



SARAH GILLE
PROFESSOR AND DEPARTMENT VICE-CHAIR
SCRIPPS INSTITUTION OF OCEANOGRAPHY

9500 GILMAN DRIVE # 0208
LA JOLLA, CALIFORNIA 92093-0208
EMAIL: SGILLE@UCSD.EDU
URL: [HTTPS://SCRIPPS.UCSD.EDU](https://scripps.ucsd.edu)

January 5, 2021

Centre National de la Recherche Scientifique
3, rue Michel Ange
75016 Paris, Cedex 16
France

Dear colleagues,

I write to provide my enthusiastic endorsement of Alex Ayet's CNRS candidature for position 19-03-CRCN. Dr. Ayet is highly visible in the international community as demonstrated by his participation in the 2018 Kavli Institute for Theoretical Physics topical program on "Planetary Boundary Layers in Atmospheres, Oceans, and Ice on Earth and Moons" and by his selection to give a talk at the February 2020 US CLIVAR workshop on Surface Currents in the Coupled Ocean-Atmosphere System. I had the pleasure of interacting with Dr. Ayet when he visited Scripps Institution of Oceanography during his doctoral studies and am honored to have served as an external examiner for his thesis jury. His PhD research was an impressive tour de force that has brought new insights to the study of the flux of momentum between wind, waves, and the upper ocean.

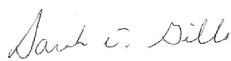
At the international level, air-sea interaction and the role of mixed-layer processes in mediating these exchanges have emerged as major science priorities that will need to be tackled to meet the needs of weather and climate models aiming to represent processes over sub-seasonal, seasonal, and interannual time scales. Dr. Ayet's proposed work tackles these problems directly, using machine learning to address the computational demands associated with modeling small-scale turbulence near the upper ocean. Importantly, his plans focus on physics-informed machine learning, capitalizing on existing knowledge of the physical world to better constrain solutions derived from machine learning. His proposed research directions respond directly to emerging science priorities, including those identified in a US National Academy of Sciences 2020 workshop on Earth System Predictability, in which speakers highlighted the value of physics-guided machine learning and the importance of ocean-atmosphere interactions.

The importance of improving our understanding of air-sea interactions was also a key outcome of the international OceanObs'19 conference, for which the oceanographic research community drafted some 150 community papers, all published in 2019 in the journal *Frontiers in Marine Science*. Air-sea interaction emerges from the community papers as a priority theme. In 2020, this led to the formation of a new Scientific Committee on Oceanic Research (SCOR) international working group on Observing Air-Sea Interactions State (OASIS). This heightened focus on air-sea flux observations will necessitate an improved theoretical and high-resolution modeling-based context for

interpreting flux observations, particularly when they represent highly intermittent, non-Gaussian turbulent features. Dr. Ayet's proposed work is perfectly positioned to tackle these challenges, by working with large eddy simulation models and by using machine learning to probe the physics governing turbulent mixing with the atmospheric and oceanic boundary layers.

In summary, I strongly endorse the recruitment of Dr. Alex Ayet to a CNRS post in machine learning of environmental quantities. He has proven himself to be an innovative early career scientist with formidable analytic capabilities, and his proposed research clearly represents a top priority question for the international science community. His selection will position CNRS to take a leadership role in applying machine learning to critical questions in sub-mesoscale air-sea interactions.

Sincerely,

A handwritten signature in cursive script, reading "Sarah Gille".

Sarah Gille
Professor