THE
ATMOSPHERIC RESERVOIR
Examining the Atmosphere and Atmospheric Resource Management

A Standard Atmosphere?

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Have you ever heard of a standard atmosphere? The weather is constantly changing, so is it possible to derive baseline atmospheric conditions for data comparison and other beneficial uses?

It's possible if large assumptions are made about the air and its properties. According to the American Meteorological Society (AMS) Glossary of Meteorology, "The air is assumed to obey the perfect gas law and the hydrostatic equation… It is further assumed that the air contains no water vapor and that the acceleration of gravity does not change with height." Basically, we have to assume a non-dynamic atmosphere, one that can't be created outside of a laboratory.

Data taken from rawinsonde weather balloon launches over mid-latitudes of the U.S. were averaged to create a table of standard atmospheric values. There were previous versions of the standard atmosphere calculated in 1925 and 1952, but we currently use the 1976 update.

The AMS Glossary of Meteorology defines a standard atmosphere as, "A hypothetical vertical distribution of atmospheric temperature, pressure, and density that, by international agreement, is taken to be representative of the atmosphere for purposes of pressure altimeter calibrations, aircraft performance calculations, aircraft and missile design, ballistic tables, etc."

At sea level, a standard atmosphere is defined as having a temperature of 15 degrees Celsius or 59 Fahrenheit, a pressure of 29.92 inches of mercury or 1013.25 Millibars, and a density of 1.225 kilograms per cubic meter. As you ascend in altitude from sea level, the computed values for a standard atmosphere decrease. If you live on the western edge of North Dakota for example, you would likely use the computed standard atmospheric values for 1000 meters, versus approximately 500 meters for central North Dakota, and somewhere between 500 meters and sea level in the eastern part of the state.

Changes in atmospheric conditions are extremely important to aviation safety. Pilots are able to predict the changed performance of their aircraft as they ascend and descend through different altitudes.

Imagine that you take-off in an airplane and fly from Fargo to Denver. Due to an increase of nearly 5,000 feet in elevation you would expect the air temperature, pressure, and density to decrease significantly, assuming a standard atmosphere. The performance of the aircraft at higher altitude would decrease unless the engines were turbocharged to compensate for it. More importantly, the altimeter setting in the aircraft would need to be adjusted higher to accurately display the aircrafts' correct altitude. Otherwise the pilot would believe that they were higher than they actually were. There is a saying in aviation, "High to low (pressure), look out below," which reminds pilots of this vital fact.

In addition to standard temperature, pressure, and density, meteorologists are interested in a standard lapse rate, or decrease in temperature with height. The standard lapse rate is 6.5 degrees Celsius per 1000 meters and is useful for measuring degrees of stability in the atmosphere.

As with any standard, a standard atmosphere is simply a tool that is indicative of the average or most common conditions. Its implications are huge, though. Without assumptions and some degree of uncertainty, we wouldn't have been able to put a man on the moon or accomplish many of history's great achievements.

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