EUROPEAN MECHANICS SOCIETY

Colloquium n. 590 – Turbulent/nonturbulent interfaces: from laboratory to geophysical scales

Dates and location

3 July — 5 July 2017, London, UK

Chairperson

Maarten van Reeuwijk (Imperial, UK)

Co-chairperson

Markus Holzner (ETH Zurich, CH), Carlos Silva (IDMEC, PT), Javier Jimenez (UP Madrid, SP)

Conference fees

- Registration fee: **250.00 €**

What other funding was obtained?

none

What were the participants offered?

This colloquium aimed to bring together scientists from a range of disciplines (fluid mechanics, turbulence, atmospheric and oceanic sciences) to report on progress in understanding turbulent non-turbulent interfaces. These interfaces are ubiquitous in nature, ranging from wakes behind bluff bodies, effluents ejected from ocean outfalls, volcanic eruptions, entrainment in the atmospheric boundary layer and oceanic mixed layer.

The colloquium brought together 32 participants, representing 10 countries. The workshop was 2.5 days long, each day had a keynote lecture, a series of shorter presentations and ample time for discussion. A full programme (including abstracts) can be found on The colloquium brought together 32 participants, representing 10 countries. The workshop was 2.5 days long, each day had a keynote lecture, a series of shorter presentations and ample time for discussion.

Applicants (members)

1. Henry Burridge
2. Oliver Buxton
3. Elisabetta De Angelis
4. Benjamin Devenish
5. Gerrit Elsinga
6. Melika Gul
7. Markus Holzner
8. Graham Hughes
9. Julian Hunt
10. Takashi Ishihara
11. Javier Jimenez
12. Sylvain Laizet
13. Pietro Salizzoni
14. Atsushi Sekimoto
15. Carlos Silva
16. Alberto Vela-Martin
17. Lilly Verso

18. Jerry Westerweel

Applicants (non members)

1. Iresha Atthanayake
2. Antonio Attili
3. Marco Boetti
4. Luis-Hernando Cifuentes-Rubio
5. Owen Jordan
6. Dominik Krug
7. Juan Pedro Mellado
8. Marius Mihai Neamțu Halic
9. Vishnu Satheesh Nair
10. Tomoaki Watanabe
11. Marco Zecchetto

Scientific report

The keynote lectures were given by Prof. Marc Avila (Bremen, DE) on Laminar-Turbulent Interfaces in Pipe Flow, Prof. Takashi Ishihara (Nagoya, JP) on Internal Interfaces in Turbulence and Prof. Andrew Woods (Cambridge, UK) on Entrainment and Mixing in Geophysical Flows. The range of physical problems and scales covered was impressive, and it was clear that significant progress had been made since the last workshop in 2012. 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 discussions were fruitful and highlighted a number of 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 (check notation), 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 scaling of the turbulent interface layer starts scaling on the Kolmogorov length scale (https://doi.org/10.1017/jfm.2018.143). However, for turbulent boundary layers at similar Relambda (https://doi.org/10.1017/jfm.2016.430) this is not the case. 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 large differences between jets and ZPG boundary layers. There is difference in the 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 superlayer seems unaffected but it does affect the turbulent sublayer. 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.

Number of participants from each country

Country	Participants
United Kingdom	10
Germany	3
Netherlands	3
Israel	2
Switzerland	2
Japan	2
Spain	2
Australia	2
Portugal	2
France	1
Total	**29**