THE UNIVERSITY OF UTAH

Department of Atmospheric Sciences

135 South 1460 East, Rm 819 (WBB), Salt Lake City, Utah 84112-0110
Phone (801) 581-6136 Fax (801) 585-3681 Web: www.atmos.utah.edu

To whom it may concern:

I offer my highest recommendation for Quentin Coopman's candidacy for a CNRS postdoctoral position 19-02-CRCN in Lille. I started working with Quentin at the University of Utah in Fall, 2013 after he completed a 2 year thesis on the remote sensing of Saharan dust with Isabelle Chiapello at the Université de Lille I. He shifted gears for his Ph.D. work to study with myself at the University of Utah and Jérôme Riedi at Université de Lille looking at the impacts of long-range aerosol transport from mid-latitudes on cloud properties in the Arctic. In December 2016, while I was on a sabbatical year at the Université de Lille, he successfully defended his dissertation entitled "Modification of arctic clouds by long-range aerosol transport" to earn a joint Ph.D. degree between the University of Utah and the Université de Lille. We have since collaborated further on a number of papers related to aerosol-cloud interactions and cloud phase changes.

Quentin's work has been focused on how best to use large satellite and model datasets to isolate the response of clouds to specific external influences such as aerosols, when cloud changes are necessarily dominated by high meteorological variability. Aerosols are well known to impact stratiform clouds, but it has been extraordinarily difficult to precisely assess the magnitude of this effect because aerosols, clouds, and meteorology all co-vary to a high degree. Quentin has been a pioneer in developing techniques to overcome this challenge by synthesizing large satellite, meteorological, and tracer transport model datasets from multiple sources. His work had several key components: He has worked with researchers at the University of Edinburgh and NILU to evaluate the accuracy of GEOS-CHEM and FLEXPART Carbon Monoxide tracer data through intercomparisons with measurements from five ground based stations in the Arctic; he has evaluated the accuracy of MODIS and POLDER measurements of cloud heights, microphysics and thermodynamic phase; and he has combined these data with meteorological datasets to assess correlations between aerosols and clouds while constraining for atmospheric thermodynamic state.

I cannot overstate how much effort and care is required to accomplish this work. As editor for Atmospheric Chemistry and Physics, I am not surprised that Quentin is now being suggested as a reviewer as "a leading expert in aerosol-cloud interactions". It speaks to what I believe to be Quentin's primary strengths. Quentin has the mathematical and computational skills to pull off such a task with a highly unusual and essential combination of care and efficiency. Quentin possesses the rare and essential combination of common sense and the spirit of double and triple checking results.

What Quentin found scientifically while doing his Ph.D. is that clouds in the Arctic are unusually sensitive to perturbations by anthropogenic pollution but that any perceived impact of biomass burning plumes can probably be attributed to covariance with meteorological state. Further, Quentin used novel techniques to determine that significantly less supercooling is required for arctic stratiform clouds to glaciate when the clouds are polluted, or that they have large droplets. His most recent work on which we have collaborated has extended these techniques to the globe as a whole to show how cloud transitions from liquid to ice occur at higher temperatures when there are significant updrafts or the cloud droplets are unusually large.

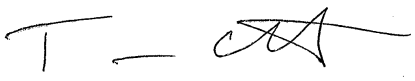
Quentin is clearly positioning himself as one of the scientific leaders in the area of cloud phase changes, a topic that is currently of very high interest in the area of studies of cloud-climate feedbacks. My own view is that radiation, cloud and precipitation microphysics, and dynamics are highly coupled, and that there are important scientific advances that can be made by integrating all three. Quentin shared with me his research plan expressing a desire to look at interactions of aerosols with clouds by tracking cloud and aerosol pathways and considering the impact of wet scavenging of precipitation. He is proposing to use a novel combination of satellite and tracer transport model data as input including interestingly both nitric acid and carbon monoxide. Such research will utilize well Quentin's strengths at drawing together disparate datasets. I was somewhat unsure

about how nitric acid concentrations will be obtained although I assume satellite datasets are available. But I have no doubt that Quentin will be able to find the required resources to be able to accomplish his research goals.

Quentin is exceptionally personable. And scientifically his focus is clearly on getting things right. He shows no qualms about challenging other scientists where it is important to do so, particularly where he does not feel those opinions are reflected in the data. He always does it in away that is supportive and collegial.

Please do not hesitate to contact me with any further questions.

Warm regards,



Tim Garrett
Professor
Department of Atmospheric Sciences