EUROMECH Colloquium 590

“Turbulent/nonturbulent interfaces: from laboratory to geophysical scales”
3 – 5 July 2017, London, UK

Chairperson: Maarten van Reeuwijk
Co-Chairperson: Markus Holzner, Carlos da Silva, Javier Jimenez

EUROMECH Colloquium 590 followed a workshop on a similar topic in 2012. It was clear that significant progress in understanding of turbulent/non-turbulent interfaces (TNTI) had been made during the last five years. The range of physical problems and scales covered was impressive. These include the understanding of the structure of the turbulent-nonturbulent interface, new decomposition techniques to understand how turbulent entrainment is brought about, progress on the understanding of internal interfaces, and research into physically important complex applications, such as reacting mixing layers (combustion), non-Boussinesq plumes and applications involving particles (clouds, volcanic plumes). A full programme (including abstracts) can be found on http://590.euromech.org/program/programme-abstracts/.

The keynote lectures at Colloquium 590 were given by:

- Prof. Marc Avila, Bremen on “Laminar-Turbulent Interfaces in Pipe Flow”;
- Prof. Takashi Ishihara, Nagoya on “Internal Interfaces in Turbulence”;
- Prof. Andrew Woods, Cambridge, UK on “Entrainment and Mixing in Geophysical Flows”.

The discussions were fruitful and highlighted several topics that remain to be resolved. One of the most pertinent questions regards the scaling of the thickness of the TNTI. The currently accepted view is that there is a turbulent interface layer which scales on the Taylor length scale, bounded on the nonturbulent side by a viscous superlayer which is of the order of the Kolmogorov length scale. Several authors presented findings which supported this view for various flows, but recent simulations indicate that at higher Relambda, the turbulent interface layer starts scaling on the Kolmogorov length scale (https://doi.org/10.1017/jfm.2018.143). However, this is not the case for turbulent boundary layers at similar Relambda (https://doi.org/10.1017/jfm.2016.430). This important issue requires further analysis and research.

Another question that emerged is whether there is one universal TNTI. Part of the question stems from the differences between jets and ZPG boundary layers concerning shear in the outer layer. Are the large-scale structures affected by the wall or is it flapping or precessions in the centreline of the jet that explain the difference?

The question of a single universal TNTI is exacerbated when considering further body forces, such as buoyancy. Here, recent work points to the fact that the viscous super-layer seems unaffected but there is an effect on the turbulent sub-layer. More complex problems, such as reacting flows in combustion, particle-laden flows or cloud edges have multiple interfaces and it remains an open question whether the TNTI is influenced by these processes and how the behaviour of the interfaces differs.

Overall the workshop was highly successful in bringing together the TNTI community, exchanging information and aligning future research. It was discussed that a follow-up meeting should take place in a few years.