

## The Thermal Plume above a Standing Human Body Exposed to Different Air Distribution Strategies

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*Publication date:*  
2009

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

### *Citation for published version (APA):*

Liu, L., Nielsen, P. V., Li, Y., Jensen, R. L., Litewnicki, M., & Zajas, J. (2009). *The Thermal Plume above a Standing Human Body Exposed to Different Air Distribution Strategies*. Poster presented at The International Conference & Exhibition of Healthy Buildings, Syracuse, NY, United States.

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# The Thermal Plume above a Standing Human Body Exposed to Different Air Distribution Strategies

Paper No.: hb2009-605

Healthy Buildings 2009, Sep 13-17, Syracuse

A breathing thermal manikin was placed in a full-scale test room. Long-time average air velocity profiles at locations closely above the manikin were taken to identify the wandering thermal plume with different ventilation conditions.

## Key findings

- The plume is more concentrated without ventilation. The plume shows more wandering with mixing ventilation.
- The plume strength is much weaker with displacement ventilation.

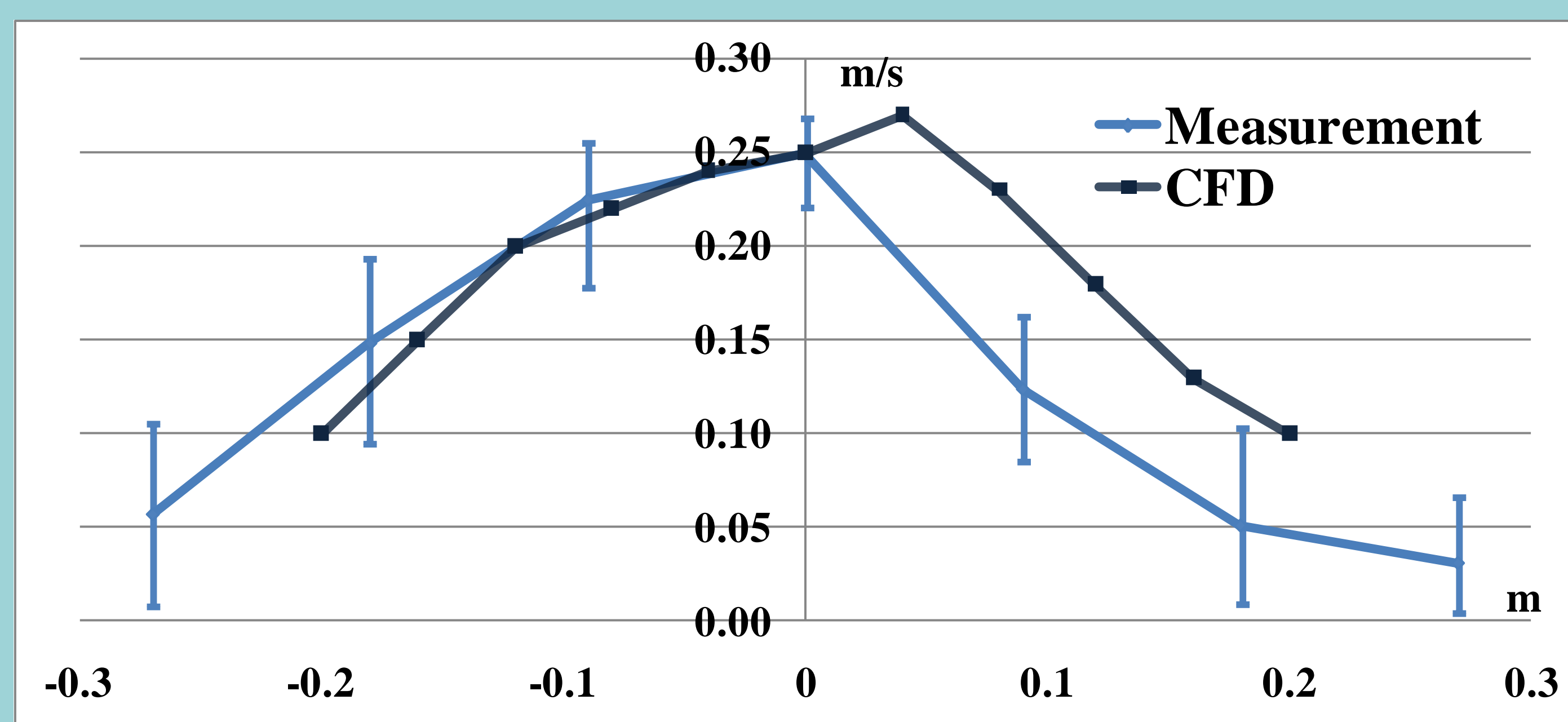


Full-scale test room  
3.17 m (L) × 2.64 m (W) × 2.93 m (H)



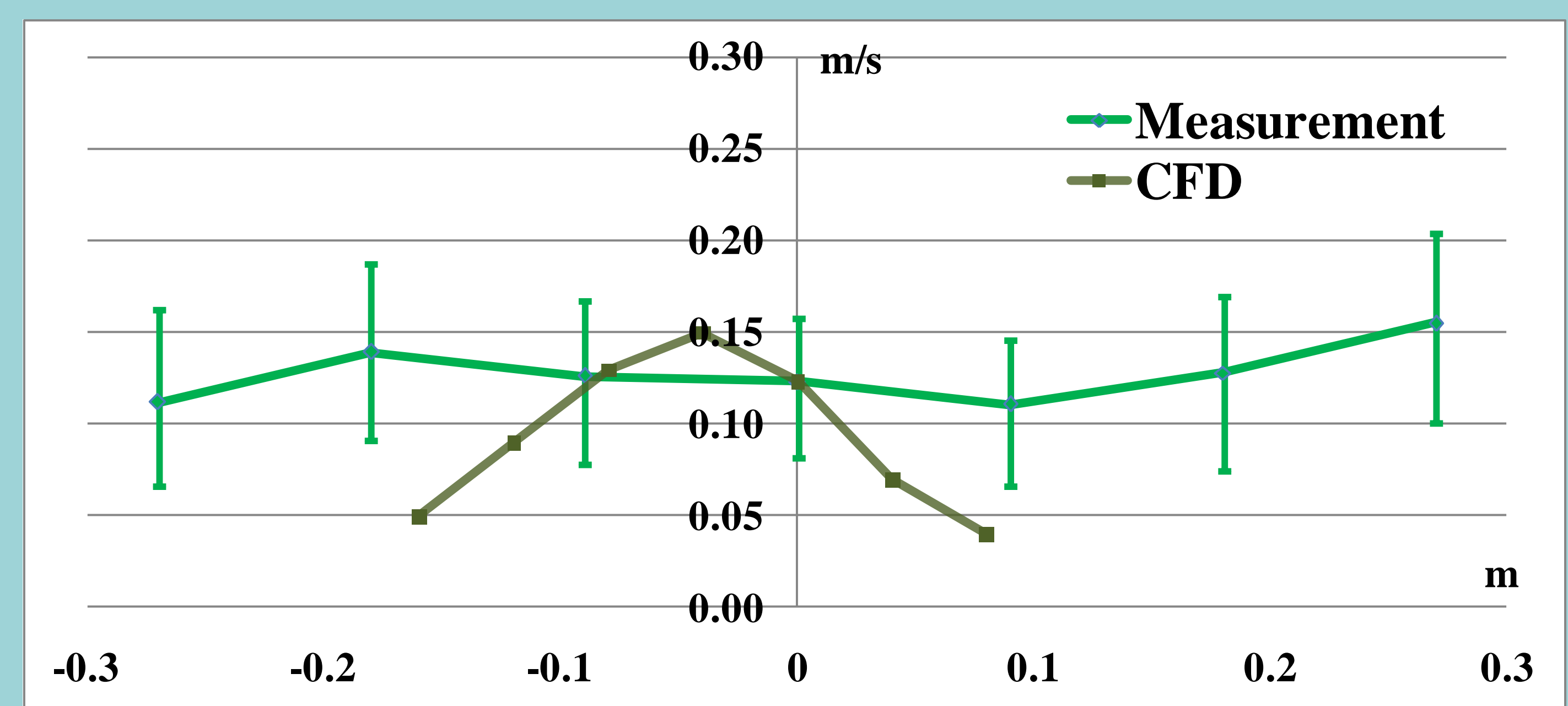
Breathing thermal manikin and  
location of sensors

## No ventilation



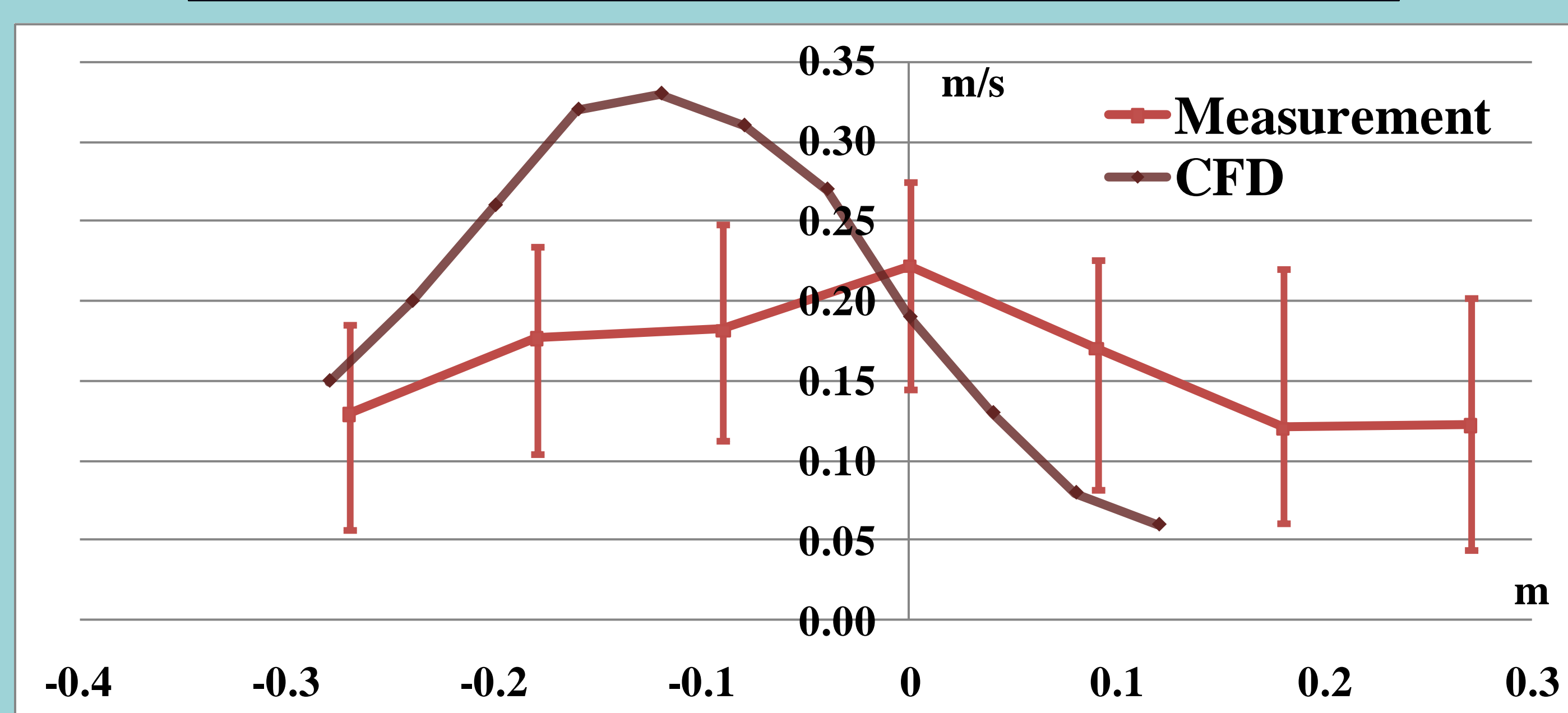
With no ventilation, the temperature in the room was 22 °C. The maximum velocity is 0.25 m/s above head. The standard deviation profile indicates that the plume far away from the center is quite weak, due to plume wandering.

## Displacement ventilation



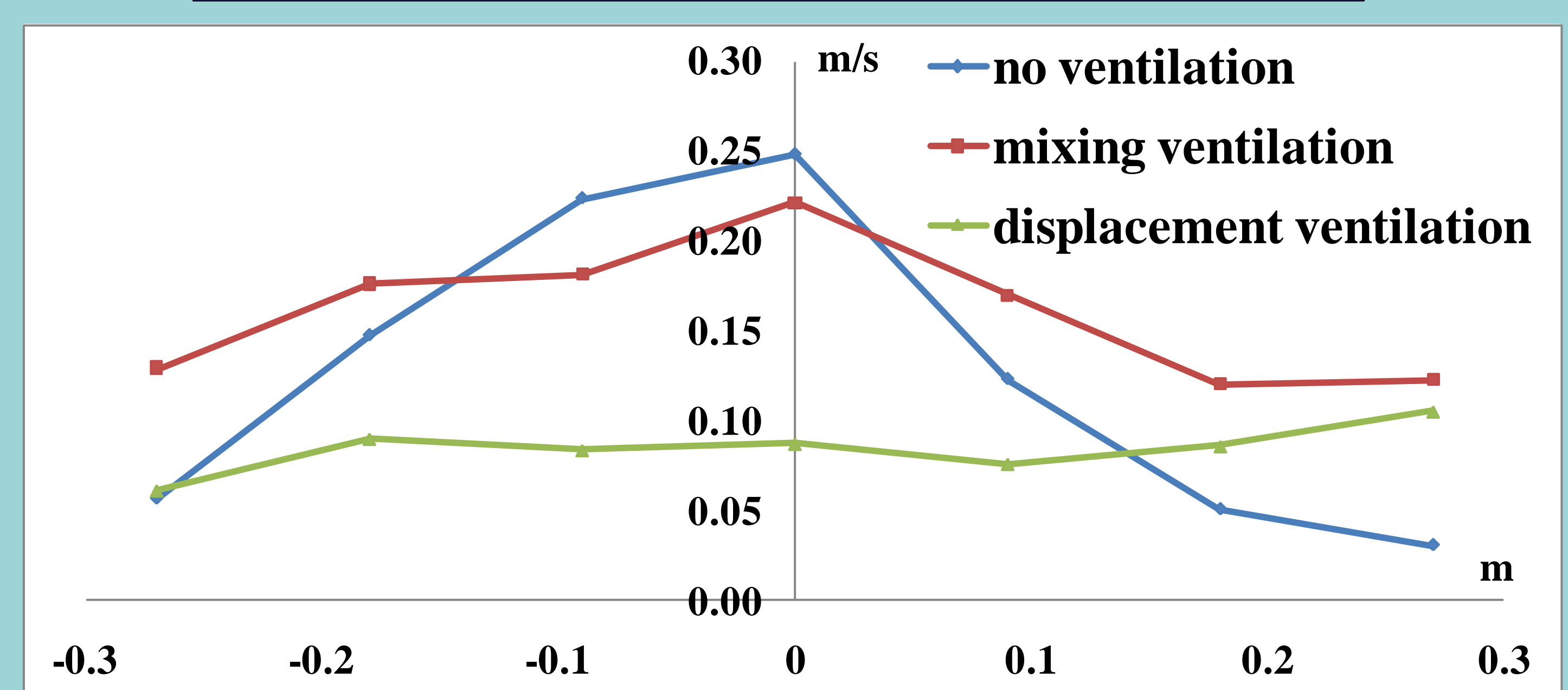
With displacement ventilation, the temperature difference between floor and ceiling was 5.3 °C. The velocities are almost constant (0.13 m/s) at all locations, about a half of the measured peak velocity in other two situations.

## Mixing ventilation



With mixing ventilation, the mean temperature was 20.8 °C. The maximum velocity is 0.22 m/s and occurred above head. The standard deviation is nearly the same for all locations.

## Comparison



The average velocities at every location with different ventilation systems