

### Scale-resolved simulations of the flow past cactus shaped cylinders

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#### INSPIRING PEOPLE

# H < 15mD = 0.3-0.8msnazzymaps.com

### Flow past Saguaro inspired cylinders

Experimental and numerical studies showed that Saguaro-inspired cylinders have ability to:

saguaro-juniper.com

- Reduce drag force;
- Reduce lift force fluctuations. [see e.g. Jie & Liu (2016)]



ord et al (2016

10-30 ribs

Shallow root system

sonorantreesvc.com



## Flow past succulents

- Succulents have low number of ribs.
- Evolved in similar environment in Eastern hemisphere as Saguaro did in Western hemisphere.
- Do they have similar aerodynamic properties?



Euphorbia trigona



Euphorbia abyssinica



### Preliminary URANS Study



0

0

0.2

0.4

0.6

 $\alpha/lpha_{\rm max}$ 

0.8

1

angle of attack for the four-rib case.

### Current work

Large Eddy Simulation of flow past a circular cylinder (validation case).

Re = 20,000 ≈12.5 million cells

Results from strong scaling tests on Cirrus (36 cores per node) for both Star-CCM+ and OpenFOAM shows:

- Very good speed up for OpenFOAM.
- Star-CCM+ scaling is not perfect, but still 90% effective on 288 cores.





Future work:

LES on flow past cactus shaped cylinders with a low number of ribs will be performed on ARCHIE-WeSt (regional HPC facility) and Cirrus (Tier-2 HPC facility) to obtain comprehensive wake statistics.

### References:

- Jie, H. and Liu, Y.Z., 2016. Large eddy simulation of turbulent flow over a cactus-analogue grooved cylinder. *Journal of Visualization*, *19*(1), pp.61-78.
- Letchford, C.W., Lander, D.C., Case, P., Dyson, A. and Amitay, M., 2016. Bio-mimicry inspired tall buildings: The response of cactus-like buildings to wind action at Reynolds Number of 104. *Journal of Wind Engineering and Industrial Aerodynamics*, *150*, pp.22-30.