Cloud Simulations

Cloud simulations are seemingly simple, as the first thing that comes to mind would be to create a simple particle system. However, the more I thought about it, there most likely exists a number of complex parts that go into realistic cloud simulations. A single cloud particle will most likely have a number of properties such as density, color and radial size. Then the particles will most likely fill up a volumetric space. Depending on how realistic we want the simulation to be we would need multiple algorithms for the physical properties of the cloud such as illumination, motion, thermodynamics, and any other real-world force that could act on the cloud. The algorithm for lighting would need to produce a realistic light scattering through the cloud since it would be inefficient to compute all light scattered. We also need to compute things like how the cloud looks on the inside and how the lighting looks when inside the cloud.

Implementing just the particle system and lighting would be complicated enough. However, as described by the guest lecturer we had in class the other day, we could map density values(or other values) per volumetric unit of the cloud then have light react accordingly to that data in space.

After reading some articles on real-time cloud rendering, it seems that creating realistic clouds requires a heavy amount of physical-based calculations that are designed to realistically mimic a clouds physical properties. The paper I read implemented algorithms for cloud motion, gas properties, buoyancy, temperature effects, humidity, water content in the cloud, etc. Then the cloud radiometry was split into numerous complex subcategories such as light absorption, scattering and extinction, and light transport. Then modeling the loud comes with its own set of complex parts such as the particle systems used and procedural noise.

Pt.2
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