

 View PDFAccess through **Autonomous University ...**[Purchase PDF](#)**Building and Environment**

Available online 2 July 2021, 108110

In Press, Journal Pre-proof 

Thermal effectiveness of wind-tower with heated exit-wall and inlet-air humidification: Effects of winter and summertime

X. Morales ^a, F.Z. Sierra-Espinosa ^b  , S.L. Moya ^a, F. Carrillo ^c[Show more](#)  Outline |  Share  Cite<https://doi.org/10.1016/j.buildenv.2021.108110>[Get rights and content](#)

Highlights:

- Wind-tower-building aided with air humidification is analysed as a heat exchanger.
- A Nu-Re correlation to wind tower dry-air/moist air flow is developed.
- Humid air provides 16.4% thermal comfort in summer.
- A model for wind-tower-building thermal effectiveness is presented.

Abstract

[FEEDBACK](#) 

Wind-towers provide natural ventilation to residential building in hot arid and semi-arid climate. Water-droplet spray can reduce the air-stream temperature at air-inlet section to increase wind-tower effectiveness. However, temperature and humidity weather conditions due to climate change throughout the year play a main role. Besides, heating of building's structure produced by solar radiation has an impact on interior air-stream temperature. This paper presents a thermal assessment of combined wind-tower air-humidification with a heated wall under the effect of winter and summertime. A correlation Nusselt-Reynolds numbers for different weather conditions was developed experimentally, which investigates thermally a simulated solar heating of an exit-wall wind-tower-building by means of a parallel plate heat exchanger tested in a low-speed wind tunnel. The effect of a water-droplet spray on the wind-tower streams and constant heating exit-wall of the building was investigated varying the air-inlet Re number between 1.3×10^4 and 2.5×10^4 . The results show that Nu number increases with Re number for both dry-air and moist-air flow wind-tower-building inlet condition. Wind-tower thermal effectiveness is 10.1% higher for wintertime compared to the summertime. Results for dry-air and moist air and the $Nu-Re$ correlation can be used as guidelines for future wind-tower designs.

Keywords

Wind-tower heat transfer; Air humidification; Residential comfort; $Nu-Re$ correlation; Wind-tower building

[Recommended articles](#)

[Citing articles \(0\)](#)

[View full text](#)

© 2021 Elsevier Ltd. All rights reserved.



[About ScienceDirect](#)

[Remote access](#)

[Shopping cart](#)

[Advertise](#)

[Contact and support](#)

[FEEDBACK](#)

[Terms and conditions](#)

[Privacy policy](#)

We use cookies to help provide and enhance our service and tailor content and ads. By continuing you agree to the **use of cookies**.

Copyright © 2021 Elsevier B.V. or its licensors or contributors. ScienceDirect® is a registered trademark of Elsevier B.V.

ScienceDirect® is a registered trademark of Elsevier B.V.

