GridLAB-D Cloud Module Requirements

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1 Application Concept

The purpose of the cloud model is to provide a means of replicating the shading effects that clouds produce on a feeder. The transitory shade caused by clouds can have a significant effect on the power production of PV panels and may have a noticeable effect on residential heating/cooling requirements. The cloud model is intended to facilitate high temporal and spatial resolution studies of these effects to assess their scale and impact. It is assumed that these studies will focus on power and energy balance questions rather than longer term (multi-week and longer) energy consumption questions.

2 Requirements

1. The cloud model shall be implemented as a part of the climate module.

2. The cloud model shall model low-level, relatively opaque (cumulus) clouds.

3. The cloud model shall implement cloud patterns to cover all points with user-provided latitude and longitude coordinates.

4. The cloud model shall determine cloud coverage for each individual point with user-provided latitude and longitude coordinates.

5. The cloud model may consider the physical size of the object at the user-provided latitude and longitude coordinates to be negligible.

6. The cloud model shall implement a cloud pattern at a resolution of at least 1 pixel $= 100\text{m}^2$.

7. The cloud model shall respect the position of the sun in the sky (annual and daily variation) when calculating the effects of the cloud pattern.

8. The cloud coverage density shall be defined by the cloud coverage value found in TMY2 datasets.

9. The cloud model shall move clouds over the provided lat/long points governed by the wind speed value found in TMY2 datasets.

10. The cloud model shall support a user-definable constant cloud opacity.

11. The cloud model shall support a means to use the same cloud pattern across multiple test runs to enable repeatability of testing and confirmation of results.

12. The cloud model shall be an optional addition to any existing models. Changes made to the code base to implement the cloud model shall not require the models in a given existing feeder to be updated even if the cloud model is not used in said feeder model.