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Oceanography and Atmospheric Sci. Meteorology

**Cloud Simulation Using HEFeS-Hierarchical Environmental Feature Structure**

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**Abstract:** The goal is to rapidly simulate **cloud scenes** including radiances using a large variety of **cloud** structure associated with a given area and season. HEFeS uses a hierarchy of climate objects for nine different scales of motion: climate regime, planetary wave, synoptic feature, meso feature, cluster, cell, sheet, voxel, and droplet. Rather than store all this information for viewing from different angles, the reproducibility property of pseudorandom number generators is used to index location and properties of each object. This "Stochastic Indexing" allows for millions of objects to be specified and retrieved with nearly zero storage. A backward running random number generator allows desired properties (e.g. 95% coldest temperature) to be generated. Instead of using ray tracing methods to render a **scene**, radiometric properties are precalculated for each object under various lighting conditions and stored as prototype objects called morficons. These are stretched to adjust for viewing perspective, exact lighting, and individual shapes. The resulting **scene** is consistent with climatology and the physics of the atmosphere.

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