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A two-layer green roof mathematical model

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We are concerned with the thermal behavior of extensive green roofs. The model is based on an energy balance for buildings with vegetation cover and it is applicable to roofs of various shapes. The two-layer model includes a vegetation layer and a substratum layer, as well as the energy exchange between the two. The unknowns in this problem are the temperatures of each layer which are described by a coupled system of two parabolic partial differential equations. One of the main feedback mechanisms is evapotranspiration, the combined process of plant transpiration and soil evaporation.

The modeling involves multivalued terms, and regularizing maximal monotone graphs is crucial to the mathematical treatment. We analyze the existence of solutions to this parabolic system of partial differential equations and present numerical results under fluctuations of some relevant parameters, including the leaf area index (LAI).

References

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