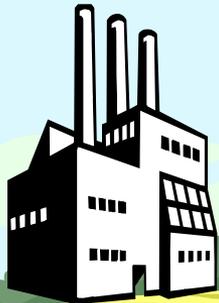


Some Notes on Trajectory Starting Height(s)
Aug 23, 2016 (initial version)
Dr. Mark Cohen, NOAA Air Resources Laboratory

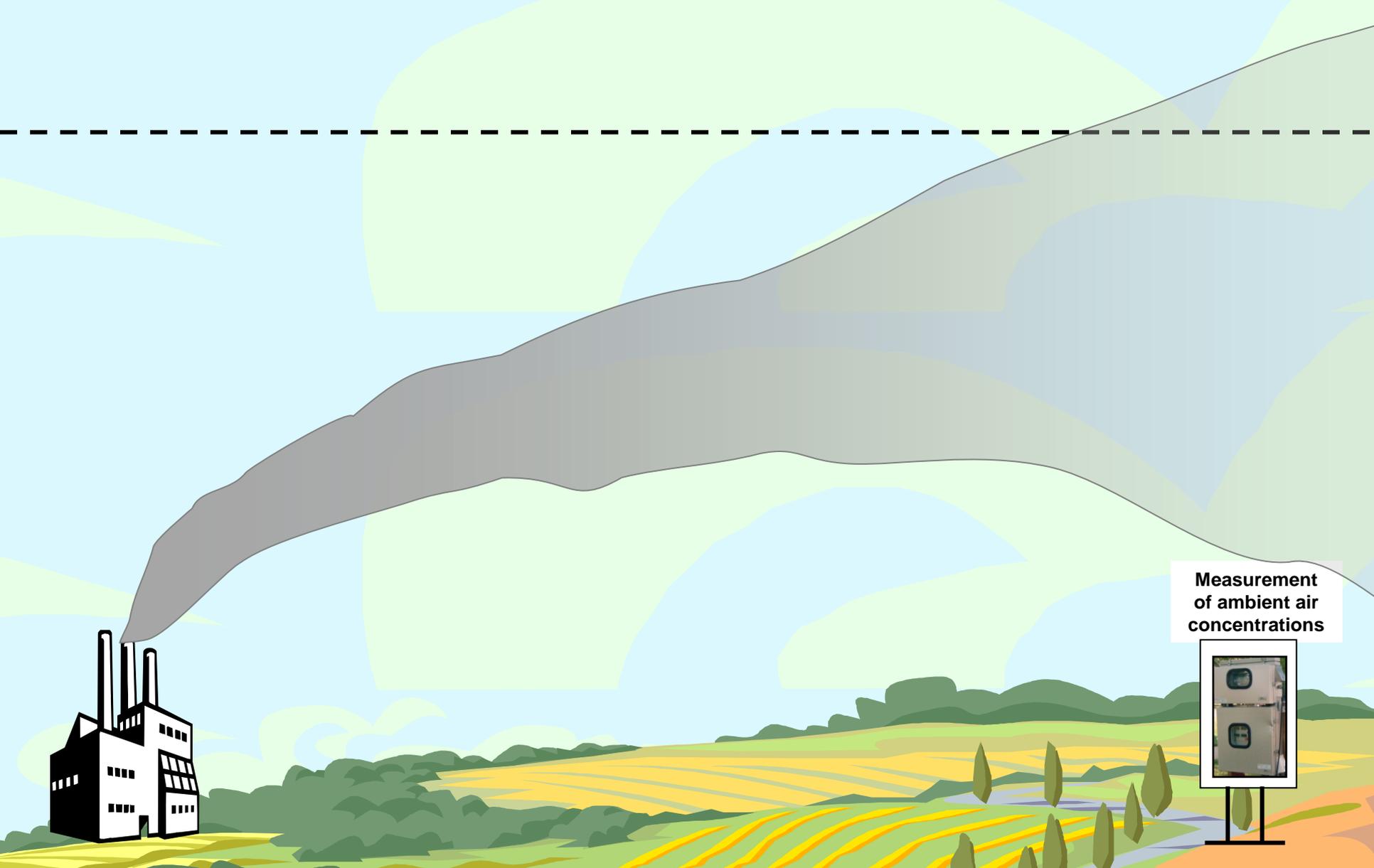
- You have some measurements at the ground, and want to do some back-trajectories to help interpret the measurements.
- What height(s) should you start the back-trajectories?



Measurement
of ambient air
concentrations



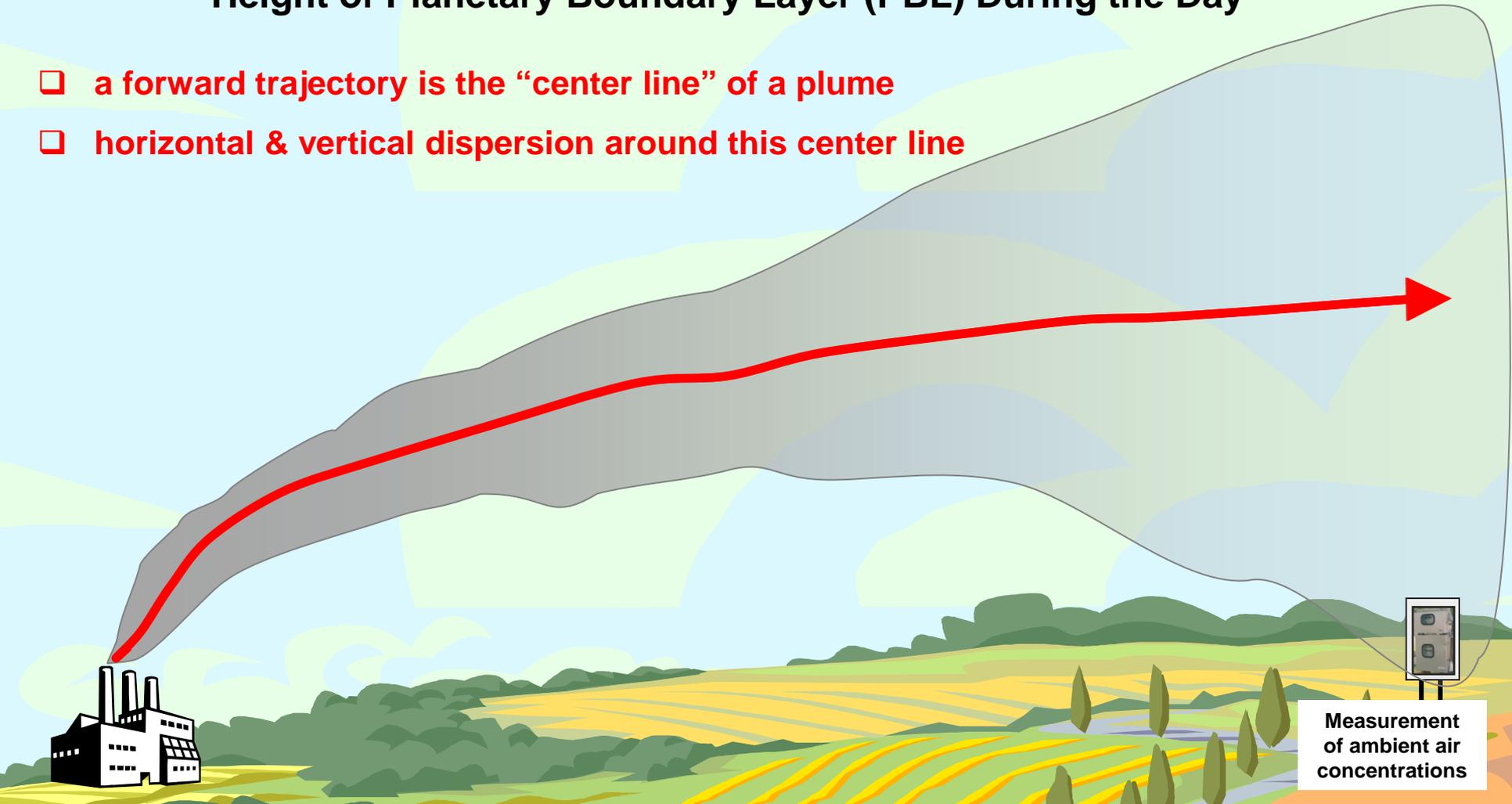
To begin thinking about this problem, consider first the forward dispersion of material emitted from a source upwind of your sampler.



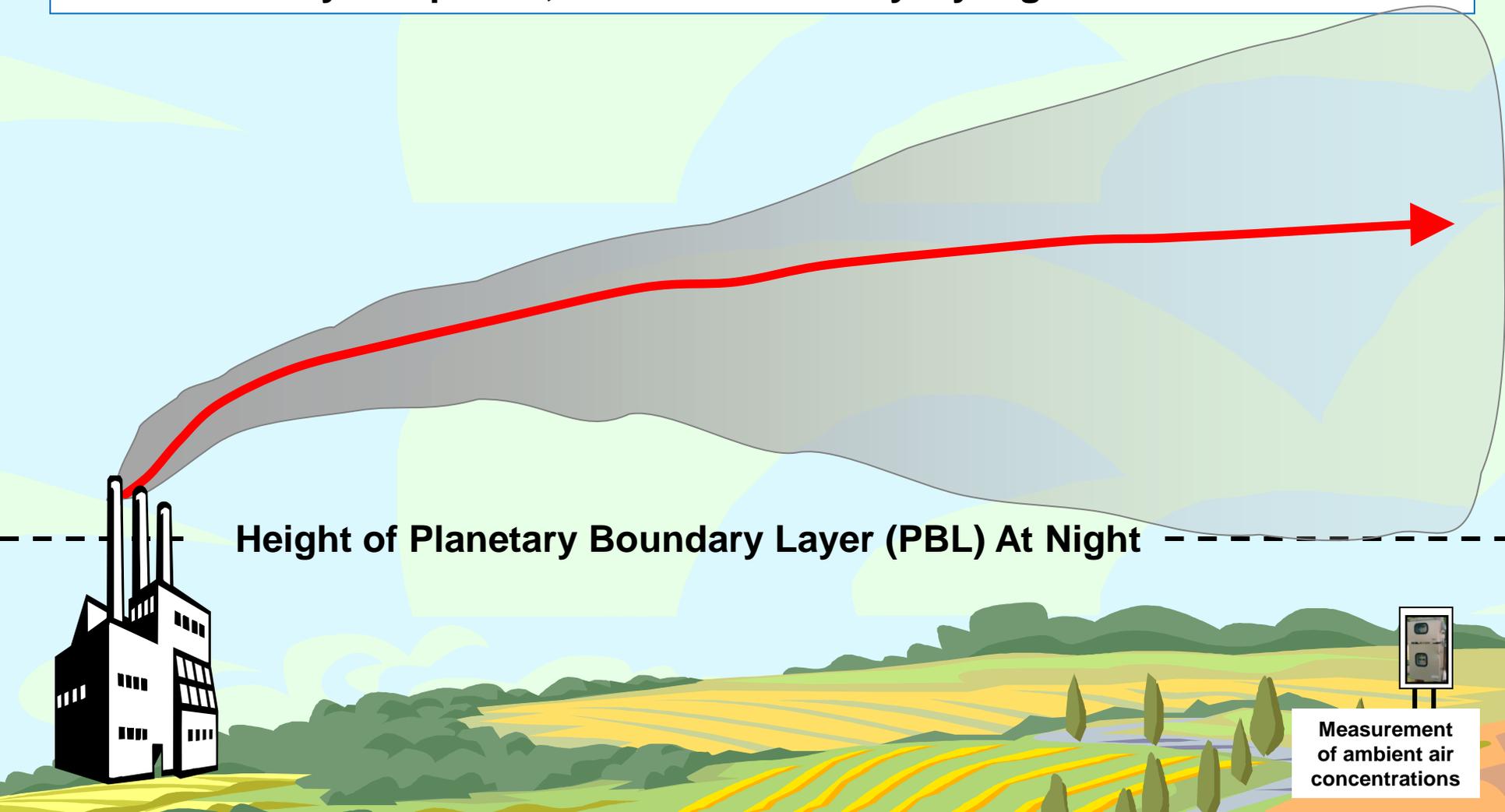
Greater than ~20km from the source,
if the forward trajectory from the source is within the PBL,
then the source can impact the measurement site,
even if the trajectory endpoint near the site is not at the height of the sampler...
This is because the PBL is relatively well-mixed during the day.

----- Height of Planetary Boundary Layer (PBL) During the Day -----

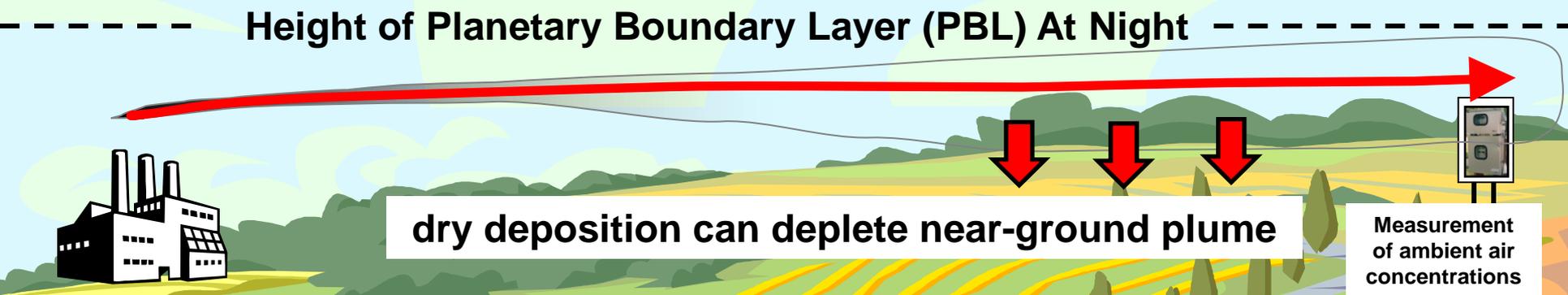
- ❑ a forward trajectory is the “center line” of a plume
- ❑ horizontal & vertical dispersion around this center line



- ❑ At night, the Planetary Boundary Layer (PBL) is generally much shallower
- ❑ Emissions from an elevated stack may be emitted above the PBL
- ❑ In this case, little or no impact on a ground-based measurement site until the next daytime period, when the boundary layer grows.



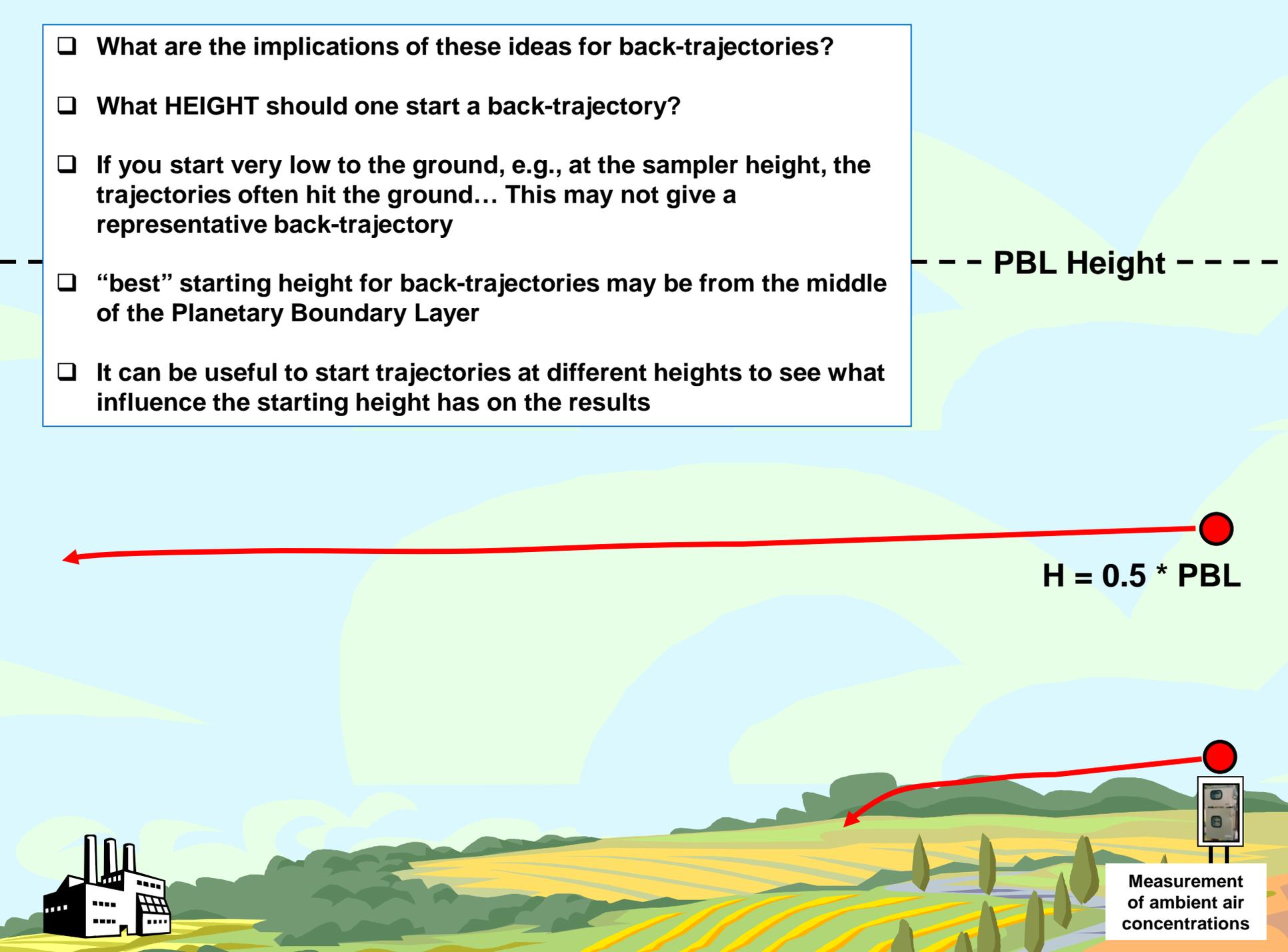
- ❑ At night, the Planetary Boundary Layer (PBL) is generally much shallower
- ❑ Emissions from an relatively low stack may be emitted within the PBL
- ❑ But, if the pollutant dry deposits relatively rapidly (e.g., reactive gaseous mercury (“RGM”), by the time the plume reaches the receptor, there may be little pollutant left...



- ❑ What are the implications of these ideas for back-trajectories?
- ❑ What HEIGHT should one start a back-trajectory?
- ❑ If you start very low to the ground, e.g., at the sampler height, the trajectories often hit the ground... This may not give a representative back-trajectory
- ❑ “best” starting height for back-trajectories may be from the middle of the Planetary Boundary Layer
- ❑ It can be useful to start trajectories at different heights to see what influence the starting height has on the results

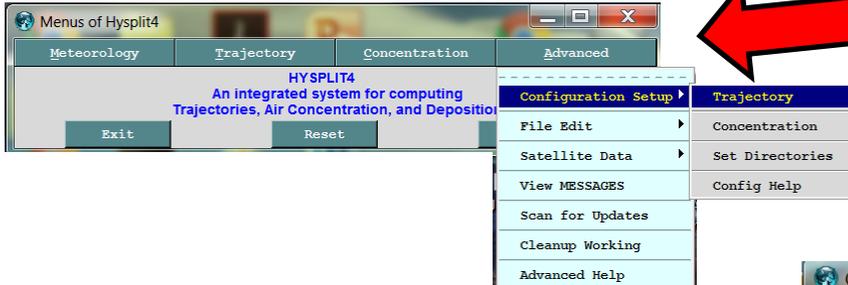
--- PBL Height ---

$$H = 0.5 * PBL$$

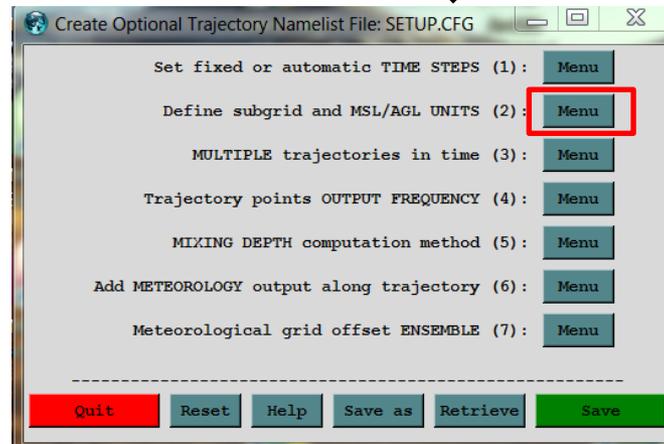


Measurement of ambient air concentrations

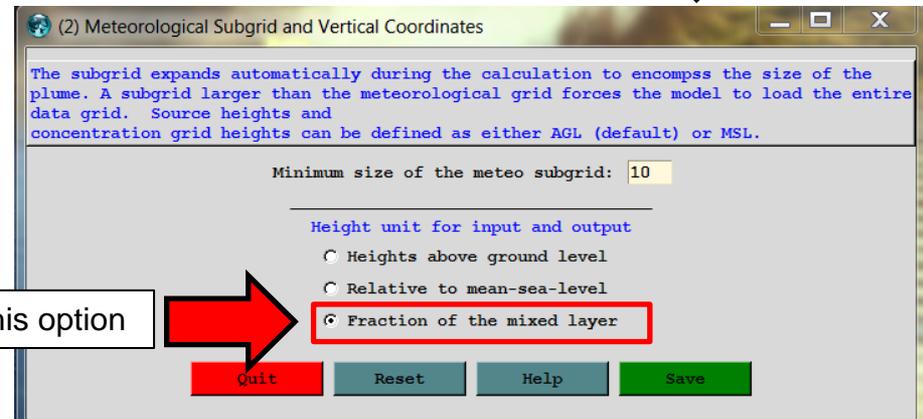
- ❑ How do you start a trajectory from the middle of the boundary layer at each time a trajectory starts?



Navigate to:
Advanced -> Configuration Setup -> Trajectory
to open the menu below:

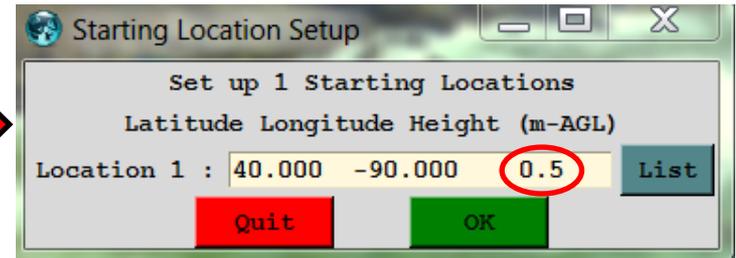
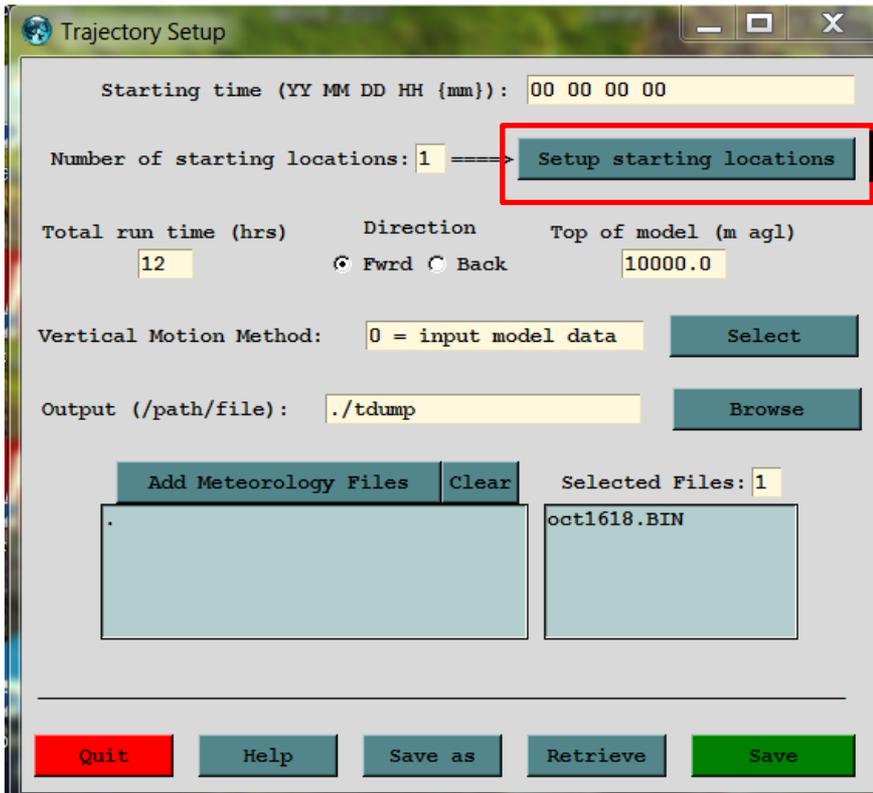


Select
Menu #2



Select this option

- ❑ Once you've set the "height" units to be "fraction of planetary boundary layer", then when you specify the height of the starting trajectory, you can pick "0.5", if you want to start at $\frac{1}{2}$ the height of the PBL



- ❑ The HYSPLIT model estimates the height of the PBL at any given location and time based on the meteorological data being used.
- ❑ So, the actual height above the ground for a given specified fraction of the PBL height (e.g., 0.5) will end up varying over time as the PBL height varies over time.