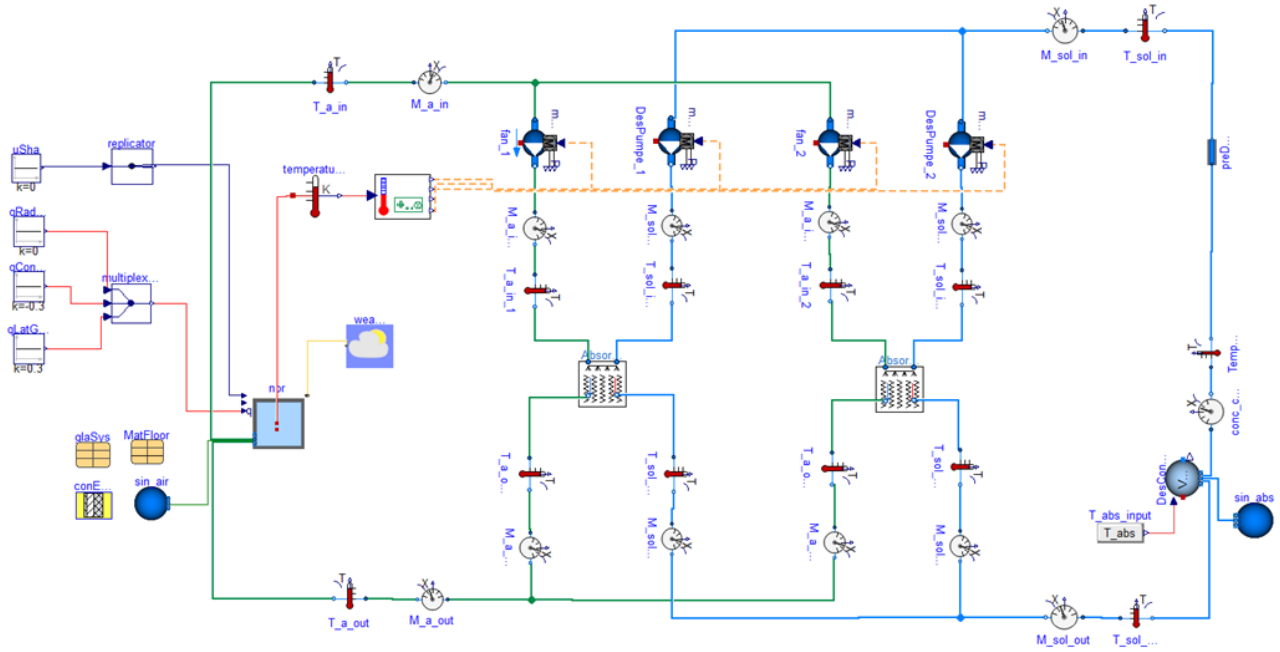
Thermochemical Fluids in Greenhouse Farming

Modelling and simulation for absorber system

The greenhouse typically maintains a high temperature due to its transparent envelope and high humidity from irrigation, so the indoor environment adjustment become a key problem. An absorber system is a promising solution for dehumidification and cooling in a single absorption process. In this project, the absorber dehumidification system for greenhouse is simulated, which includes greenhouse, absorber, solution tank and controller. Greenhouse model contains some components changing the thermal characteristics, such as envelop heat transfer coefficient and indoor latent heat source. The finite difference method is employed to simulate the absorber.



A three-stage control strategy (a small absorber on, a big absorber on and two absorbers on) is used to manage the system working conditions. Additionally, laboratory experiments are conducted to define the heat and mass transfer coefficient for model validation and calibration.

After simulations and case studies, the main results and some suggestions for end-users are presented. Firstly, the increase of irrigation will lead to lower temperature but higher humidity under the same control stage. Therefore, after irrigating the farmland, the dehumidification system should be turned on in time, as in this period, the dehumidification load will be very high. Secondly, the different control stages can efficiently manage the indoor environment to maintain humidity within the range of 60-80% and temperature around 30-40°C. For practical condition, the stage change point should be suitable. Besides, the solution's temperature also plays a key role in dehumidification process, the lower the temperature, the better the system performance. During practical system operation, the solution tank should set at the cool place with sunshade, and the temperature should be monitored and adjusted if possible.

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