

1. Initialization

- Packets are generated based on the IC and BC in grid cells.
- Each packet receives an ID, x, y, z.
- Time-step selection is based on the condition that a packet may not travel more than $\frac{3}{4}$ of the distance between all opposite faces of a grid cell.

2. Packet management

- The number of packets in each grid cell must not exceed five.
If exceeded: Remove the extra packets.
The concentration of remaining packets will be the average of all available packets.
- Each grid cell must not be empty.
If empty: Add an extra packet.
The concentration of the added packet will be similar to that of the closest packet.
- The properties of the packets are controlled through all time steps.

3. Advection

- The three-dimensional advection equation is solved to update the location of packets.

4. Diffusion

- The implicit Eulerian diffusion equation is solved to obtain an average over the number of packets in each grid cell.
- By considering each packet the center of the cell and the cell average as neighboring cells, the diffusion equation is solved for each packet using the predictor-corrector method.
- Horizontal diffusion requires extra sub-grid diffusion for pair-wise diffusion.

5. Emission

- The emission fluxes of various species (similar to CMAQ) are added to each packet through vertical diffusion.

6. Output generation

- Based on Lambert's projection, the x, y, and z of each packet are converted into longitude, latitude, and altitude.
- C-TRAIL is generated during every output time step (1 h).