Contribution ID: **83** Type: **Poster Presentation**

Thermoregulation and Ventilation in Termite Nests: Towards Bio-Inspired Solutions to Design Energy Efficient Buildings

Wednesday, 24 May 2023 10:30 (1h 30m)

Abstract
Termite nests have long been recognised for their ability to maintain self-sustained ventilation and thermoregulation irrespective of external climatic conditions. Although there has been significant interest in this topic, especially from a point of view of designing energy-efficient buildings, the mechanisms by which the nest properties are controlled are not fully understood.
In this study, we investigate how the structural properties of termite nests, constructed by different termite species, affect temperature regulation and ventilation. We combine X-ray tomography, numerical simulations, and machine learning to correlate nest properties with climatic conditions. The results show that termite nests in the savannah vegetation have similar architecture and structural properties and have larger surface to volume ratio and surface complexity compared to nest in the forest vegetation. Large surface to volume ratio and surface complexity are properties which have been linked to efficient gas exchange and reduced nest insulation. The results will be correlated to pressure and velocity fields, permeability, thermal conductivity, and CO2 dispersivity obtained from millimetre-scale 3D numerical simulations, which will enable us to better understand the processes that control self-sustained ventilation and thermoregulation in termite nests.

Participation

In-Person

References

- King, H., Ocko, S., & Mahadevan, L. (2015). Termite mounds harness diurnal temperature oscillations for ventilation. Proceedings of the National Academy of Sciences of the United States of America, 112(37), 11589–11593. https://doi.org/10.1073/pnas.1423242112 -Korb, J. (2011). Termite mound architecture, from function to construction. In Biology of Termites: A Modern Synthesis (pp. 349–373). Springer Netherlands. https://doi.org/10.1007/978-90-481-3977-4_13
- Singh, K., Muljadi, B. P., Raeini, A. Q., Jost, C., Vandeginste, V., Blunt, M. J., Theraulaz, G., & Degond, P. (2019). The architectural design of smart ventilation and drainage systems in termite nests. http://advances.sciencemag.org/

MDPI Energies Student Poster Award

Yes, I would like to submit this presentation into the student poster award.

Country

United Kingdom

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

Primary author: Ms KARIBI-BOTOYE, Nengi Fiona (Heriot-Watt University)

Co-authors: Dr THERAULAZ, Guy (Centre de Recherches sur la Cognition Animale (CRCA), Centre de Biologie Intégrative (CBI), Université de Toulouse,CNRS, UPS, Toulouse, France.); Prof. DEMYANOV, Vasily (Heriot-Watt University); Dr MULJADI, Bagus P. (University of Nottingham); Mr NATHANAIL, Athanasios (Heriot-Watt University); Dr MENKE, Hannah (Heriot-Watt University); Dr MAES, Julien (Heriot-Watt University); Dr SINGH, Kamaljit (Heriot-Watt University)

Presenter: Ms KARIBI-BOTOYE, Nengi Fiona (Heriot-Watt University)

Session Classification: Poster

Track Classification: (MS09) Pore-scale modelling