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Suplementary Material to “Problem-solving in pre-service physics teacher education: A didactic analysis of the role and use of metacognitive skills”

Appendice B: Problem Scenario 2: The urban heat Island effect

Cities function as local hotspots due to the "urban heat island" phenomenon, which results in significantly higher ambient temperatures in urban areas compared to their surrounding rural landscapes. This effect is driven by several factors: reduced ventilation and heat retention caused by the geometry of buildings and streets; heat generated by human activities; the high heat-absorbing properties of urban materials (such as asphalt and concrete); and a lack of vegetation. Urban expansion and the increasing frequency of heat waves under climate change are projected to exacerbate this phenomenon. Currently, 55% of the global population resides in cities, a figure expected to rise to 60% by 2030, with 67 million new residents added annually, primarily in developing nations. Urban populations are particularly vulnerable to extreme weather, especially heat waves, which are amplified by the urban heat island effect. Although the phenomenon is well-recognized, comprehensive observations to understand its global variability and future evolution remain limited. While climate change itself will have a limited effect on the magnitude of the urban heat island, ongoing urbanization coupled with more frequent heat waves will render cities increasingly vulnerable to future warming.