

## **Effect of Free Convection on Cave Micrometeorology**

Ravindra Dwivedi and John L. Wilson

Dept. of Earth and environmental Science, New Mexico Tech., 801 Leroy Place, Socorro,  
NM, 87801

ravindra@nmt.edu

### **Abstract**

Understanding of cave micrometeorology is useful for many purposes, for example, to understand and manage cave ecology and biogeochemistry, and to understand impacts on cave ecology caused by human cave explorations, and to understand and manage cave decorations. Micrometeorology is characterized by the movement of air, heat, water (in both vapor and liquid forms), and various gases, for example CO<sub>2</sub>, and O<sub>2</sub>. Cave air and wall temperatures are influenced by heat storage and conduction in the rock, by water evaporation and condensation processes, and by advection and diffusion processes in the air. Air advection is in turn driven by external connections to the outside atmosphere, and by internal free convection cells driven by geothermal heat flow from beneath the surface. The time-space patterns of air and cave wall temperatures provide insight into all these processes, and also are easy to measure.

In this research study, three approaches for temperature observation have been followed: highly sensitive air-turbulent temperature fluctuation sensors with fluctuation sensitivity 0.001°C; a fiber optic cable to sense spatial and temporal variation of temperature with a resolution of 0.01°C with flexible spatial and temporal sensitivity of 1 meter and 1 minute; and HOBO temperature sensors with resolution up to 0.1°C. The temperature variations were recorded according to these three modes along cave walls and in the air along cave passage. The results indicate effect of the geothermal gradient, and of water evaporation and condensation processes, on temperature variation in the cave domain. These results also show that fiber optic cables, turbulence towers and HOBO temperature sensors can be helpful observational tools for examining the effect of free convection on cave micrometeorology.