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## Digital model of S'pore being built for study on tackling heat



As temperatures rise, Singapore is looking at how it can make its outdoor environment cooler - and it is starting this quest in the virtual world. PHOTO: ST FILE

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# 'Digital twin' simulation will help researchers study factors affecting outdoor temperatures

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As temperatures rise, Singapore is looking at how it can make its outdoor environment cooler - and it is starting this quest in the virtual world.

A "digital twin" of Singapore is being built under the Cooling Singapore project, a national research initiative funded by the National Research Foundation (NRF).

This model will allow researchers and policymakers to find out the various factors that affect outdoor temperatures - be they traffic flow, the type of land surface or the proximity of a water body.

They can also use the model to see how new strategies can be used to make being outdoors more comfortable for people.

This "digital twin" of Singapore is not unlike the simulations in popular city-building video game SimCity. Except that in "SingCity", real-life parameters are used.

For example, data on Singapore's buildings, traffic, vegetation and land surfaces will be incorporated.

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Regional-and micro-scale climate factors, such as the direction and amount of wind a particular area receives, or the relative humidity there, will also be inputted into the model, dubbed the Digital Urban Climate Twin, or Duct.

Professor Gerhard Schmitt, lead principal investigator of the Cooling Singapore project, told The Straits Times that Duct will let urban planners and policymakers generate different scenarios to understand how land use plans will affect urban heat and outdoor thermal comfort.

The urban heat island effect happens when buildings, roads and vehicles release heat into the environment, especially at night. Studies have shown that this phenomenon has resulted in temperature differences of up to 7 deg C between urban and less built-up areas here.

Prof Schmitt, who is from research institute Singapore-ETH Centre, said the research team, which is led by nine principal investigators, is also planning social science research studies.

### 7 deg C

Temperature difference between urban and less built-up areas here, caused by the urban heat island effect.

He told The Straits Times: "An example is to produce islandwide vulnerability maps of Singapore to identify locations that most urgently need intervention, such as areas with high temperatures where more young children or elderly people live."

This is the second phase of the Cooling Singapore project and will span three years.

An earlier phase of the project, which began in 2017 and has since concluded, examined scientific literature and case studies around the world to come up with a menu of 86 strategies to cool the city, from incorporating water bodies into the city to using paint that can reflect the sun's heat.

These measures aim to make the Republic cooler through design and the use of innovative materials, for instance.

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Singapore Management University's Associate Professor Winston Chow, a Cooling Singapore project principal investigator, said cooling strategies that can be implemented at new sites will differ from those in existing estates, which may need more retrofitting.

"Some solutions that could work at existing estates could include, for example, having larger park spaces, green roofs and green walls, or having better technology, such as solar thermal hybrid air-conditioners, to reduce waste heat inputs into the urban climate," said Prof Chow.

At the national level, electric vehicles, more efficient cooling technology or changes in human behaviour could also have an impact.

For example, people being more conscious of how urban waste heat is generated could lead to less use of petrol-powered cars or air-conditioning, he added.

An NRF spokesman said the urban heat island effect is expected to worsen with global warming. This could have long-term implications on public health, air and water quality, as well as general liveability.

Higher temperatures also encourage the use of air-conditioning, which could, in turn, drive up temperatures even further due to increased emissions, said the spokesman.

"Tackling the urban heat island effect is a key aspect of Singapore's overarching climate adaptation and resilience plan," she said.

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NRF also said the project could provide opportunities for Singapore. Due to its multidisciplinary nature, expertise in multiple research areas - such as climatology, computer science and environmental engineering - will be required, providing opportunities for aspiring and established scientists.

And as climate change is a global problem, solutions developed here could also be exported.

"It is vital that we continue to invest in such research efforts to develop mitigation and adaptation measures that can be applicable in Singapore and around the world," said the NRF spokesman.

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