Experimental investigation of the spatiotemporal variability of blowing snow

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1.5 m

SPC: 15
Ultrasonic-anemometer: 15
Air Temp., Dew point: 2
SPC: 100 kHz
others: 1 kHz

DFIR: Double Fence Intercomparison Reference

AWS
FEB. 2018
TOUBETSU

Obs. period
FEB. 2018
TOUBETSU

Obs. period
Blowing snow mass flux

Feb. 1

Feb. 8
SPC: 39 cm high

Feb. 23
SPC: 6 cm high
Blowing snow mass flux

SPC: 39 cm high
Spatiotemporal distribution of snow mass flux

20:42 - 24:00  Feb. 8, 2018
Spatiotemporal distribution of snow mass flux

20:42 - 21:12  Feb. 8, 2018
Spatiotemporal distribution of snow mass flux

20:42-20:45 Feb. 8, 2018
Spatiotemporal distribution of snow mass flux

20:48:40 - 20:50:20  Feb. 8, 2018
Wavelet analysis


Coherent structure in the boundary layer

**Quadrant Analysis**

Fluctuation of horizontal and vertical wind speed: \( u', w' \)

**VITA: Variable Interval Time Averaging**

Variance of turbulent energy production

\[
\text{Var}_{uu}(t) = \frac{1}{T} \int_{t-T/2}^{t+T/2} u'^2(t')dt' - \left[ \frac{1}{T} \int_{t-T/2}^{t+T/2} u(t')dt' \right]^2
\]

Ejection \( D(t) = \begin{cases} 
1 & \text{var}_{uu}(t) > ku'^2 \text{ and } du/dt > 0 \\
0 & \text{otherwise}
\end{cases} \)

Sweep \( D(t) = \begin{cases} 
1 & \text{var}_{uu}(t) > ku'^2 \text{ and } du/dt < 0 \\
0 & \text{otherwise}
\end{cases} \)

**Quadrant Analysis, Quadrant-hole Analysis and VITA**


\( \Rightarrow \) Aksamit and Pomeroy (2017)
Large-Eddy Simulation coupled Lagrangian Snow Transport model (LLAST)

Main-process (in air)

(3D) wind modification

(3D) particle dynamics

Sub-process (on surface)

aerodynamical entrainment

splash process (collision)

Large-Eddy Simulation (LES) ↔ Newton’s equation of motion