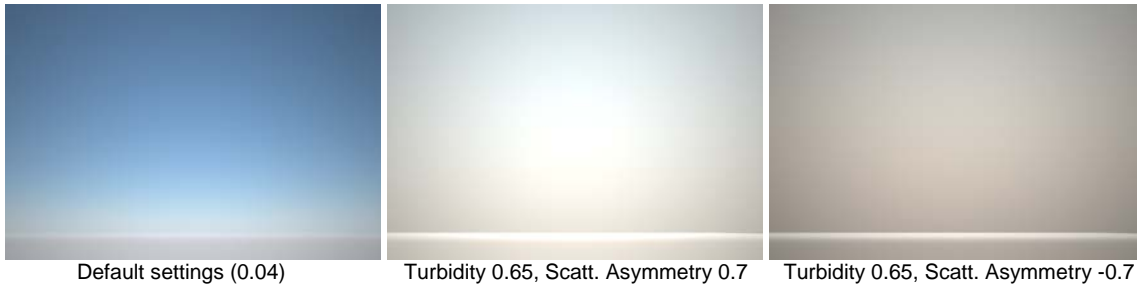
Gas Properties:

- **Ozone:** this parameter refers to the amount of ozone gas in the atmosphere. The default setting of 0.4 centimeters means that if you gathered all the ozone in a vertical column stretching through the entire atmosphere you would get a stack of ozone of 0.4 cm high. Ozone filters potentially damaging ultraviolet light from reaching the Earth's surface. Increasing the ozone value will give the sky and illumination a blue tone, lowering it will give a more yellow tone.
- **Water:** this parameter refers to the amount of water vapor in the atmosphere. It is measured in cm, in the same way as ozone. This setting may not have much influence on the look of the sky at midday, but will have a clearer effect at sunrise and sunset. Increasing water will make the sky look heavier and less saturated, with a red/ orange tone at the horizon and darker blue throughout the rest of the sky.

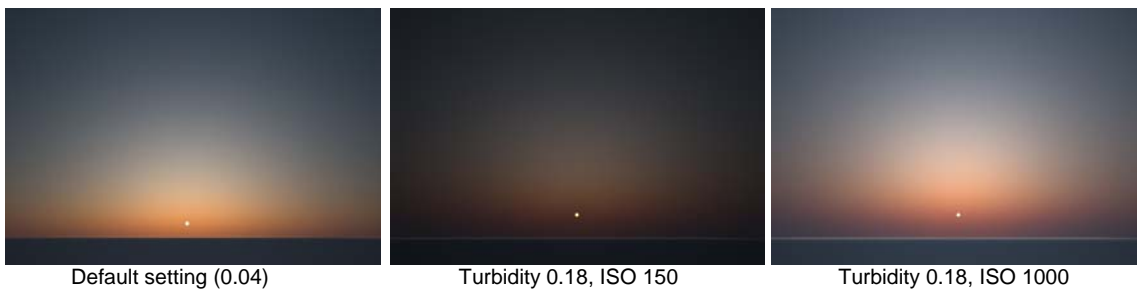
Aerosol Properties:

- **Turbidity Coefficient:** this setting is related to the concentration and amount of particles in the sky. A value of 0 means a perfectly clean sky (in which case the next three parameters won't have any effect). 0.01 is a good value for low turbidity (an almost clear sky), 0.05 will give a medium turbidity and 0.1 stands for a high turbidity. It is not uncommon though to have values of around 0.5 for very dense aerosol atmospheres/ dirty skies, for example after a volcano eruption. Raising the amount of particles in the atmosphere will usually result in a darker/ "dirtier" sky, but the effect depends also on the Scattering Asymmetry parameter (see below). In

bright daylight situations and with a positive Scattering Asymmetry, raising the Turbidity Coefficient will at first desaturate and brighten the sky. Raising the parameter further will start to darken the sky. With negative asymmetry, the sky will begin to desaturate and darken. The following images show this effect:



Raising the Turbidity Coefficient in sunset situations will darken the sky. Remember that you can also raise the ISO of the camera in these cases, which can reveal an interesting sky:



- Wavelength Exponent:** this setting is related to the average size of particles in the atmosphere. The particle size influences which wavelengths of light get absorbed and scattered. Their main effect is a change in the aerosol chromaticity (the quality of color as determined by its colorfulness and hue). Changing this value can have a big impact on the overall coloration of the sky, and the effect of the Wavelength Exponent will be more visible the higher you set the Turbidity Coefficient. 1.2 is a normal value. Lower values will have a desaturating effect on the sky, while higher values will at first increase the saturation of the sky, and then gradually make it turn towards green and then orange:



- Reflectance:** this refers to the rate of energy scattered and absorbed by the aerosols (the albedo of the aerosols). Higher values will scatter more light from the aerosols which will brighten the sky and scene illumination. Values range from 0 to 1. A value of 1 means that all light that interacts with the aerosol scatters, and none is attenuated. Common values are 0.6 for urban/ industrial aerosol, 0.9 for continental, and 0.98 for maritime.

- **Scattering Asymmetry:** this factor controls the anisotropy of the particles, or in which direction most of the light hitting the particles will be scattered. When a light beam hits a particle, it can be reflected in all directions, back to the incoming direction, or go in the opposite direction. This value goes from -1 to 1. A negative value means backward scattering (a scattering halo will appear in the opposite direction of the sun, see image below) which will have an overall darkening effect on the sky. 0 stands for isotropic value, meaning the light will be scattered equally in all directions. Positive values give forward scattering. 0.7 is a good value but you can get interesting effects playing around with it.



Scattering Asymmetry 0.7 (default)



Scattering Asymmetry 0

Tips:

- Keep in mind that the atmosphere parameters influence each other. If you raise the Turbidity Coefficient (more particles in the atmosphere), the Wavelength Exponent, Reflectance and Scattering Asymmetry parameters will then have a greater influence on the look of the sky: they are affecting a larger amount of particles.
- Maxwell Studio and some of the plug-ins can interactively show an accurate OpenGL view of the current sky coloration and brightness. In Studio, press the “K” key to activate/deactivate the Sky Preview. This OpenGL view also takes into account the cameras F-stop, ISO and Shutter Speed settings.
- Do not set a higher negative or positive Scattering Asymmetry setting than -0.85/ 0.85 to avoid noisier renders.
- The scene illumination and coloring change depending on what sky settings you use – if you raise the ozone level, which makes the sky scatter more blue light, your entire scene will have a bluer illumination.
- Because the Maxwell camera has a fixed white balance of 6500K, you can save your render as HDR and white balance your image in an image editing application that can handle HDR files.
- If the horizon appears too bright compared to the rest of the sky, lower the Planet Reflectance and decrease the Scattering Asymmetry.
- Don’t use negative values for parameters except for the Scattering Asymmetry control.
- The sun disk is accurately displayed in this sky model. For example, if you use a wide angle lens the sun disk will appear small in the render. If you use a telephoto lens the sun disk will appear much bigger. Try turning on scattering and/ or diffraction for some cool effects.

