

Pressure

The consideration of the forces that influence atmospheric flow is key in weather forecasting. Force is the quantitative description of the interaction between two physical bodies, and was fully defined by Sir Isaac Newton in his Laws of Motion.

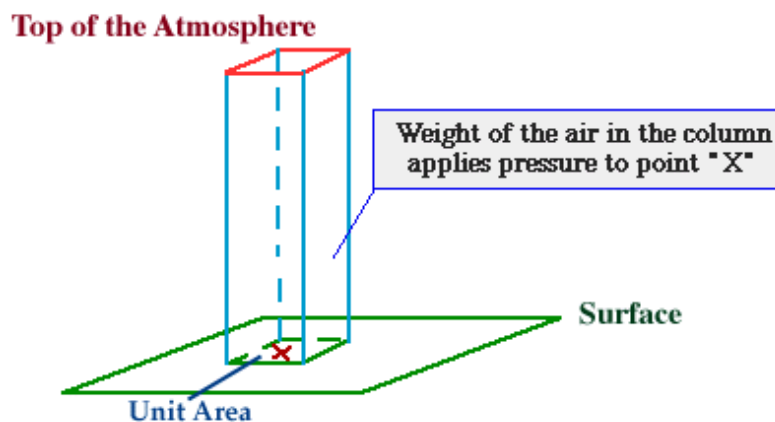
Pressure as Weight of the Atmosphere

In the case of the example (illustrating the force of pressure) discussed in class, pressure is defined as a force per unit area, or

$$p = F_p/A \text{ or } F_p = pA$$

On the sealevel weather map, that pressure force is just the weight of the atmosphere “pressing down” on the earth’s surface.

Where $p = (mg/A)$



where m is the mass of air in the air column, and A is the area over which the weight (pressure force) acts. If only the pressure force acting perpendicular to the earth's surface is considered, then it is drawn as a vector pointing in the negative z direction.

The reason that this analogy works (pressure as weight of the atmosphere) is that gravity produces an added downward component to the vibrational mode of the molecules.

Pressure is Distributed in All Directions

In reality, pressure is distributed in all directions, as well be illustrated in the demonstrations in class. The concept of pressure as weight of the atmosphere works well, though, if you imagine a perfectly flat person laying on the ground. He or shoe would only experience the pressure force acting downward. The diagram below illustrates the pressure forces along the z and x axes in the middle of a swimming pool.

