Relative Humidity – Video Tutorial

Since relative humidity is an important term we use to describe the water content of air, let's make sure we know what it means. **ABSOLUTE HUMIDITY** is the amount of water vapor present in a unit volume of air, usually expressed in kilograms per volume of air or in units of pressure. **SATURATION ABSOLUTE HUMIDITY OR CAPACITY** is the absolute humidity a given parcel of air ***could*** have if it were saturated or at capacity. That number depends entirely on the temperature. The warmer the air, the more kinetic energy and, hence, velocity, the molecules have, the more saturated it can be with water. The cooler the air, the slower the molecules, the less saturated it CAN be. Air over the Great Barrier Reef of Australia is quite warm. Its capacity is high!

RELATIVE HUMIDITY (R.H.) is a measurement of how close an air mass's water concentration is to its maximum. RH is a percentage – what percent of capacity has been reached. It is the most useful measurement when discussing weather systems, because it tells us how much more water could be evaporated or how close it is to raining.

Imagine that the yellow box in this picture represents a particular air mass. The white box in the top right is an approximation of how much of this air volume can be taken up by water. (Note: in reality, the water would be present and disseminated throughout, not separated into this little box. Separation is only for the purposes of this explanation.)

If there is no water present in this air mass, then what is the relative humidity of the air? 0% That's dry air that will actively evaporate any water that's around. So let's evaporate until ½ of the capacity is filled. So Relative Humidity is 50%. What happens to this air mass' **relative humidity** when the air temperature cools?

As the air temperature cools, its capacity for water decreases. The water that's already within now takes up a larger percentage of the decreasing capacity. What happens to air's **relative humidity** when air temperature warms?

When air temperature warms, the capacity increases. The percentage of fullness therefore decreases.
What happens when the capacity is completely full?

Pause now.

When the capacity is reached and air is saturated with water, water will start to precipitate on available solid surfaces. The temperature at which a given air mass with a given absolute humidity would reach its capacity or becomes saturated is called the **Dew Point**. In this graph, you see temperature across the bottom X-axis – increasing to the right. On the Y-axis, we see absolute humidity measured in water pressure or concentration. The different curves represent different relative humidities – increasing as you move upwards. This white arrow points at the 100% relative humidity line. The red lines show that at that temperature (12 degrees Celsius), 100% relative humidity is reached when vapor concentration reaches 11 grams of water per cubic meter of air. At that same concentration of water, but a higher temperature, such as 20 degrees Celsius, the relative humidity would decrease. What about an air mass at a temperature around 4 degrees Celsius? It would reach a 90% relative humidity or fullness at a vapor concentration of 5 grams per cubic meter – a concentration that would put 12 degree Celsius at 50% relative humidity and 20 degree Celsius air at only 30% relative humidity.

Pause now.

When we see clouds in the sky, we know that relative humidity of that air mass reached 100% and droplets of water started to precipitate (usually around microscopic bits of dust in the air). Such air is usually less dense, rising air that cools as it moves upward. The cooling causes relative humidity to increase until it hits 100%. The water that precipitates falls downward due to gravity, but with small water droplets and rising air, it can look to us on the ground as though the cloud is stationary. Note: When a cloud is moving along the ground, it is called fog. Anyone who's spent much time in San Francisco during the summer has first-hand knowledge of fog and knows that it's made of water droplets, as these cover the windshields of cars and glasses of bicyclists who travel through these fog banks. Notice that the image of the hurricane shows a spot in the middle with no clouds. This clear "eye" in the center is a region where air is sinking and warming up. Its relative humidity is decreasing, so there's no precipitation – only evaporation.

Pause now.

For more information and more detail, continue on to the next video in this series.

[End credits]

Air-Sea Interactions Series:
Part I: Seasons
Part II: Relative Humidity
Part III: Atmospheric Gases, Heats, and Pressures
Part IV: Atmospheric Circulation
Part V: Weather Phenomena

Relative Humidity
Geoscience Video Tutorial
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