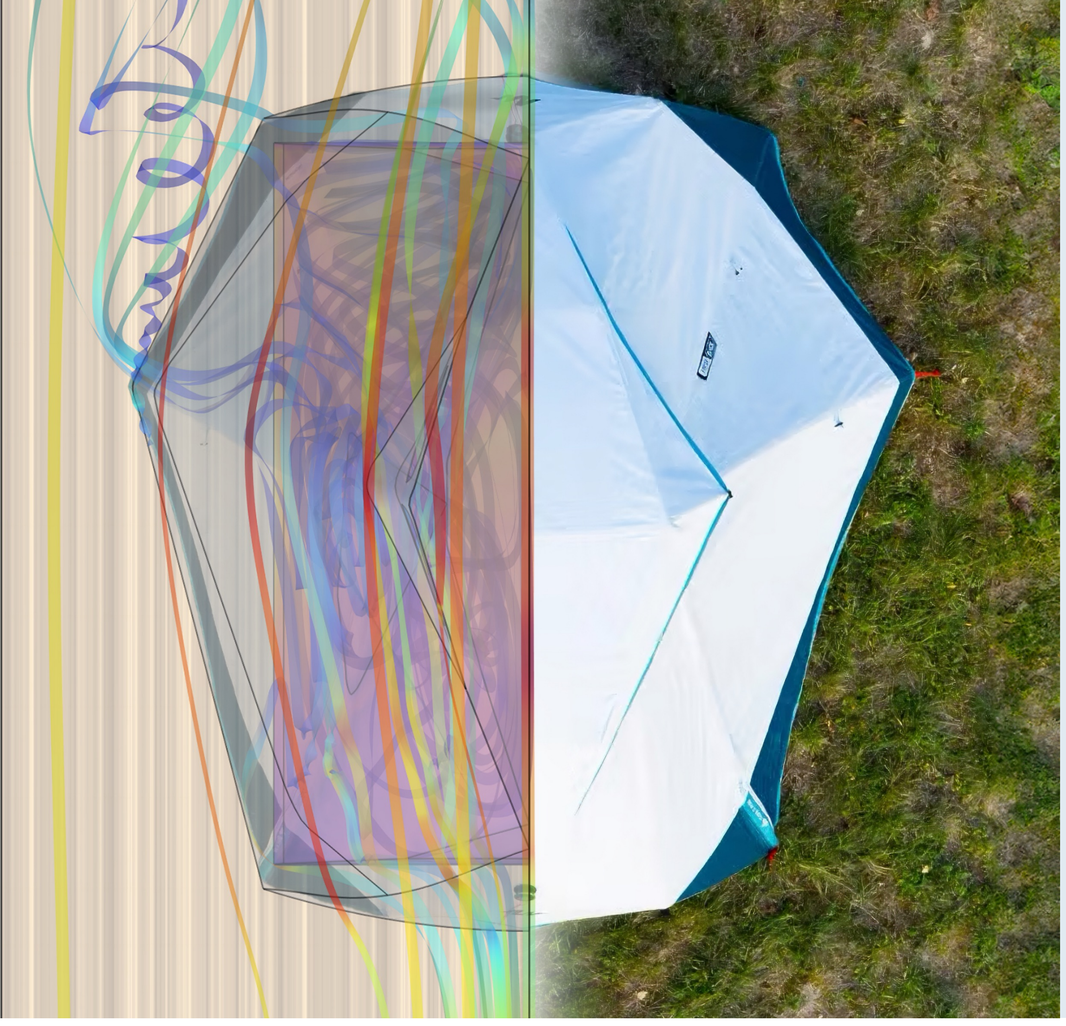

Solar Radiation Resistance Simulation of Tents

Verify the capacity of blocking solar radiation in a tent to assure customer’s thermal comfort. Validate the model by confronting experimental and numerical results.

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Context & Goals

To increase campers’ comfort, Decathlon has developed a textile technology called "Fresh & Black (F&B)“ that regulates the internal temperature and reduces the interior surface irradiation compared to classic textiles.

Laboratory tests are conducted for quantification and this is the only way of comparing the performance of different prototypes regarding temperature and solar radiation resistance.

This procedure is expensive, time consuming and needs reliable physical prototypes.

For that reason Decathlon leads a thermal digital project with three aims. Firstly, to **reproduce** the existing physical tests. Secondly, to **compare** the performance of different tents. Thirdly, to **create a simulation application** as a predictive tool.

At this stage, the numerical model for this tent is **validated**.

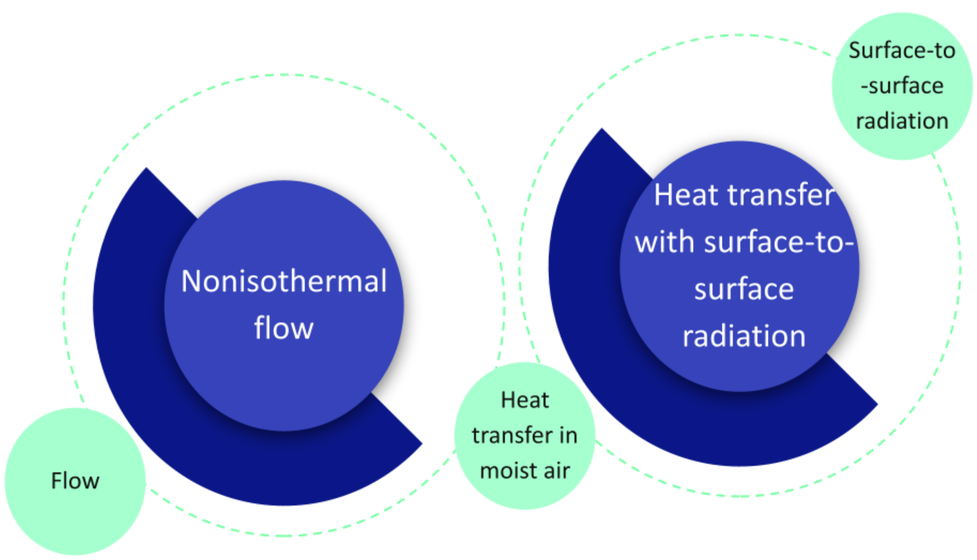

FIGURE 1. Schema of the physics and multiphysics used to solve the case study.

Methodology

Two multiphysics are used: Nonisothermal Flow and Heat Transfer with Surface-to-Surface Radiation. To solve the model, three stationary studies are considered:

1. Using a k-ε turbulence model with wall functions treatment.

2. Implementing a Low Reynolds number k-ε turbulence model with an automatic wall treatment and considering the initial values of variables solved from the first study.

3. Using the Ray shooting method as a radiation method and considering the values of variables not solved from the second study.

First Results

To evaluate the numerical model, a F&B tent is simulated. The model is built using a wind speed of 2 m/s, an ambient temperature of 27 °C and an external radiation source of 24 x 1400 W, estimated iteratively using an auxiliary sweep to get a surface irradiation of 750 ± 50 W/m² on the floor. Confronted experimental/numerical values are presented bellow:

Tent model	Experimental measurements	Numerical values	Difference
Easy F&B 2s 2p	35,1 °C	34,6 °C	1,4 %
	513 W/m²	522,4 W/m²	1,8 %

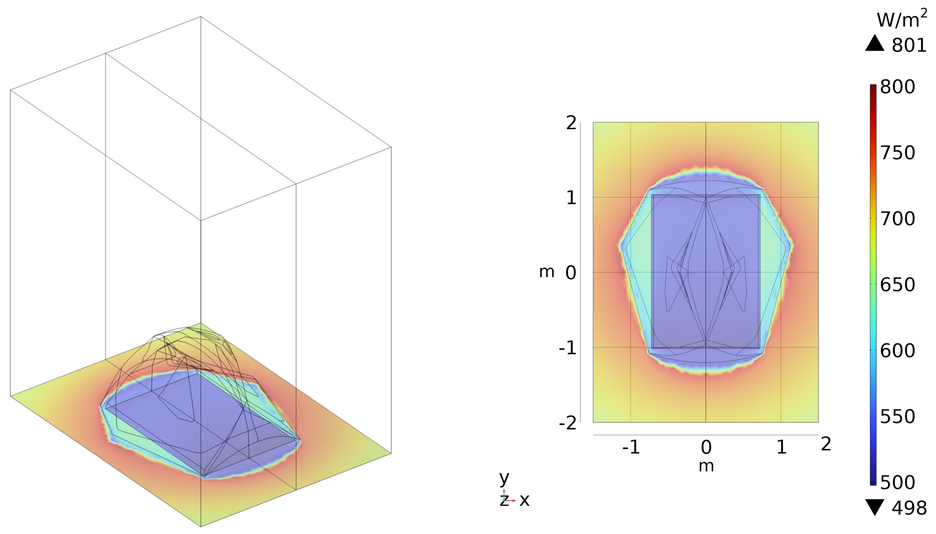

FIGURE 2. Surface irradiation (navy blue represents the best protection of the scale considered). Left: isometric view. Right: top view.

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