

# A multidisciplinary modeling approach of plant gas exchange in reduced gravity environments

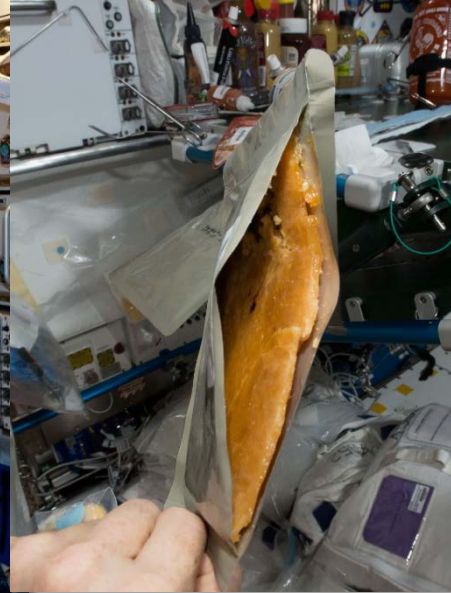
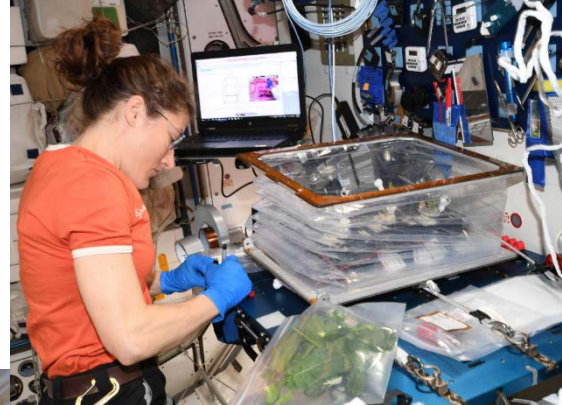
Lucie Poulet, NASA Postdoctoral Fellow, Kennedy Space Center

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4. Universität Bremen
5. Örebro University
6. NASA Kennedy Space Center











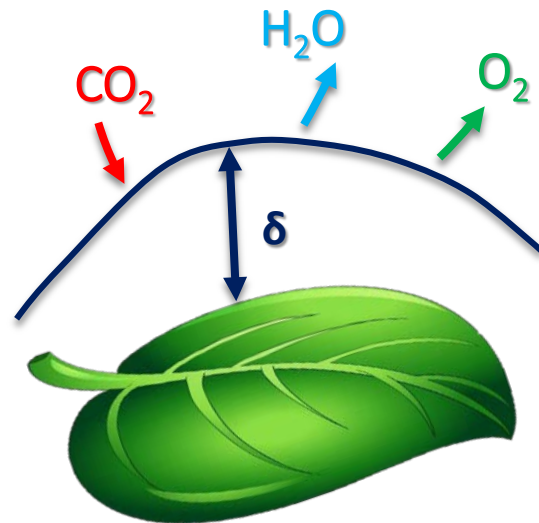
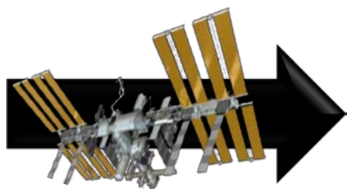
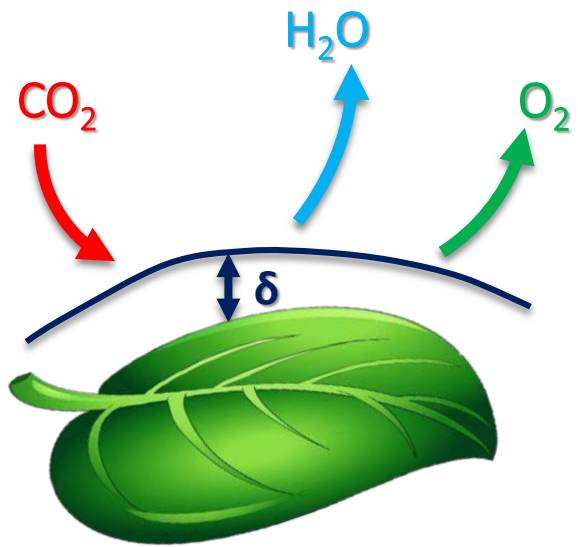
Credits: NASA



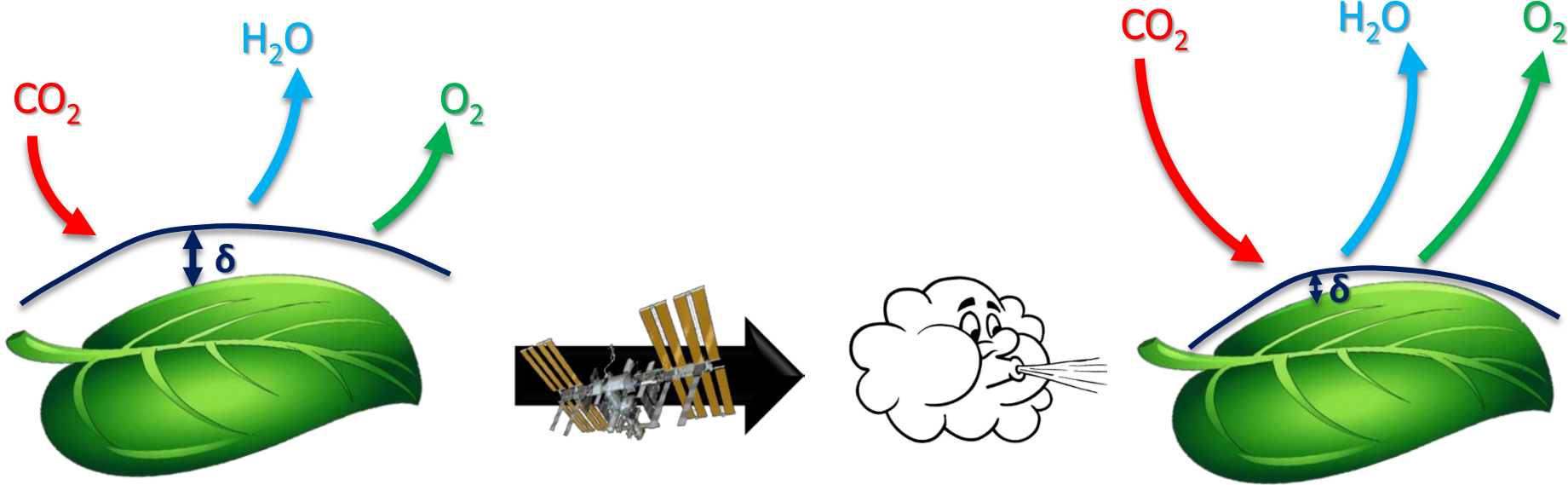
Mars Greenhouse Credits: NASA



Credits: NASA

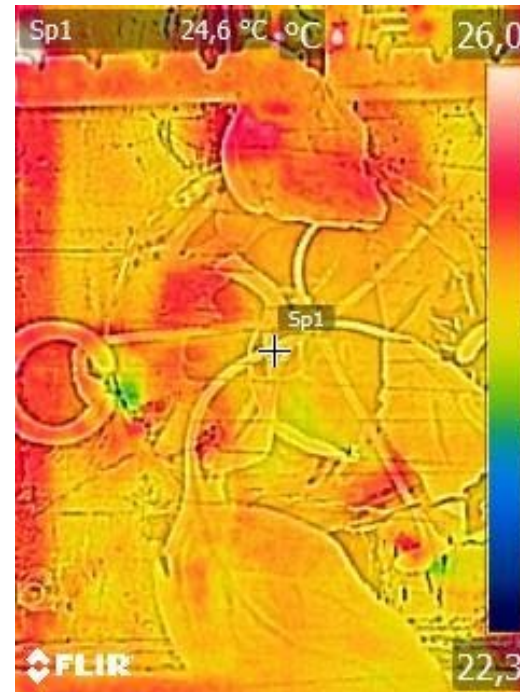
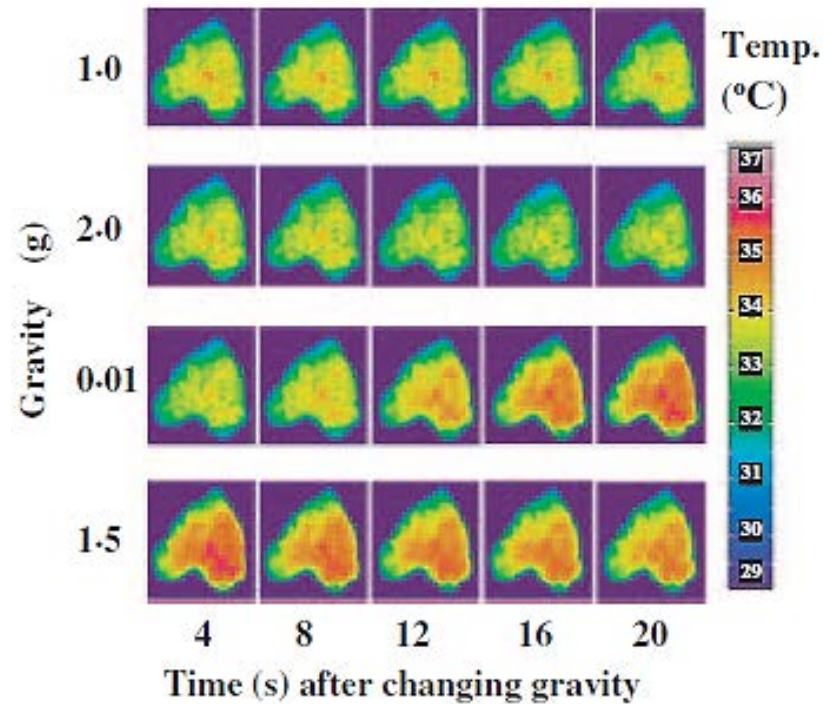


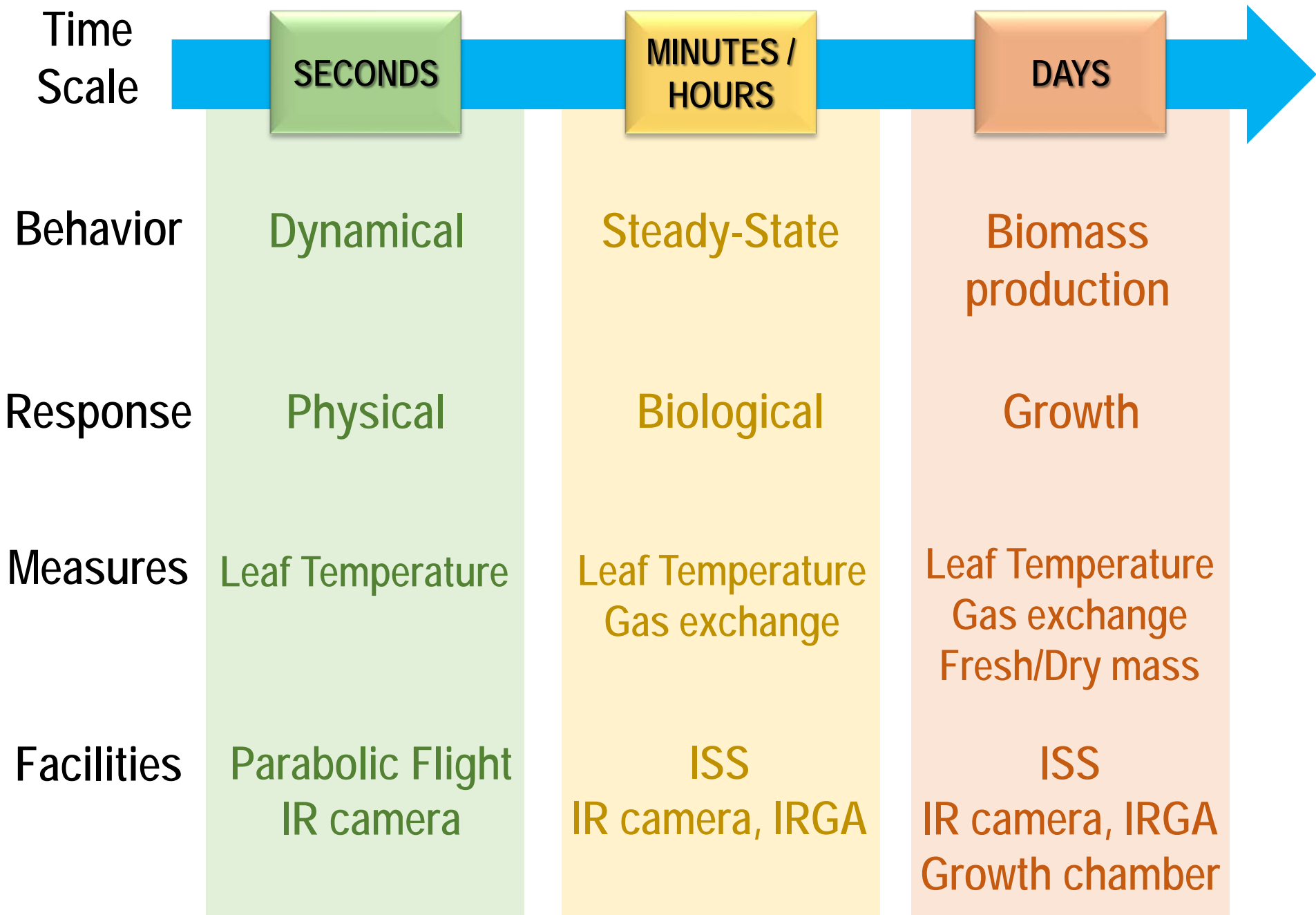




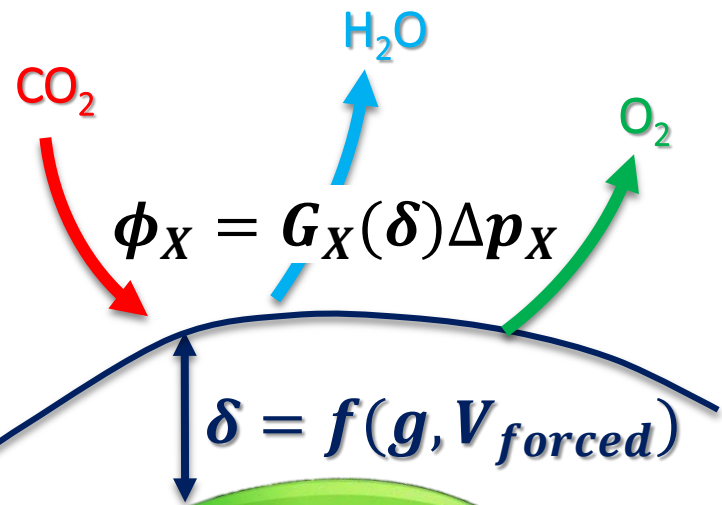
Kitaya et al., The effect of gravity on surface temperatures of plant leaves, *Plant, Cell and Environment*, (2003), 26, 497–503.

Poulet, Vernay, Sharif, Kondyli, CNES Parabolic Flight Campaign 2017 (unpublished)

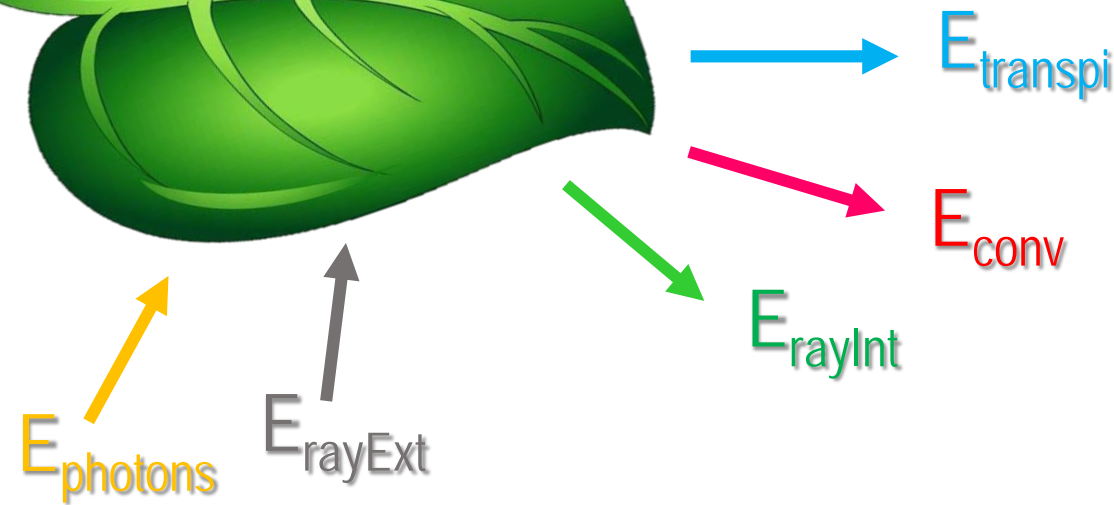




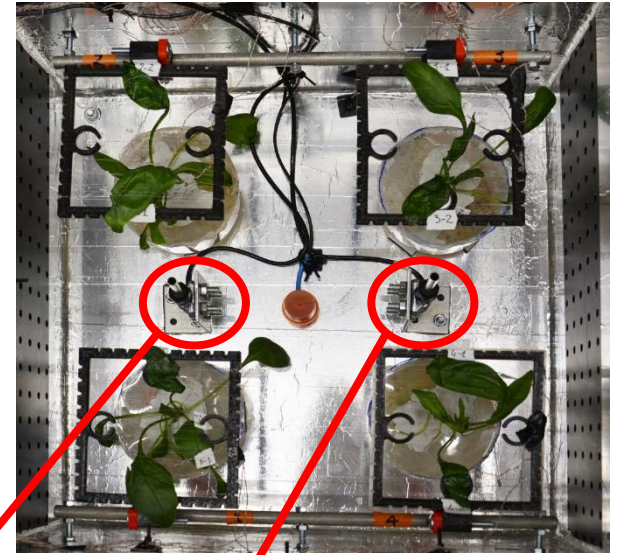
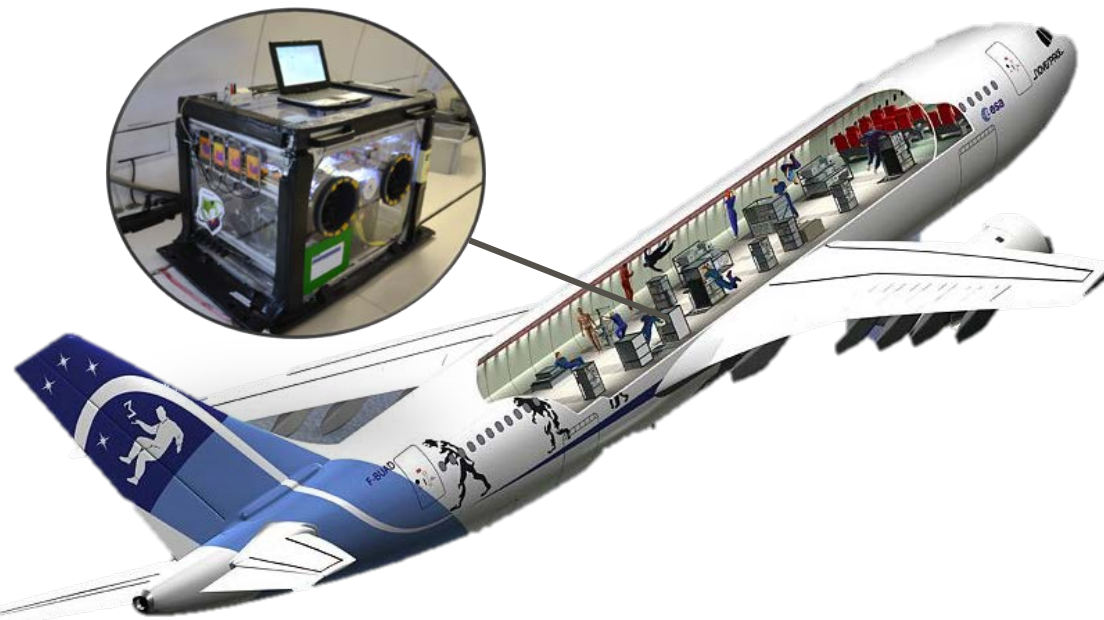
Mass Balance



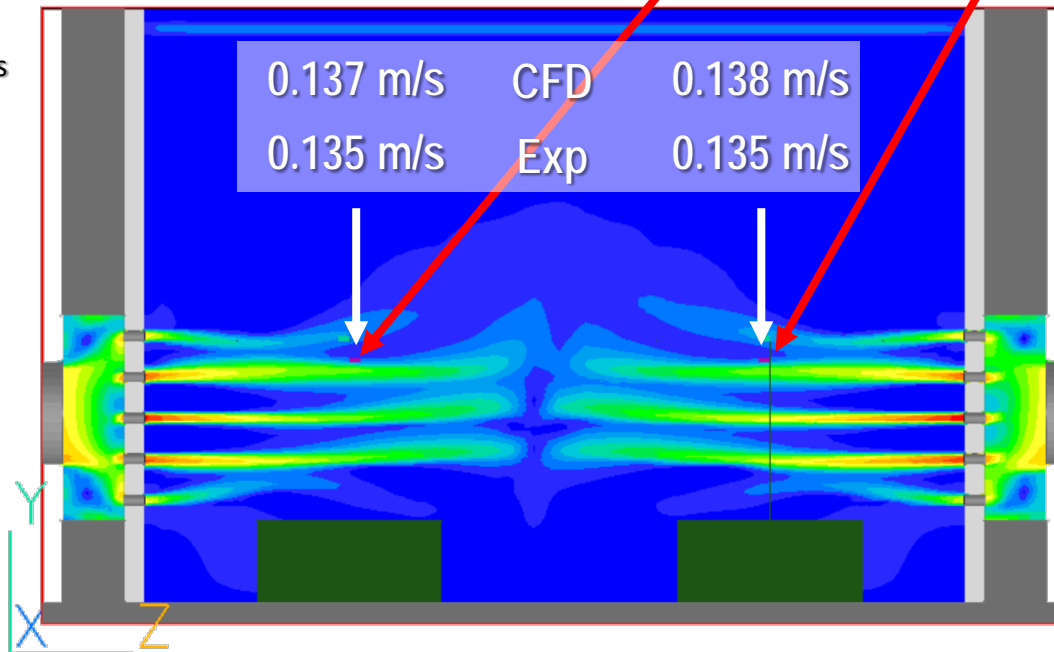
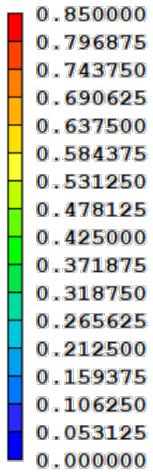
Energy Balance



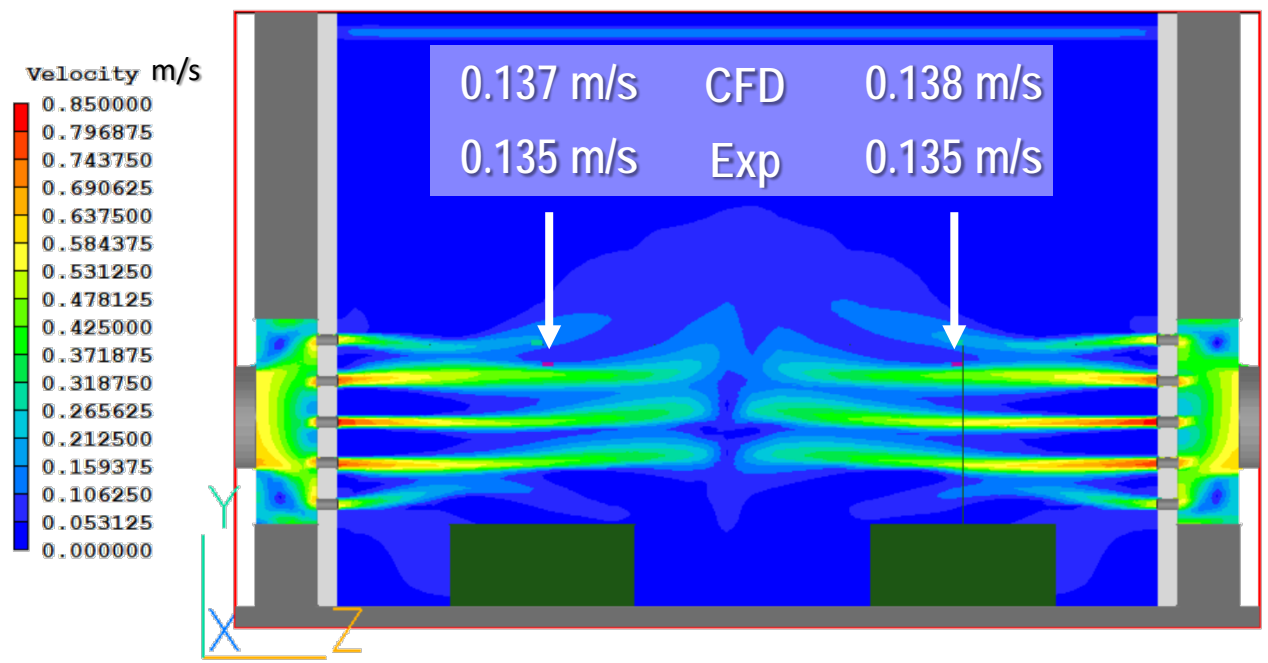
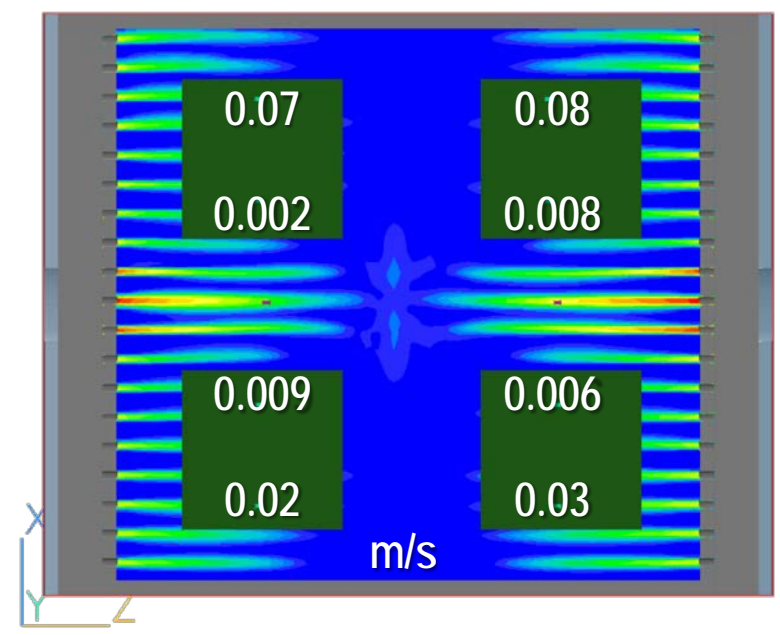
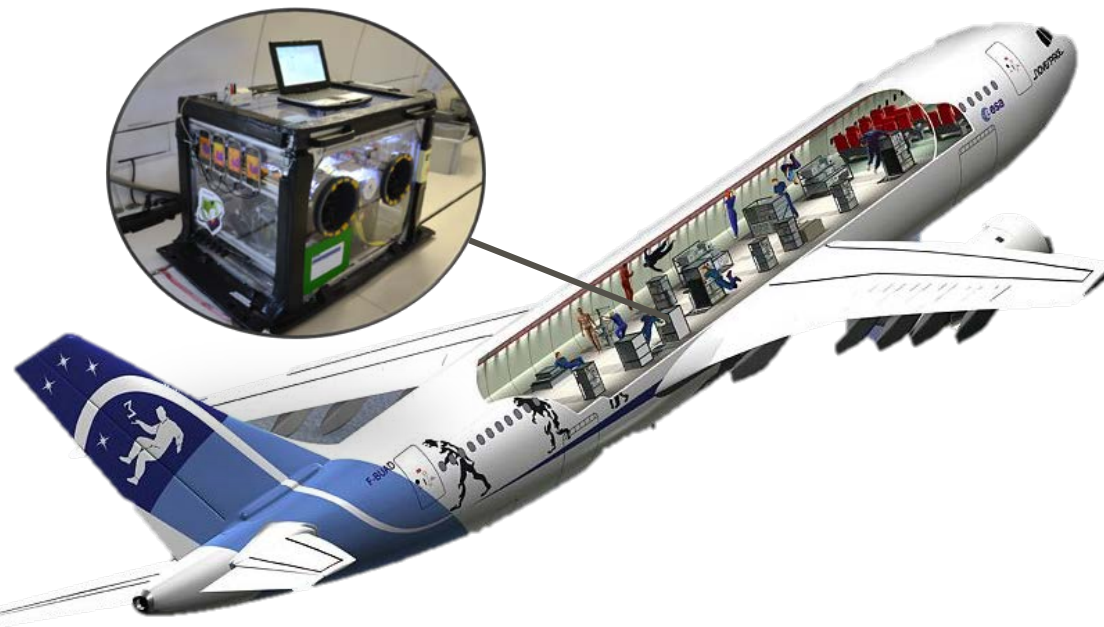
$$T_{leaf} = f(\phi_{H_2O}, m_{H_2O}, I_0, \delta)$$



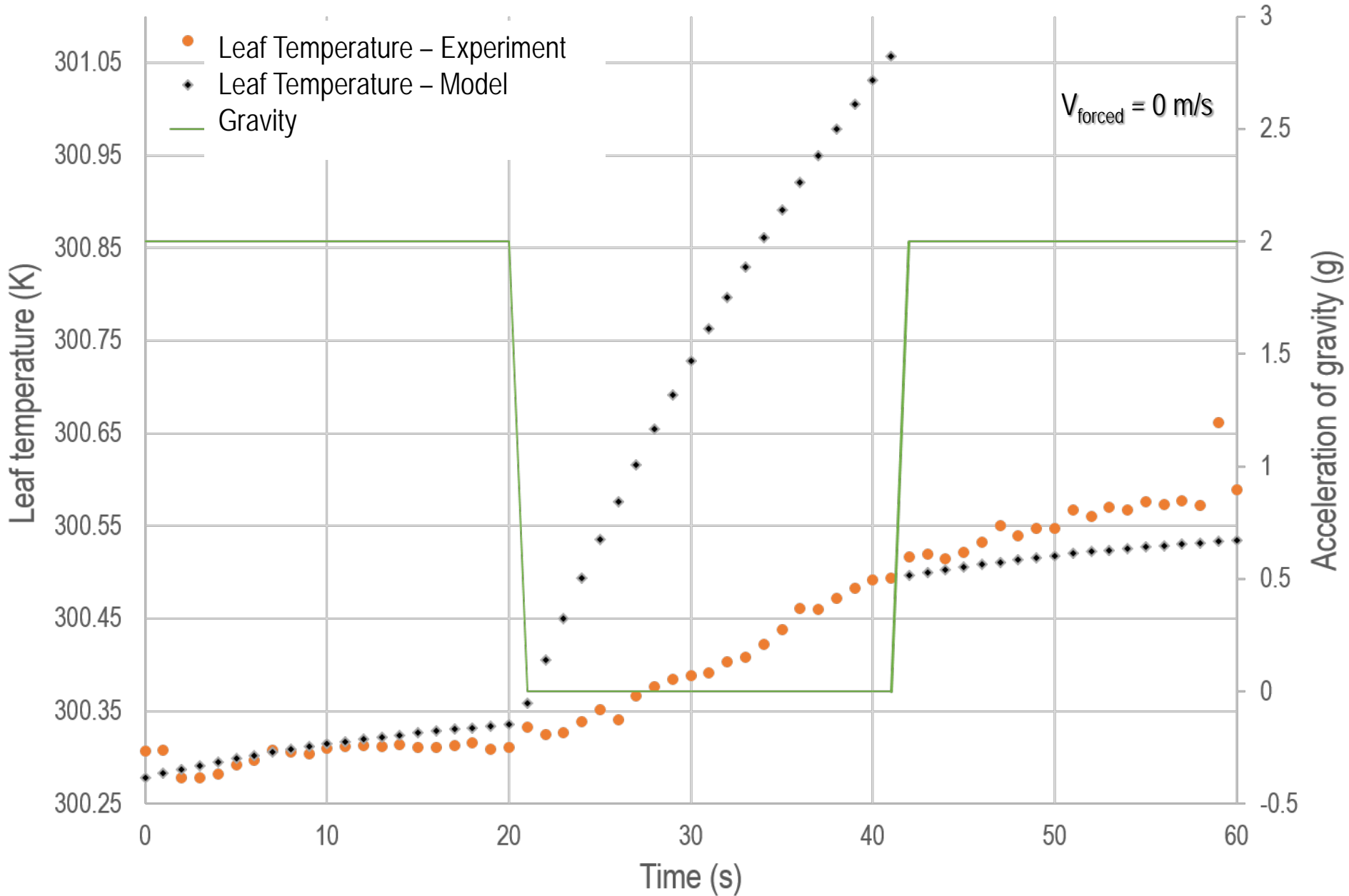
Velocity m/s







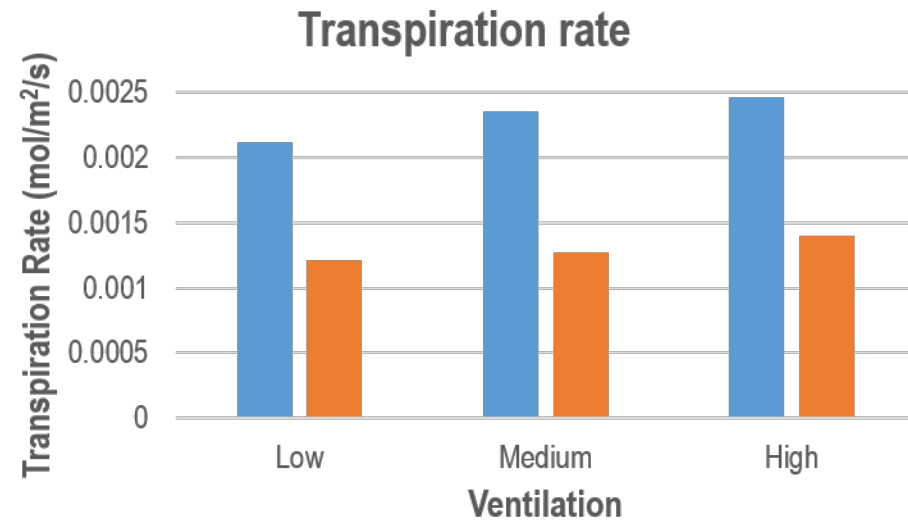
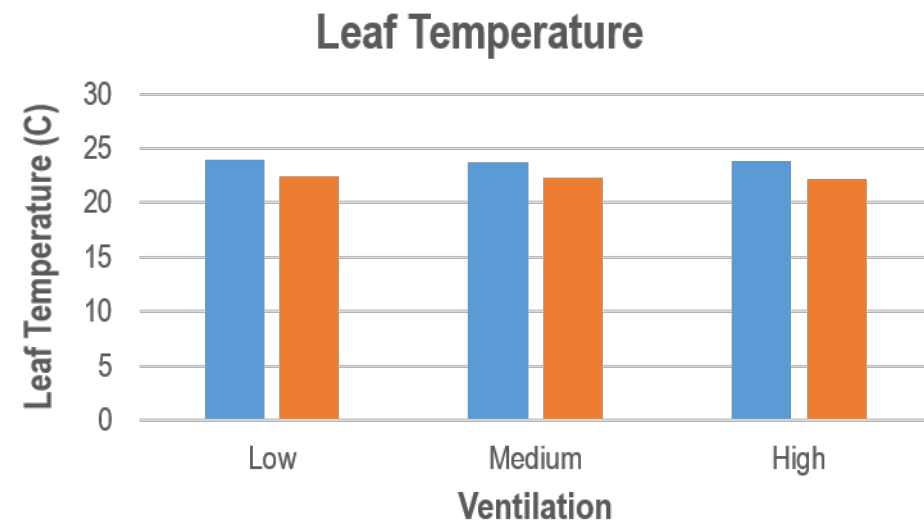
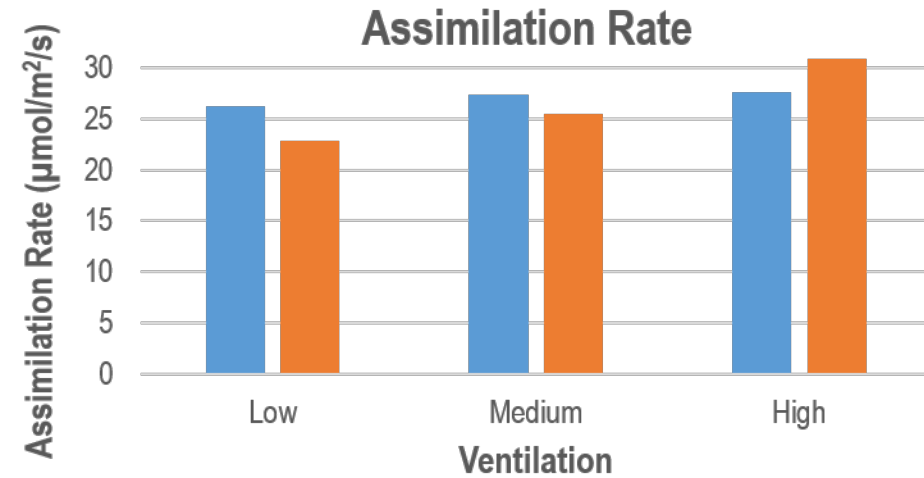
# Model validation dynamic state: leaf temperature







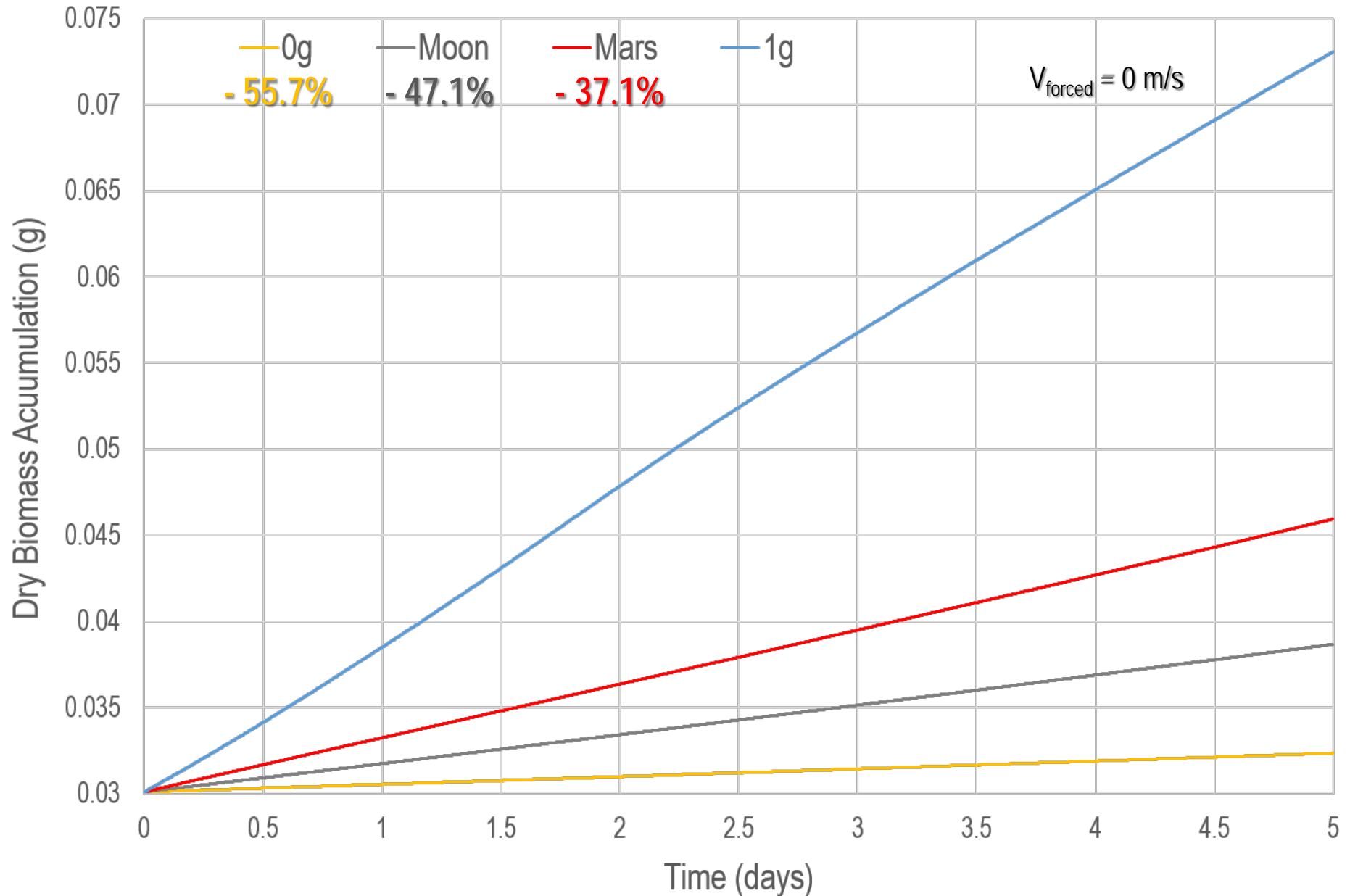
# Model validation in steady state: gas exchange and temperature



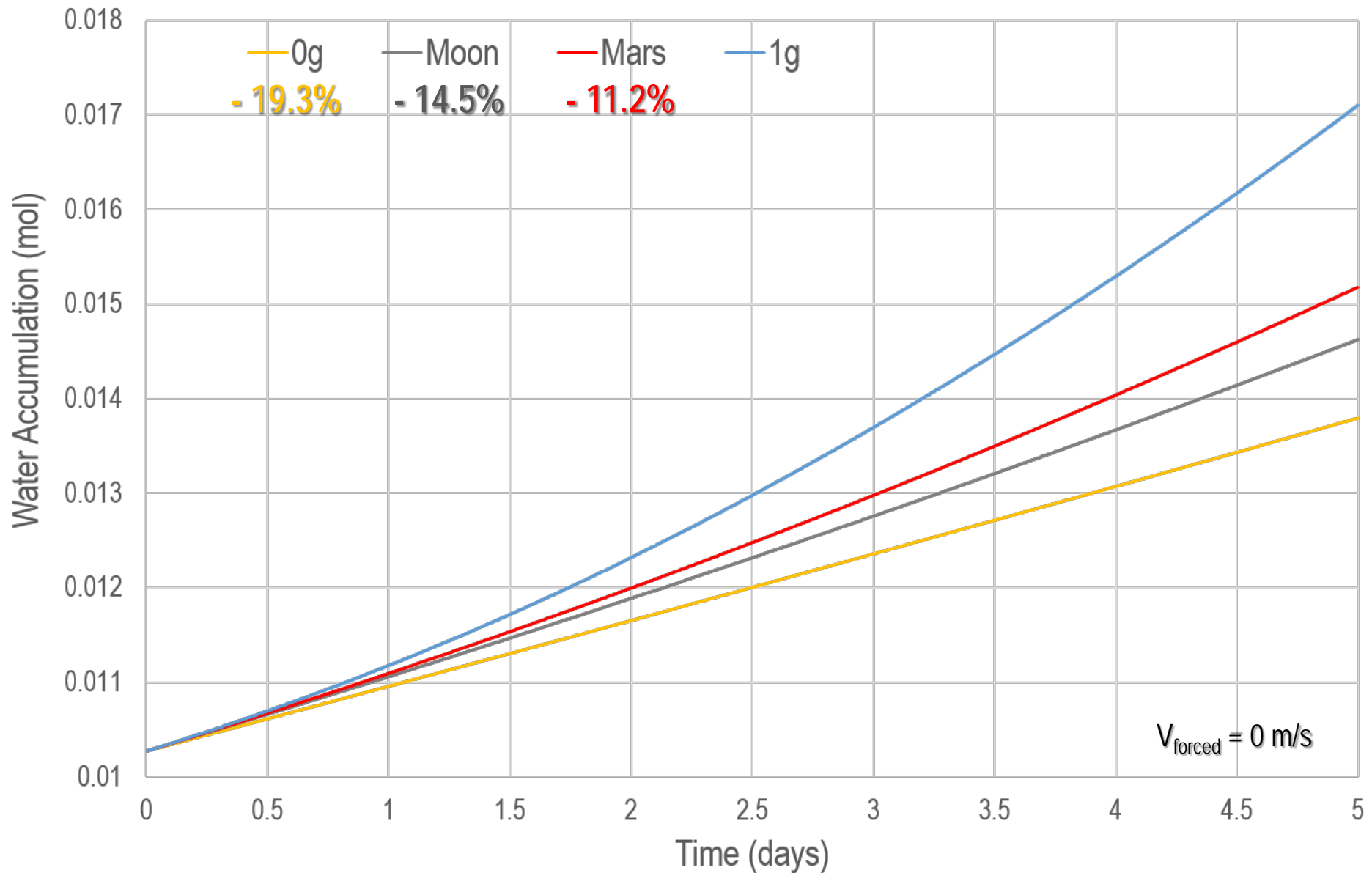
Experiment  
Model



# Long-term growth response in multiple gravity levels



# Long-term growth response in multiple gravity levels





A full-page image of an astronaut in a white spacesuit standing on the lunar surface. The astronaut is positioned in the lower-left foreground, facing slightly towards the right. The lunar surface is grey and rocky, with various craters and shadows. In the upper-right background, the Earth is visible as a blue and white sphere against the blackness of space, which is filled with numerous stars. The overall scene is brightly lit, likely by the sun, creating sharp shadows.

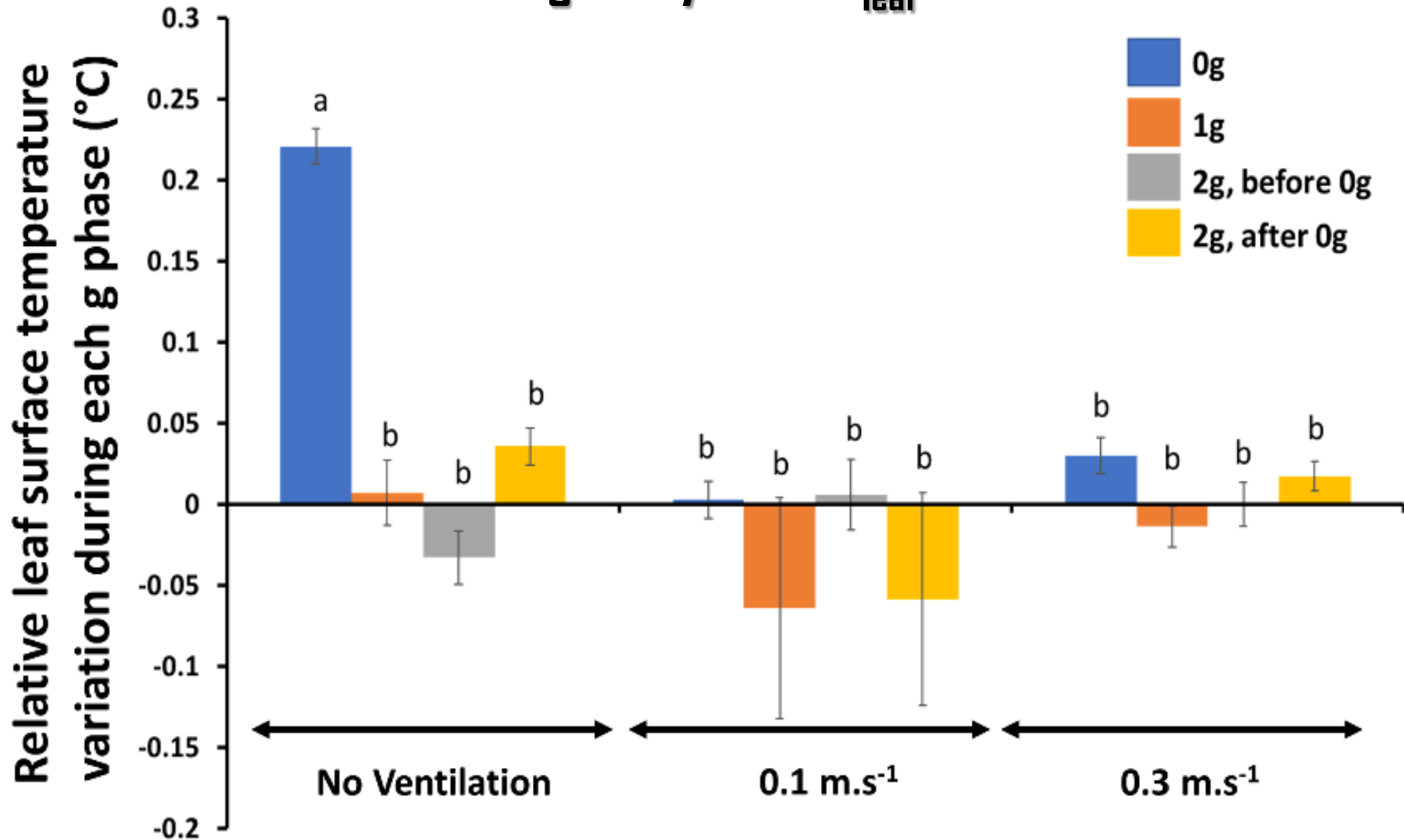
**THANK YOU! QUESTIONS?**

**Back Up**



# Tleaf\_end - Tleaf\_begin on IR transpi => degrees/s

## Effects of airflow and gravity on IR T<sub>leaf</sub>



# Effects of airflow and gravity on RH in leaves' vicinity

Leaf : < 0.0001 \*\*\*

Fan tension : < 0.0001 \*\*\*

Gravity : 0.25

Fan tension : leaf < 0.0001 \*\*\*

