Mathematics confirm the efficiency of horreos with slots

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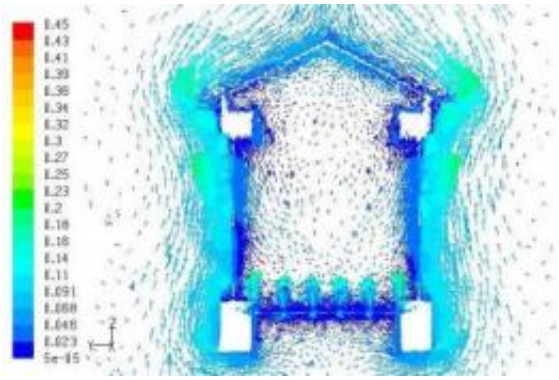


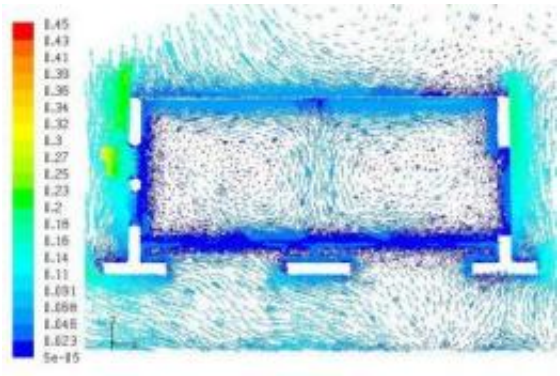
This image shows the air flow patterns in a hórreo dry-store structure (vertical plane). Credit: C. Saá, J.C. Morán, J.L. Míguez et al.

Horreos, a type of Galician dry-store structure, with slotted floors regulate temperature better in sunny weather conditions, which helps preserve the corn stored there. This is something that people from ancient times knew, and has been ignored in recent restorations, that is proven now with a mathematical model developed in the University of Vigo (Spain).

In many restorations of old hórreo dry-store structures in recent years, slots that perforated the floor were removed. This was not a good idea, according to a study that researchers from the University of Vigo have just published in the *Energy and Buildings* journal.

The slots not only ventilate the inside, where the corn and other food is kept, but they also reduce the temperature when the sun shines. Scientists have confirmed this by placing "thermohygometric" sensors in the hórreo and entering the records into a mathematical model. Fluid mechanic equations have served as a reference.

"Although on principle one could think that the heat is good for drying the corncobs, if the temperature raises a lot, the corn's hygrometric balance curve changes and it begins to absorb moisture from the environment. This helps the proliferation of bacteria which makes the corn rot" said César Saá, researcher at the University of Vigo and lead author of the study.



This image shows the air flow patterns in a hórreo dry-store structure (longitudinal plane). Credit: C. Saá, J.C. Morán, J.L. Míguez et al.

The researcher highlights that "the main advantage of having a slotted floor in hórreo dry-store structures is that it clearly shows better results in two parameters: the efficiency in ventilation and preventing internal temperatures from rising."

There is scientific evidence supporting the traditional custom of opening

the access doors of the dry-store structure (normally there are two, one at the front and one on the side) to improve ventilation when the solar radiation is high during the September to May storage period.

Throughout these nine months the team analysed the hórreo's response to climate, which has been the basis for this first published study. Further studies will be subsequently published. As a model, a "Pontevedra style" structure was used, made of stone and wood, which is different from the "Coruña style" which is just made of stone.

Mathematical simulations and flow patterns

In order to carry out the mathematical operations, a simulation software was used and created a calculation net of eight million elements. Air flow patterns were obtained, which are fundamental to understanding the ventilation of the dry-store structure in different climate action situations.

The graphics of the vertical transversal and longitudinal sections of the dry-store structure show a large upward flow towards the middle of the building through the slots in the floor. The emissions escape en masse through the top row, and to a smaller scale through the first line of the side slots.

The whole study was carried out in a dry-store structure with no corn. "In this situation, the flow patterns can differ from ones with a stocked hórreo (due to the interference from the corncobs) but we believe the conclusions regarding the efficiency of ventilation and temperature contention do not vary much" Saá highlights.

The food is preserved in these buildings using only the energy provided by the atmosphere. "From this point of view, the hórreo dry-store structures are very efficient, and maintenance of them is virtually

unnecessary over the years" the researcher concludes.

More information: C. Saá, J.L. Míguez, J.C. Morán, J.A. Vilán, M.L. Lago, R. Comesaña, (J. Collazo). "The influence of slotted floors on the bioclimatic traditional Galician agricultural dry-store structure (hórreo)". *Energy and Buildings* 43 (12): 3491-3496, December 2011. Doi:10.1016/j.enbuild.2011.09.015

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