MASS DENSITIES

The System of Study: Let us postulate a system of study consisting of a ***p***-population of gaseous atmospheric molecules in random motion in proximity space. The surface of interest is the intangible surface of an imaginary sphere surrounded by the ***p***-population.

The Mean Mass Density: The mean mass density ($\bar{\rho}$) of any portion of the system of study is a simple product of the mean molecular number density and the mean molecular mass of that system.

$$\bar{\rho} = \bar{n}\bar{m}_p \qquad \text{ADS01}$$

Here, $\bar{\rho}$ is the mass density in kilograms per cubic meter of air, $\bar{n}$ is the number of gas molecules per cubic meter, and $\bar{m}_p$ is the mean molecular mass of the ***p***-population.

Although widely used in fluid dynamics, the mass density is rarely used at all in either kinetic gas theory or statistical mechanics. In these two disciplines, it does not appear to be a fertile concept. Once you have it, there is little that you can do with it.

Still Air Parameters: The essay Still Air Parameters gives the following values for still air with no net evaporation or condensation. The system temperature is 25° C, and the system pressure is 1,000 hectopascals.

$\bar{\rho}$ = 1.15 904 kilograms per cubic meter for humid air.
$\tilde{\bar{\rho}}$ = 7.26 714 X 10^{-3} kilograms per cubic meter for water vapor.
$\dot{\bar{\rho}}$ = 1.15 324 kilograms per cubic meter for dry air.

Mass Density in Moving Air: When the wind blows, the values of many atmospheric parameters change significantly. These changes will be functions of the wind speed and the wind direction relative to the surface of interest. Phenomena related to fluid flows are discussed in advanced papers in this collection.

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REFERENCES

Internal References: References to other essays in this collection are linked in the essay text by hyperlinks. You may follow these hyperlinks or ignore them, as you choose.

External References: These are papers by other authors that contain statements or data that are specifically incorporated into this essay. This paper has no external references.

General References: These are works that I have read carefully and whose views have helped to shape the views presented in this collection. None of these authors are have any responsibility for my many unconventional views and opinions.

Arthur Brown; **Statistical Physics**; Elsevier, New York, 1970.

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Charles Kittel; **Thermal Physics**; John Wiley & Sons, New York, 1969.

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