EGU2020-13993
https://doi.org/10.5194/egusphere-egu2020-13993
EGU General Assembly 2020
© Author(s) 2020. This work is distributed under
the Creative Commons Attribution 4.0 License.

Saltation layer of cohesive drifting snow observed in a wind tunnel

Jean-Luc Velotiana Ralaiarisoa[1,2], **Florence Naaim-Bouvet**[1], Kenji Kosugi[3], Masaki Nemoto[3], Yoichi Ito[3], Alexandre Valance[2], Ahmed Ould El Moctar[4], and Pascal Dupont[5]

[1]Univ. Grenoble Alpes, INRAE, UR ETNA, Grenoble, France
[2]Univ Rennes, CNRS, Institut de Physique de Rennes, UMR 6251, Rennes, France
[3]Shinjo Branch, Snow and Ice Research Center, NIED, Shinjo, Japan
[4]Laboratoire de Thermocinétique, CNRS UMR 6607, Université de Nantes, Nantes, France
[5]INSA Rennes, LGCGM, Rennes, France

Aeolian transport of particles occurs in many geophysical contexts such as wind-blown sand or snow drift and is governed by a myriad of physical mechanisms. Most of drifting particle are transported within de saltation layer and has been largely studied for cohesionless particles whether for snow or for sand. Thus, the theoretical description of aeolian transport has been greatly improved for the last decades. In contrast cohesive particles-air system have received much less attention and there remain many important physical issues to be addressed.

In the present study, the characteristics of drifting cohesive snow phenomena is investigated experimentally Several wind tunnel experiments were carried out in the Cryopsheric Environment simulator at Shinjo (Sato et al., 2001). Spatial distribution of wind velocity and the mass flux of drifting snow were measured simultaneously by an ultrasonic anemometer and a snow particle counter. The SPC measures the size of each particle passing through a sampling area. The size is classified into 32 classes between 50 and 500µm. Compacted snow was sifted on the floor. Then snow bed is left for a determined duration time to become cohesive by sintering.Two kinds of snow beds with different compression hardness were used (“hard snow” with a compression hardness of about 60 kPa and “semi hard snow” with a compression hardness of about 30 kPa). Wind tunnel velocity varied from 7 m/s to 15 m/s. Moreover steady snow drifting can be produced by seeding snow particles at a constant rate at the upwind of the test section. The results are compared with those obtained for loose surfaces. It was shown that :

- on hard snow cover, aerodynamic entrainment does not occur and saltating particles from the seeder just rebounded without splashing particles composing the snow surface (Kosugi et al.,2004). b, the inverse of the gradient of the mass flux decay with height is proportional to the friction velocity. The mass flux profiles exhibit a focus point. It is also confirmed (Kosugi et al., 2008) that the saltation height increased with increasing particle diameter throughout the full range of investigated wind tunnel velocity. Such characteristics are not observed for cohesionless snow particles (Sugiura et al.,1998)

-on semi hard snow cover, the inter-particle cohesion makes the transport unsteady and spatially

inhomogeneous. A steady state is never obtained. It makes experimental protocol and experiments repeatability tricky. Without seeder, the same trends are observed compared to the previous experiments on hard snow. With seeder, the drifting snow flux dramatically increases, even for low wind speed, leading to snow cover vanish.