

Rare back-flow events in wall-bounded turbulent flows

Ramis Örlü^{1,*}, Cheng Chin², Ricardo Vinuesa¹, Philipp Schlatter¹ and Min Chong³

¹ Linné FLOW Centre, KTH Mechanics, Royal Institute of Technology, SE-100 44 Stockholm, Sweden
(ramis@mech.kth.se, rvinuesa@mech.kth.se, pschlatt@mech.kth.se)

² Department of Mechanical Engineering, University of Adelaide, South Australia 5005, Australia
(cheng.chin@adelaide.edu.au)

³ Department of Mechanical Engineering, University of Melbourne, Parkville 3010, Australia
(min@unimelb.edu.au)

Following the work by Lenaers et al. [1], in which rare back-flow streamwise velocity events have been documented in direct numerical simulations (DNS) of turbulent channel and boundary layer flows, several experimental and numerical studies have confirmed both their existence and their statistical and structural characteristics. More recent work assessed their dependency on Reynolds number as well as the pressure gradient parameter. In the current presentation we will review these works and extend them towards the influence of a superimposed secondary flow, as it naturally occurs in a toroidal flow, for which the orientation of the wall-shear stress fluctuations is strongly imparted by the secondary flow as apparent from the shown wind-rose.

REFERENCES

- [1] P. Lenaers, Q. Li, G. Brethouwer, P. Schlatter, and R. Örlü. *Phys. Fluids.*, **24** (2012) 035110.
- [2] A. Noorani and P. Schlatter. *Int. J. Heat Fluid Flow*, **61** (2016) 108–116.

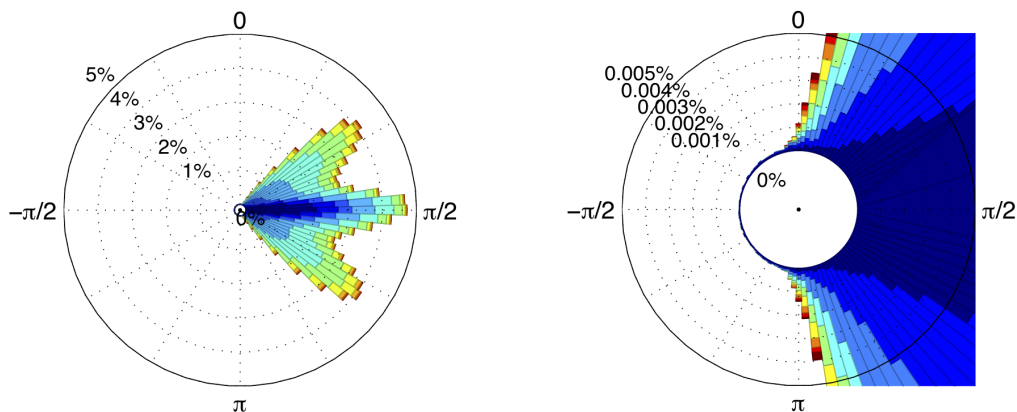


Figure 1: Instantaneous streamwise wall-shear stress for the torus [2]. Probability density function of the orientation of the wall-shear stress vector and magnitude for (Left) torus with (Right) zoomed-in view.