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Citation (APA)
Bastankhah, M., Becker, M., Churchfield, M., Draxl, C., Prakash Goit, J., Khan, M. A., A Martínez-Tossas, L., van Wingerden, J. W., Watson, S. J., & More Authors (2024). Dries Allaerts, 1989–2024. *Wind Energy Science*, *9*(11), 2171–2174. https://doi.org/10.5194/wes-9-2171-2024

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Wind Energ. Sci., 9, 2171–2174, 2024
https://doi.org/10.5194/wes-9-2171-2024
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eawe european academy of wind energy
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Dries Allaerts, 1989–2024

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Published: 12 November 2024

Dries Allaerts was born on 19 May 1989 in Leuven, Belgium, and passed away at his home in Wezemaal, Belgium, on 10 October 2024 after battling cancer. Even though Dries only became involved in wind energy science since he started his PhD research in 2012, he has had a profound impact on the community, in terms of both his scientific realizations and the many friendships and collaborations he developed over the years. His scientific acumen, open spirit of collaboration, positive attitude towards life, and playful and often cheeky sense of humor will be deeply missed by many.

In his early years, Dries grew up in Leuven and Rotselaar (close to Leuven) with his older brother and parents. He loved reading, practicing judo and the clarinet, and playing strategy-based board games. He was a member of the concert band Panta Rei in Leuven, where he also met his wife Fran. Dries started his bachelor's and master's education in engineering science at the university of Leuven in fall 2007. During this time, he was already interested in wind energy, building small wind turbines in Peru as part of an internship for the non-profit organization Humasol.

In summer 2012, Dries graduated magna cum laude as a Master of Science in Engineering: Energy, with an MSc dissertation on nuclear fusion. Afterwards, he started his PhD at the same university in the team of Johan Meyers, with a focus on the simulation of the interaction between wind farms and the atmospheric boundary layer. During his years as a PhD researcher, Dries pioneered large-eddy simulations (LESs) of wind farms in conventionally neutral boundary layers (Allaerts and Meyers, 2015), with many practical initialization methods that are still commonly used. His simulations led to ground-breaking new insights into the interaction of large wind farms with the atmosphere, in particular the importance of the boundary layer height and the excitation of atmospheric gravity waves in both neutral and stable stratification conditions, including in depth analysis of energy budgets and the importance of unfavorable and favorable pressure gradients in the system (Allaerts and Meyers, 2017, 2018). Dries obtained his PhD degree in November 2016 and continued as a postdoctoral researcher in Leuven for another two years. During this time, he was involved in the European Wind Atlas project and also focused on the development of fast engineering models for wind-farm resource assessment (Allaerts and Meyers, 2019), extending earlier work on linear gravity wave theory by Smith (2010) in addition to combining it with classical engineering wake models. This work has since become the basis of current engineering models for wind-farm blockage and wakes, such as WAYVE (https://gitlab.kuleuven.be/TFSO-software/wayve, last access: 8 November 2024) or the multi-scale coupled model (Stipa et al., 2024b), and has inspired a new generation of researchers in the field.



Figure 1. Dries with his wife Fran and kids Emil, Nore, and Suzie. September 2023, Maasmechelen, Belgium. Photo courtesy of Fran Vandikkelen.

In 2018 Dries joined the National Renewable Energy Laboratory (NREL) as a postdoctoral researcher, moving to Boulder, Colorado, with his wife Fran and their 1-year-old son Emil. At NREL, Dries contributed within a project about mesoscale–microscale atmospheric coupling (Haupt et al., 2023; Allaerts et al., 2020; Draxl et al., 2021; Allaerts et al., 2023). One of his main contributions was the development of what he termed the "profile assimilation technique" (Allaerts et al., 2020, 2023), which allows researchers to drive atmospheric large-eddy simulations using mean profiles obtained from a mesoscale weather model or even from field observations. Dries's arrival at NREL was timely: NREL researchers had begun performing mesoscale-driven microscale simulations in complex terrain and were facing challenges from "mysterious" waves polluting the solution field. Because of his previous experience simulating atmospheric gravity waves, Dries quickly identified these mysterious waves as none other than atmospheric gravity waves, and he promptly helped to properly treat them at domain boundaries. Matt Churchfield remembers Dries describing the simulation of atmospheric gravity waves "like wrestling in mud". Dries loved conversation about a wide range of research topics, and sometimes those conversations led to publishable research findings. A good example of this is how he helped with actuator line modeling of wind turbine rotor aerodynamics within large-eddy simulations. Dries and Martínez-Tossas worked together with the help of Emmanuel Branlard and Matt Churchfield on reformulating the actuator line equations such that they could easily be solved using a simple numerical algorithm (Martínez-Tossas et al., 2025). He also took on the overhaul of NREL's large-eddy-simulation solver, the Simulator fOr Wind Farm Applications (SOWFA), bringing it to a more flexible, modernized state. Given his short tenure at NREL, his list of accomplishments is amazingly large. More importantly, he befriended and encouraged many people outside work. Dries, Fran, and Emil made many friends and explored the numerous national parks, monuments, and hiking trails of the mountainous western USA.

Dries had an open invitation to stay at NREL, but Fran and Dries wanted to raise their son near their families in Belgium, so they returned to Europe where they had two more children, Nore and Suzie. He started as an R&D Engineer at Diabatix, but was hired after 6 months by TU Delft as an assistant professor in the Wind Energy Section, working in the group of Simon Watson in the Faculty of Aerospace Engineering. During his time at TU Delft, Dries continued his work on wind farm aerodynamics, including the impact of gravity waves on performance, cluster wake mixing to reduce wake losses, and the modeling of wind turbine interactions for dynamic control. His enduring spirit of collaboration meant that he formed a close cooperation with the control group of Jan-Willem van Wingerden, which included his work with Marcus Becker (Becker et al., 2022b, a) on wind farm control and with a wider team at the Faculty of Mechanical Engineering on a new topic called cluster wake control (Gutknecht et al., 2024), for which Dries played a pivotal role, obtaining funding to further explore this topic. Besides his collaboration with the people at the Faculty of Mechanical Engineering, Dries worked closely with colleagues in Aerospace Engineering including Stefan Hickel, working on LES modelling of boundary layer flows. A very fruitful collaboration ensued when Sebastiano Stipa, studying for a PhD at the University of British Columbia under Joshua Brinkerhoff, stayed for a research visit at TU Delft. This collaboration resulted in multiple publications, including work on modelling wind farm canopies (Stipa et al., 2024d), simulating gravity waves in LES codes (Stipa et al., 2024a), the development of the TOSCA LES model (Stipa et al., 2024c), and the aforementioned multi-scale coupled (MSC) model (Stipa et al., 2024b) based on an earlier three-layer model developed by Dries when at KU Leuven. He was very committed to open science, and this led to the release of the Linear Buoyancy Wave Package (LBoW) for solving uniform strat-



Figure 2. The Wind Energy Science Outstanding Reviewer Award handed out at the Grand Cloister of Santa Maria Novella on 30 May 2024, during the Torque2024 conference, Firenze, Italy (Dries is on the far-right side of the picture). Photo courtesy of Christiane Montavon.

ified flow over terrain features (Allaerts, 2022). His passion for wind farm aerodynamics came through in his teaching, and he and Simon Watson developed a master's course on wind resources and wind farm yield, incorporating lectures and hands-on software exercises.

Dries was loved and respected by colleagues in the community, not only for his scientific contributions but also for his precision, generosity, positive attitude, and mentorship. Even at the very beginning of his research career, Dries impressed fellow PhD researchers with his care for detail, including impressive schematics and visualizations of his research output. He loved super computing and was involved in major code developments and overhauls during his time in Leuven and at NREL. On the recurring issue of tedious debugging (often together with colleagues), Dries used to joke, "I have the perfect solution to this; let us just stop writing bugs in our code". Dries was also involved in NREL's SOWFA overhaul and the creation of its main solver "superDeliciousVanilla", with the strange name thanks to Dries and Matt Churchfield. Many people find vanilla ice cream plain or boring – something that Dries and Matt could not disagree with more. They both believed vanilla ice cream was sublime and formed a bond over this. After overhauling the SOWFA code, the question of what to call the main solver remained. Super Delicious Vanilla was a most excellent flavor at one of Boulder's best ice cream shops, so the name was a natural fit. Dries was also a gifted mentor, generous with his time and ideas. Even as a senior PhD student, and more so during his later career, he helped younger colleagues with career advice, cheering them up when they got stuck in their PhD research and helping with any questions on wind-farm atmosphere interactions, but also providing more practical advice on moving with family to the USA or applying for a faculty position.

In summer 2023, Dries was diagnosed with cancer. Even when his illness led to a period of extended leave, he was still passionate about his work and continued to provide supervision for his PhD candidates when he was able. He was highly respected as a supervisor and mentor to his PhD students, caring deeply for both their research progress and their personal well-being. During the last year of his life, Dries also remained active in the community, reviewing papers, participating in PhD committees, collaborating with colleagues, etc. Even when he knew (by the beginning of 2024) that his cancer was not treatable, Dries remained involved, always bringing a smile and a lot of positive energy. He participated in the Torque conference in Firenze (May 2024), accompanied by his wife Fran. He was very active during the scientific sessions, and many of us were grateful to be able to spend time with him. During Torque, he was also one of the recipients of the Wind Energy Science Outstanding Reviewer Award (see Fig. 2), another testimony to his involvement in the community. In Firenze, Dries promised us that he would keep attending wind energy conferences as long as he was around. Beyond any doubt, he will keep doing so in our memories.

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