A means to sense surface PM$_{2.5}$ levels from space would be a great help to state air quality planners, health researchers, and aerosol scientists. To make this connection requires linking PM$_{2.5}$ to aerosol scattering and integrating scattering to determine aerosol optical depth, which is more readily sensed from space than these other parameters. PM$_{2.5}$ mass should be linked to scattering, provided that the growth of aerosols with humidity can be properly accounted for. In the eastern United States, this should be relatively straightforward, since the aerosol is spatially homogeneous, is of the right size to scatter efficiently, and is comprised of sulfate and other anthropogenic compounds that are reasonably straightforward to measure. Making that connection has been difficult due to the paucity of high intensity aircraft campaigns in the area capable of measuring aerosol mass and scattering simultaneously. In 2011, the DISCOVER-AQ campaign provided just such a data set. We have integrated the mass as measured by the DISCOVER-AQ P-3 aircraft instruments across several chemical species, reproducing approximately 90% of the total mass. Our analysis of data from the 2011 DISCOVER-AQ campaign has found a very robust statistical connection between the integrated aerosol mass and scattering. We will use this relationship to demonstrate the connection between PM2.5 and scattering, and in turn make the link between PM$_{2.5}$ at the ground and aerosol optical depth from space.