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Size-resolved dust flux measurements in a fallow wheat field from the Japan-Australia Dust Experiment (JADE)

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The time- and size-resolved dust flux was observed by using optical particle counters and profile measurements of wind speed and air temperature on a dry, non-crusted fallow wheat field in Australia during the Japan-Australia Dust Experiment (JADE). Mineral dust emitted from the ground surface into the atmosphere by strong winds is transported around the globe and can have effects on cloud properties and thus on climate. Therefore not only on the amount of dust but also on the size of the dust particles is important. To evaluate the power n of the law linking dust flux to friction velocity according to the particle size, the time- and size-resolved number and mass concentrations were measured and dust flux along with the friction velocity was evaluated by a gradient method. This observation shows the simple relationship between diffusion dust flux and friction velocity using power law to address questions: what is the best value to use for the power n? Does the n has the particle size dependency? The dust concentration and dust flux fluctuated greatly with time, and the fluctuations corresponded well with fluctuations in u*. The trend of the relationship between friction velocity and dust flux was similar across all measured particle sizes. Size distributions of suspended dust particles at two different heights (1 and 3.5 m) had a similar shape and modal behavior. This is different from saltation sand particles. This result indicates that dust particles were transported by vertical turbulent eddy motions. As for dust mass flux, particles ranging in size from 2.0 to 8.4 μm composed 90% and particles from 0.6 to 2.0 μm composed 10%. While, finer dusts are dominant for number concentration. Number concentration and mass flux behave differently. The dust flux integrated from 0.6 to 8.4 μm in six bins fluctuated greatly, depending on friction velocity. When the power law equation was fitted to the data for each particle size range, the power n should be determined separately for each particle size range when estimating the size-resolved dust flux.