Generalities

Natural lighting in Yag is managed by several interacting systems:

- A directional light (the sun)
- A global indirect light (ambient light)
- A physical model of planetary atmosphere (the atmosphere)
- A fog layer
- Volumetric clouds

Those systems are managed from the Atmosphere window available in the main menu.

- Ray Tracing: It is also possible to enable Ray Tracing to go for a photorealistic lighting. This parameter is experimental and will be briefly presented at the end of this document.

The sun

The sun is the main light source in Yag and has the following properties.

- Directional light
  - There is no source, all rays are parallel and have the same direction.

- Generates shadows
  - Anything facing the rays is lit, the rest is completely black.
  - By its very nature, the sun creates pitch black shadows.

Hour and minutes of the day
Intensity
Color

Indirect light intensity (only with Ray Tracing)

Ambient light intensity (see further)

Latitude
North direction

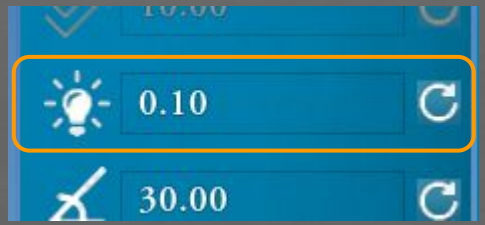
Rotation speed in game-seconds per real-second:
- 3600 = 1 hour/second

Artificial increasing of sun beam effect.

Ambient light

The Ambient light is a global lighting that has the following properties:

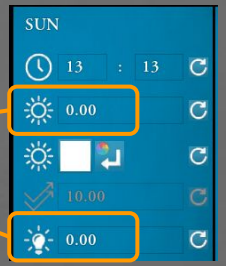
- There is no source nor direction: all objects and all directions are lit identically.
- Intuitively, it works as if each object was emitting its own light.
- It creates no shadow.
- It’s a very flat lighting that can be used in the following cases:
  - To complement the sun (to lighten the black shadows of the sun)
  - As a night light
  - As an artificial lighting to force unlit objects into visibility
- It is managed through a unique parameter that drives its intensity:



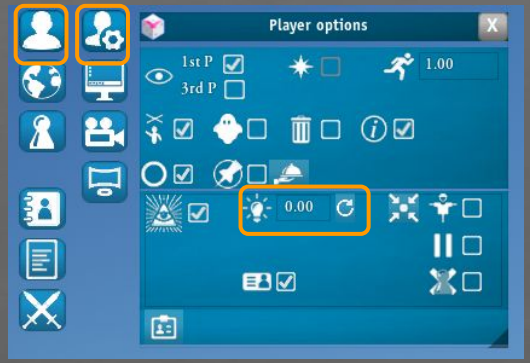
Custom ambient light (Dungeon Master)

The DM can enable a local ambient lighting that players won't see.

- It allows the DM to manage his/her map and content while players are in pitch black.
- Reminder: to create pitch black
  - Set the sun intensity to 0
  - Set the ambient light to 0



- This lighting is specific to the DM and is managed from the player options window:



Atmosphere (1/2): generalities

Atmospheric light results from the interaction between sunlight and atmosphere constituents.
Physics offers 2 approximations to model this interaction:

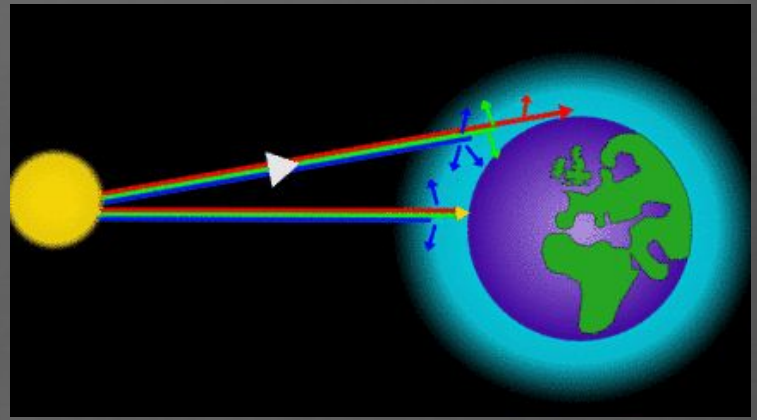
- “Rayleigh” diffusion: diffusion of the light by particles smaller than the light wavelength (oxygen, nitrogen, etc.). This diffusion depends on the color (= wavelength) of the light and it gives its colors to the sky (yellow sun, blue/red sky).

- “Mie” diffusion: diffusion of the light by particles larger than the light wavelength (droplets of water, pollution, etc.). This diffusion does not depend on the color of the light and it creates the white of the fog and clouds.

Yag proposes a realistic model for a planetary atmosphere made of 3 systems:

- The sky (Rayleigh diffusion)
- The fog (Mie diffusion)
- Absorption

Default settings correspond to the Earth atmosphere.



Atmosphere (2/2): parameters

Each system is driven by 2 parameters
- Intensity: it's the density or thickness of gas
- Color: it's the chemical composition of gas

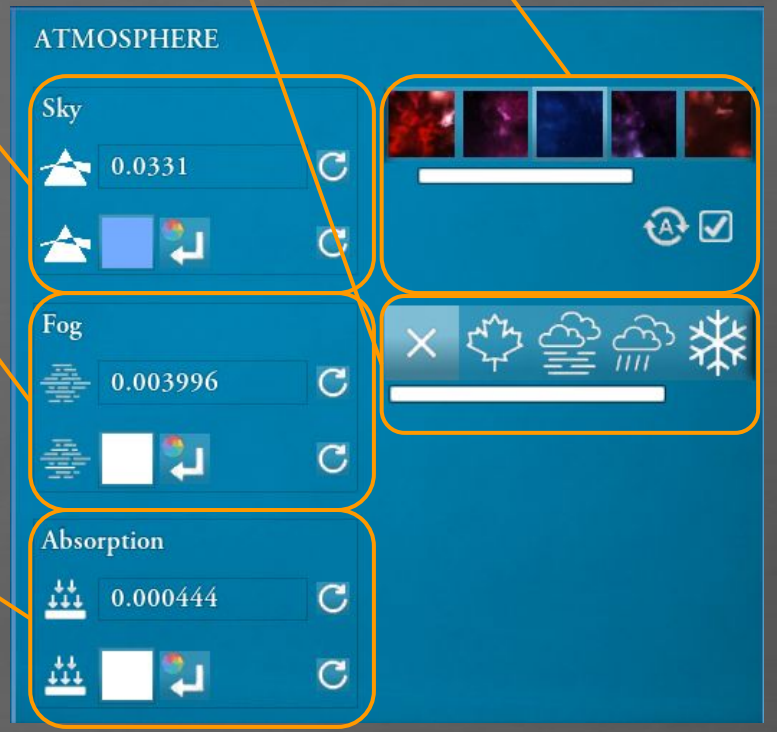
The sky: (Rayleigh) diffusion of the air (oxygen + nitrogen)
- Intensity: atmosphere thickness => pushes colors toward red
- Color: pollution / exoplanet

The fog: (Mie) diffusion of water vapor
- Intensity: fog density
- Color: pollution / exoplanet

Absorption by all existing gas
- Intensity: darkens the sky
- Color: chemical composition
  - Works opposite to the 2 other colors
  - We choose the absorbed color
  - The visible color is the complementary one
  - Ex: if we absorb Cyan, we'll see some Red

Type of night sky
Automatic/max night sky luminance

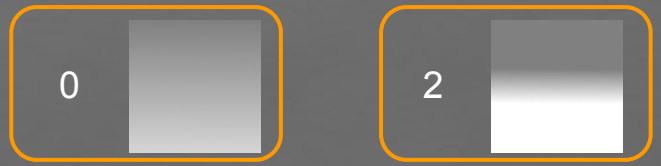
Choose a weather effect



The fog layer

It’s a fog, the density of which depends on the altitude.

- Altitude (in chosen units meters/feet) and global density
- Opacity is the maximum authorized density
- The profile sets how density varies with altitude
  - Small value: uniform fog
  - Large value (max = 2): very pronounced layer

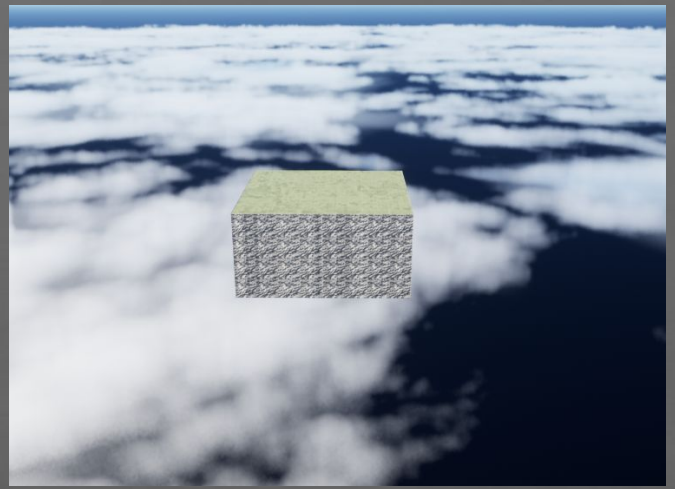


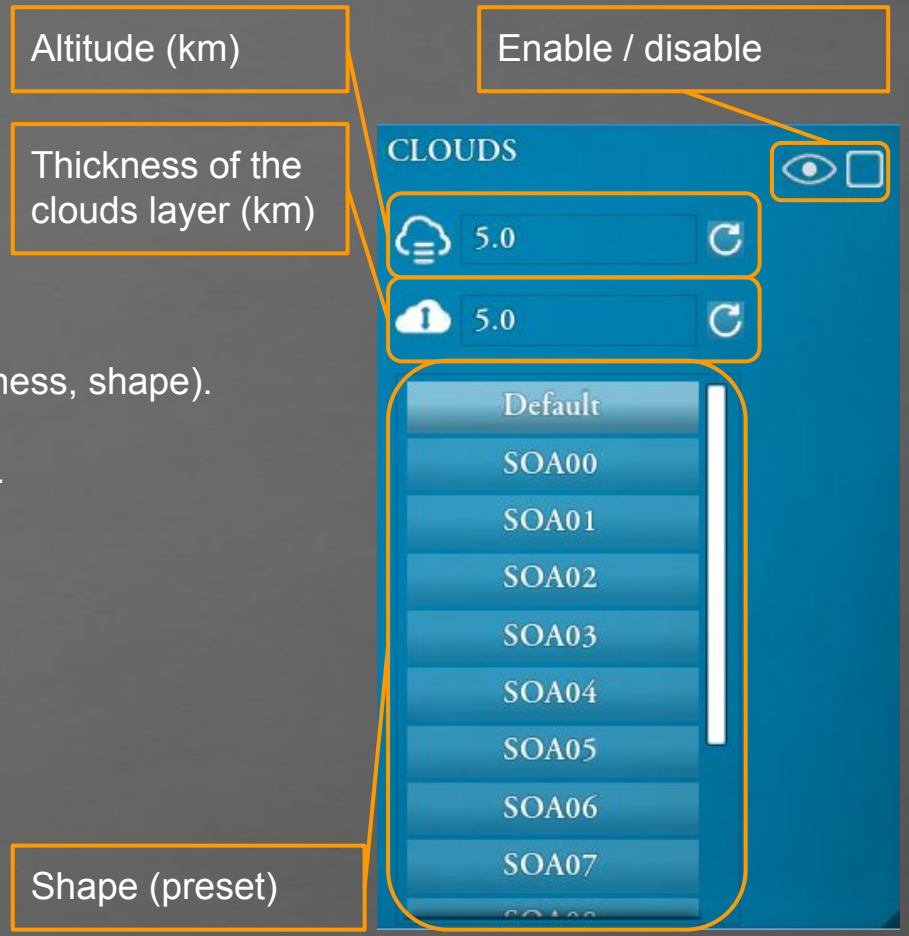
- This color is artificially added to the one computed by the atmospheric model.
  - It is black by default to not alter the model.
  - Change it to get artistic effects (magic, chemistry, exoplanet…).

Clouds

Clouds in Yag are volumetric.

- We can go inside or above.
- They are managed by 3 parameters (altitude, thickness, shape).
- Altitude can be negative, to create a celestial world.
  - For example here with an altitude of -5 (km):





Ray tracing (1/2): generalities

Ray Tracing simulates the physical behavior of light by casting light rays (hence the name) for each pixel of the screen.
This technique is often called CGI (Computer Generated Imagery).

- Allowing rays to bounce/go through the scene objects according to the laws of physics creates some very realistic effects (indirect lighting, reflexion, refraction...), and hence a photorealistic lighting.

- This technique is still very young in real-time simulations because it is very resources intensive and can cause severe slowdowns.

- It's a very recent technology in the Unreal Engine, so:
  - It is compatible with a limited number of graphics cards.
  - It's still difficult to manage: difficult configuration due to lots of available options
  - It doesn't support all features (ex: fog, fire, opacity):
  - https://docs.unrealengine.com/en-US/RenderingAndGraphics/RayTracing/index.html
  - It is still quite buggy.

- For those reasons, RT in Yag should be considered very experimental.

Ray tracing (2/2): parameters

Ray Tracing is enabled in the Settings window:

- Off: RT is disabled
  - Standard and historical lighting in Yag
- Optimized: RT enabled but set to limit resource consumption, which also limits lighting quality.
  - It's a hybrid setting that improves the image quality without limiting performance too much.
  - Allows a continuous usage for mid range (and RTX compatible) graphics cards.
- Full: RT fully enabled, giving a lighting as realistic as possible.
  - It is very slow and resource consuming.
  - For example: can be used temporarily for a screenshot

Off:
- Flat lighting
- Hard shadows
- no refraction

Optimized:
- Better volumes
- Soft shadows
- No refraction

Full:
- All options on
- Best possible quality