

## Degradation of Heating, Ventilation, and Air Conditioning Components across Locations

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**Abstract :** Materials degrade at different rates in different environments depending on factors such as temperature, aridity, salinity, and solar radiation. Therefore, predicting asset longevity depends, in part, on the environmental conditions to which the asset is exposed. Heating, ventilation, and air conditioning (HVAC) systems are critical to building operations yet are responsible for a significant proportion of their energy consumption. HVAC energy use increases substantially with slight operational inefficiencies. Understanding the environmental influences on HVAC degradation in detail will inform maintenance schedules and capital investment, reduce energy use, and increase lifecycle management efficiency. HVAC inspection records spanning 14 years from 21 locations across the United States were compiled and associated with the climate conditions to which they were exposed. Three environmental features were explored in this study: average high temperature, average low temperature, and annual precipitation, as well as four non-environmental features. Initial insights showed no correlations between individual features and the rate of HVAC component degradation. Using neighborhood component analysis, however, the most critical features related to degradation were identified. Two models were considered, and results varied between them. However, longitude and latitude emerged as potentially the best predictors of average HVAC component degradation. Further research is needed to evaluate additional environmental features, increase the resolution of the environmental data, and develop more robust models to achieve more conclusive results.

**Keywords :** climate, degradation, HVAC, neighborhood component analysis

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