EFFECTS OF HUMIDITY ON YOUR PROPERTY

telkonet

Defining a High Humidity Climate

The amount of moisture in the air, “humidity,"continually varies. Think of a sponge as an analogy. When relative humidity is 50%, the sponge is half full of water. When relative humidity is 100%, the sponge is holding as much water as it possibly can. When relative humidity is 0%, the sponge is completely dry and free of moisture.

Climate

Buildings in Orlando, FL are more susceptible to humidity challenges than for example, Atlanta, GA. What climate qualities make Orlando more susceptible to humidity than Atlanta? Orlando is situated in an area that experiences high humidity for an extended period of time in the cooling season.

Climate change will significantly increase humidity

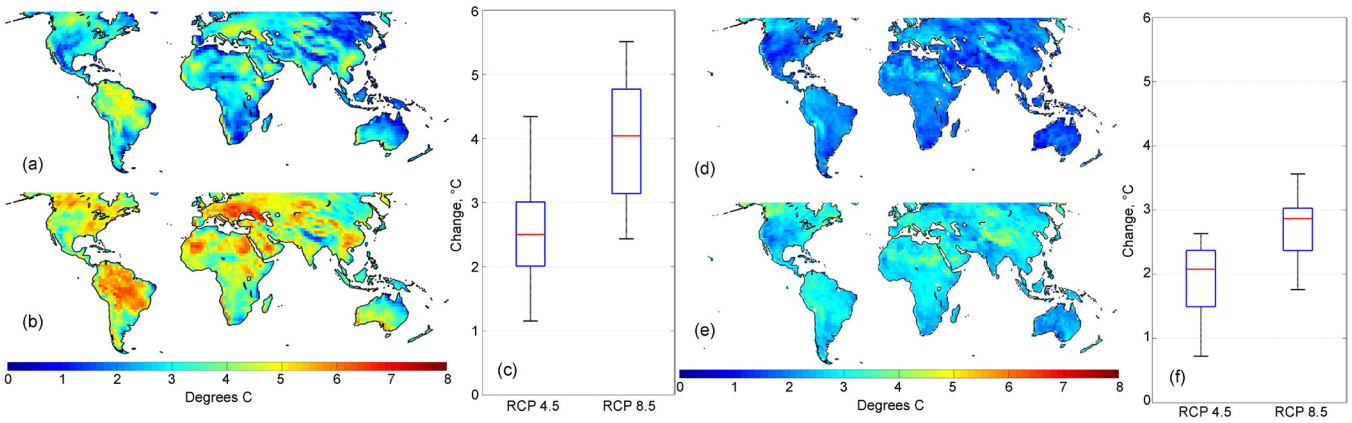


Figure 1. Panels (a)–(c): changes in annual maximum air temperature in 2060–2080 relative to 1985–2005 under RCP 4.5 (a) and RCP 8.5 (b). Panel (c) shows the range in projected annual maximum temperature increase spatially averaged over land for both emission scenarios over all 18 CMIP5 GCMs. Panels (d)–(f): same as (a)–(c) except for annual maximum wet bulb temperature. Air temperatures increase at a faster rate and have more spatial variability than wet bulb temperatures, in part due to the dependence of wet bulb temperature on humidity.

https://iopscience.iop.org/article/10.1088/1748-9326/aaa00e
https://e360.yale.edu/digest/global-warming-could-cause-dangerous-increases-in-humidity

Active Dehumidification

HVAC units are either designed with active dehumidification components or without. Active dehumidification components target and control humidity. HVACs that include this feature tend to be more expensive and less common. Note that on PTAC's, active dehumidification cannot be retrofitted later. Justin Lendowski, Senior Controls Engineer at Telkonet, recommends that when shopping for HVAC's, do not skimp on options like this one. PTACs with dehumidification are worth the extra cost. If they are not in your budget, cost-effective alternatives are available.

Humidistats

Your HVAC units might feature humidity sensors, or humidistats which measure humidity but do not control humidity.

You may have read that thermostats with humidistats simply cannot reduce room RH%, because they drive the HVAC based solely on room temperature, regardless of what the humidistat indicates. This is partially true. For some thermostats, the humidistat does not affect HVAC operation whatsoever.

However, the good news is that now there are smart thermostats featuring humidistats which operate using specific firmware, designed to drive the HVAC based on temperature, humidity, occupancy, and other parameters. Firmware can be customized for your climate and your unique property.

When Moisture Makes an Extended Stay

Once outdoor water vapor has made its way past porous building materials, it moves first through the wall cavity, then the insulation, and finally the drywall. Often moisture is stopped by non-porous or semi-porous vinyl wall coverings. This is problematic. Moisture will collect behind vinyl wall coverings, condensing and soaking the drywall and insulation until it is soft and crumbly, encouraging the growth of mold and mildew.

How Does This Affect My Business?

The presence of mildew or mold in a building creates a host of problems, big and small.

In the hospitality industry, the unwelcome effects of mold and mildew can cost you your customers' brand loyalty. The presence of mildew or mold in a room creates stale-smelling, musty air that will greet the guest as soon as they open the door. Hotels can lose loyal guests who are turned off by the sight and smell of mold and mildew, some of whom announce their bad experiences on TripAdvisor and other social media platforms, complete with photos.

Fact: We're better at detecting smells in a humid environment than in a dry environment. In heat and high humidity, there are more water molecules in the air to bind and carry olfactive particles into our noses. Trash still smells in the winter, but the cold, dry air limits how far the stench can travel.

- Mold and mildew caused by sustained high humidity inside buildings can cause health problems ranging from minor reactions (nasal stuffiness, throat irritation, coughing or wheezing, eye or skin irritation) to more severe reactions like lung infections, especially for those with mold allergies and lung disorders like COPD.

Insects

Some insects are attracted to mold and mildew as a food source. Here are the most common insects that eat mold and mildew:

- Cockroaches
- Mold mites
- Foreign grain beetles
- Termites
- Book lice

Other insects, even if they don't feast on mold, just feel comfortable in warm, damp environments. Dust mites, bed bugs, centipedes, and earwigs are examples.

Other Problems Attributed to High Humidity

According to CDC, high humidity can also cause these problems:

- Mold in carpet, bed or couch
- Peeling wall paint
- Disintegrating drywall
- Wet insulation
- Damaged electronics due to condensation and corrosion
- Caved-in floorboards
- Decaying cabinets, shelves or other woodwork

Solutions Repair/Remediate

- *Mold*

  If mold is already an issue at your property, the EPA offers guidelines in the Mold Remediation in Schools and Commercial Buildings Guide.

  > *The cost to repair mold damage and prevent its return can be astronomical. As the National Institute of Building Sciences describes one hotel's costly mold reparations, "only a few years after opening its doors, the hotel underwent a major overhaul. Over 40,000 square feet of gypsum wallboard was removed and replaced in the newly constructed guestrooms. Three hundred HVAC systems were replaced. Ultimately, repairs and other associated costs exceeded $6 million."*

  It is impossible to eliminate 100% of the mold and mold spores in an indoor environment. However, mold growth can be controlled indoors by controlling indoor moisture.

- *Moisture*

  Moisture damage will continue to advance until outside air and moisture leaks are blocked and appropriate vapor barriers are installed or repaired.

Dehumidification

- *Oversized HVAC Units*

  Avoid installing oversized HVAC units, especially in high-humidity climates. An oversized HVAC unit will cool the room rapidly then shut off. This is problematic for several reasons. It does not allow nearly enough time to reduce the room's relative humidity during its cooling cycle; it makes for an uncomfortable indoor climate; it can reduce the air quality, and increase wear and tear on the unit with more starts and stops than it should.

- *Outdoor Air Dampers*

  Outdoor air dampers are mechanical devices that regulate airflow. When they're in the "open" position, they allow fresh air to enter a building. They allow "make up" air into the building when exhaust fans run, and they contribute to the building's proper pressurization.

  When they're in the "closed" position, they prevent rain, snow, and humid air from entering. Dampers that are "always open" (which is more often the case for fancoils than PTACs) present a major problem in hot humid locations like Miami, FL.

  Air dampers can be fully automated, partially automated, or manually operated as is the case in some older buildings.

- *A/C*

  Air conditioners can reduce humidity by pulling warm air in and cycling it over cold coils, producing condensation, thereby removing moisture and reducing humidity in the air.

  However, there are still air conditioners in existence with thermostats that measure temperature but not humidity. Because of this, this kind of air conditioner stops running when the ideal temperature is reached, NOT when the ideal relative humidity is reached.

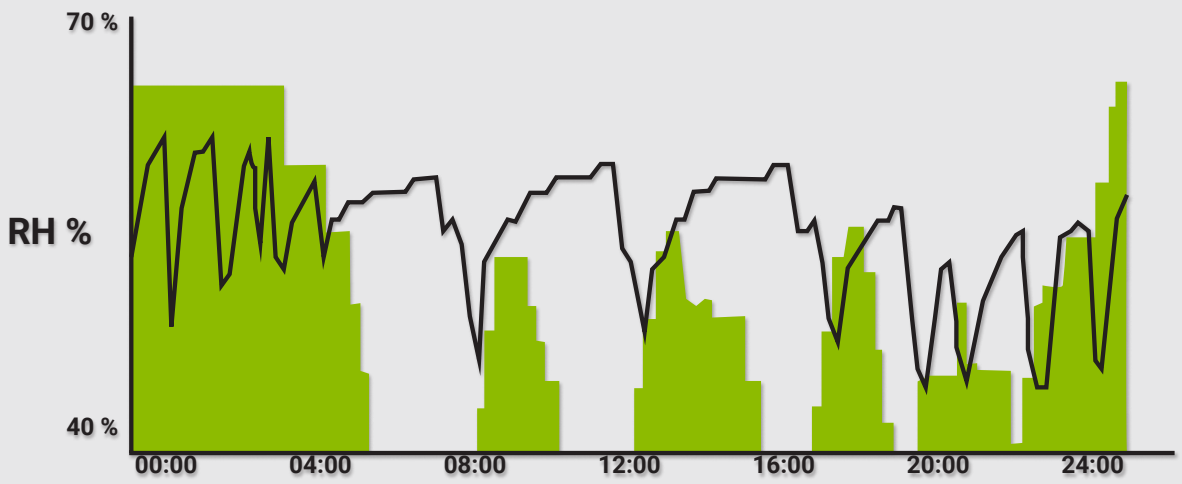
During each dehumidification cycle, the HVAC system activates, driving the relative humidity to a defined level (for example, 55%) and the sustained cooling-drives effectively dehumidify the air. Though relative humidity climbs in between refresh drives, it never reaches the peak levels seen during the occupied period. The dehumidification cycle forces the HVAC system into a sustained cooling drive, which typically lasts for 10 to 15 minutes every 4 to 6 hours.

Fact: It's easier to dehumidify a room or living space that is unoccupied than one that is occupied. Without occupants in the space, the air conditioner can run more aggressively until the humidity in the air reaches a defined level without disturbing anyone with an uncomfortably chilly space, or the noise of a continuously running HVAC.

Fancoils with the heating coils in the re-heat position can be controlled to actively dehumidify by reheating the air coming off the cooling coil, so over-cooling does not happen.

As shown in **Graph A**, when guests or residents return, dehumidification continues, albeit less aggressively, so that they remain comfortable. HVAC systems are able to overcool in Low/Cool by a mere 1 or 2 degrees without an occupant noticing.

Graph B illustrates the details of a typical dehumidification cycle.

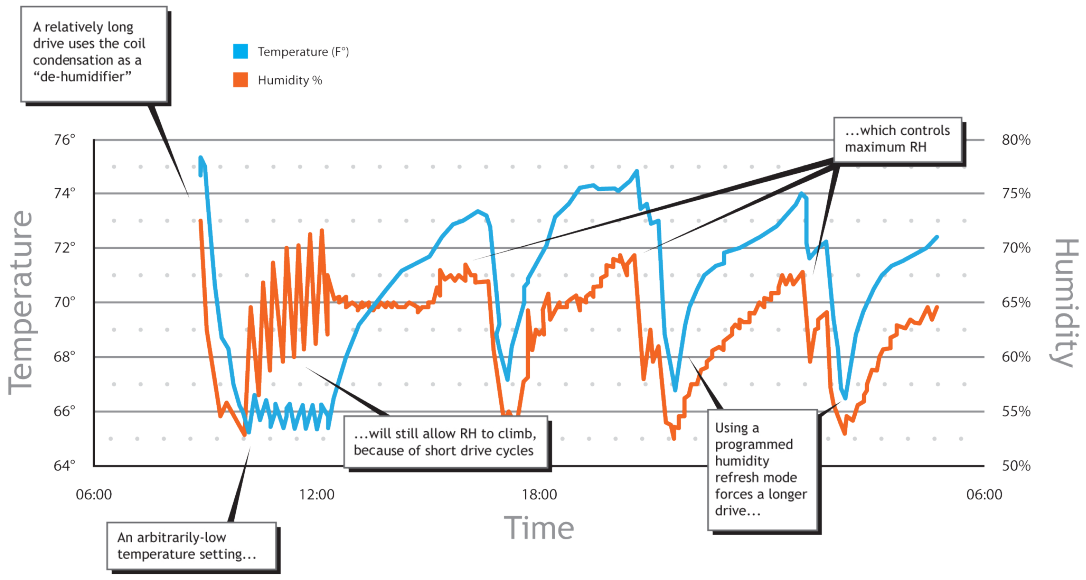


When occupant leaves, air conditioner runs more aggressively to achieve desired RH%. When occupant returns, room temperature returns to set point; humidity control is still enabled but is less aggressive.

Graph A

The Occupied Room

During the data collection period, the room remained occupied from 9:00 a.m. until 12:30 p.m. At the beginning of this period, the HVAC system sustained a long cooling drive to bring the hot, humid room down to the setpoint temperature of 66°. The occupants selected a deliberately low setpoint to represent a common way people attempt to combat dehumidification: by drastically lowering the room temperature. During this long initial drive, the relative humidity dropped from approximately 73% at 9:00 a.m. to 53% by 10:00 a.m. At this point, the thermostat in the room began to maintain the setpoint temperature with a series of short cooling drives, but the relative humidity continued to climb steadily in a sawtooth pattern. In other words, the relative humidity dropped during each of the short drives—but quickly returned to even higher levels after the room reached the setpoint temperature and the HVAC system shut off. The drives were too short to force enough condensation on the cooling coil to achieve effective dehumidification.



Graph B

The Unoccupied Room

At approximately 12:30 PM, the occupants left the room. At this point, the temperature in the room drifted away from the setpoint just far enough to reduce system runtime and achieve maximum energy savings. During this unoccupied period, the thermostat activated a Refresh Cycle. The Refresh Cycle forced the HVAC system into a sustained cooling drive, which typically lasts for 10 to 15 minutes every 4 to 6 hours.

For the rest of the day, the room remained unoccupied. The thermostat allowed the temperature to drift significantly higher than the room setpoint and the HVAC unit continued to sit idle. During each Refresh Cycle, the HVAC system activated and drove the relative humidity below 55%. The sustained cooling drives effectively dehumidified the air. Though relative humidity climbed between refresh drives, it never reached the peak levels seen during the occupied period.

Energy Management Systems

Some Energy Management Systems (EMS) can be programmed to measure and control humidity using specifically engineered firmware.

Recall the outside air requirements we mentioned earlier: the amount of outside air entering a building has to be controlled. Some EMS systems have the capability to control the damper via the firmware in their smart thermostats.

Typically, EMS firmware that controls humidity is designed to work with fan coil units. There are some EMS platforms that can essentially add active dehumidification to PTAC units, depending on the design.

The best way to dehumidify is to cool slowly, using a Cool/Low Fan. It dehumidifies better than a Cool/High Fan. Less airflow over the cold coil allows more condensate (moisture in the air) to form on the coils, removing it from the supply air more effectively. When the relative humidity is above a certain threshold, smart thermostats can be programmed to allow only Cool/Low.

Fan coils with the heating coils in the re-heat position can be controlled to actively dehumidify by reheating the air coming off the cooling coil, so over-cooling does not happen.

Occupancy

Hospitality

In the hospitality industry, if there is a PMS (property management system) interface with an EMS, unsold rooms can more aggressively drive down humidity than even unoccupied rooms.

Education: Extended Breaks

In higher education, during extended breaks (particularly in summer) some universities turn off their HVACs entirely to save energy. With an EMS, the HVAC can remain on, and it will drive down humidity to acceptable levels and still save energy.

Conclusion

High humidity can occur across the U.S., to varying degrees. Problems associated with high humidity can prove costly to remediate. It is therefore wise to maintain indoor humidity below 55% (approximately) RH.

Maintain HVAC units and keep an eye out for leaks. Address mold issues promptly, before minor problems grow into unwieldy ones. Mold and mildew are unsightly and musty smelling, and more significantly, be a threat to occupants' health.

A powerful and effective EMS system will assist in controlling humidity, particularly when they offer these features:

- Highly calibrated occupancy sensing
- Humidity sensing AND controlling damper automation
- "Profiles" which automatically control groups of thermostats remotely, aggressively driving down humidity in unoccupied or unrented rooms
- An energy management system contributes to healthy humidity levels and saves time, energy, and the cost of repairs caused by high humidity

Ask your Telkonet sales representative how our products designed for humid climates can solve YOUR property's humidity issues.

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