SDI Review Form 1.6

Journal Name:	**Advances in Research**
Manuscript Number:	**Ms_AIR_20223**
Title of the Manuscript:	**The Significance of Time Step Size in Simulating the Thermal Performance of Buildings**
Type of the Article	**Original Research Article**

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This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty'**, provided the manuscript is scientifically robust and technically sound.
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PART 1: **Review Comments**

	Reviewer's comment	**Author's comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Compulsory REVISION comments	16: "demonstrated" A demonstration involves general behaviour and sure relationships, in your case you reported just one application in which it happens, so you should substitute "demonstrated" with "reported" (or similar) 40-41: "However, it has limitations in modelling the thermal performance of buildings due to the long computing times involved" Not only because of this.	***These great comments are very much appreciated.*** The reviewer's comment was addressed as outlined below. **Amended to "reported" in the Abstract.** **The following has been added to the Introduction Section.** However, it has limitations in modelling the thermal performance of buildings due to the long computing times involved, cost of the software and the complexity for inexperience end-users. In addition, most CFD applications require small time steps size but this leads

		to the excessive computing time especially under real weather conditions.
	Add details of the mesh used in the calculations (nodes, cell sizes, first node distance from the wall…) and of the numerical settings (first/second order, wall functions, turbulence modelling…).	**This has been added in Section 2.** An automatic mesh was generated for analysis of the modules using an automatic topological examination for entire geometry to find the distribution of nodes and the mesh size. In this analysis, 264534 nodes and k-epsilon turbulence modelling were used. Finally, a grid independence test was conducted to ensure the CFD simulation accuracy.
	Finally, CFD means Computational Fluid Dynamics. When using time steps in the order of hours, you completely lose the "Fluid Dynamics" part of the simulation, thus altering the output of the code. Even using 1 minute the CFD code is not able to reproduce the natural convection of air inside the Test Modules (the external flow is important as well). Natural convection is the driving mechanism that allows the heat in the air (the data you are comparing with) to be transferred through the boundary layer near the walls to the external environment, and vice versa. If you renounce to reproduce the fluid dynamic, than you are using CFD completely outside if its field of application. In this sense you should speak about "explorative CFD analysis", giving proper highlight to this aspect in the article.	**Added in Section 3.1** The fluctuations ranges during a diurnal cycle were less than 4.6 ºC and the hourly changes were less than 0.5 ºC for the InsCB module during summer and winter weeks. This indicates there were no rapid changes in temperature recorded inside the module. In general, the temperature variations were changed in slower rate compared to the other parameters analysed by the CFD (e.g. velocity).

	The final outcome of your research should be that, even if used outside of its field, CFD is surprisingly able to give not so inconsistent results with experimental data, even consistent (probably by error compensation effects) in some cases. Which can be also interesting.	**Not included in the paper** The larger time step iterations may allow capturing the natural convection between the air and walls, producing consistent results when compared with the real data. **In regards to "explorative CFD analysis", this part was added to the Introduction Section.** This paper explores the competency of CFD using larger time steps to find internal air temperature and capability of the numerical method. When successful, this may establish new applications for the CFD analysis eliminating an excessive commuting time. **This part was added to the Section 3.** Sensitivity analysis was performed to ensure the accuracy of CFD's simulation when compared with the internal air temperature for all modules. These stable and consistent results are shown in Figures 10, 11 and 12.

Minor REVISION comments	9-10: *"using a smaller time step size can provide more accurate results when simulating a shorter period"* It is expected for longer periods also. 17, 35: add the definition of the akronims	**This was amended.** It is expected that using a smaller time step size can provide more accurate results but long term simulations for complex building analysis is significantly lengthening computing time. **These definitions were added.** CFD: Computational Fluid Dynamics PC: Personal Computer and GHG replaced by greenhouse gas.
Optional/General comments	In principle, in CFD application the adoption of smaller time steps is expected to be beneficial in terms of accuracy of results. It is "expected" because is not always obtained. In your case smaller time steps provided smaller temperature fluctuation than calculations with larger time steps and experimental data. Once it happen you have to try to identify the cause(s); in general this kind of issues is related to numerical diffusion. With larger time steps the larger numerical diffusion enhance the temperature mixing, and so its fluctuations. It turns that, in your case, a well-known numerical issue compensates model (physical, numerical, grid) deficiencies.	**Possibly, however:** Finding building internal air temperature using larger time step provided better temperature fluctuation than CFD results with smaller time steps. This might happen by error compensation effects which is an inherent part of CFD analysis. All numerical and modelling errors in addition to uncertainties are fundamentally independent of each other so they can compensate or add to each other in an unpredictable way (*Johann F. G*). On the other hand, if there is any error compensation effects, the results should change with each time step or with different season in unpredictable way but this is not the case

		here as the CFD results are consistent for different time steps over the testing period during winter and summer weeks. This may possibility eliminate any error compensation effects. The discretization method was used in the CFD simulation which enables to imitate the natural convection of air inside the test modules using larger time steps. Johann F. G., Centrifugal Pumps, 3rd Edition, Springer; 2014 (available on: http://www.amazon.com/Centrifugal-Pumps-Johann-Friedrich-G%C3%BClich/dp/3642401139)