

# On Size-distribution of Falling Snow

by

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## Abstract

The size-distribution of falling snow flake was observed by employing the condenser paper coated with the powder of water blue pigment. It appears, on an average, that the number of small snow flake is greater than the large one. The distribution curves of the mass are flat or sharp. With a large amount of falling snow, equivalent water drops of snow flakes are 0.5 mm to 0.75 mm in diameter.

## 1. Introduction

Many research works on the size-distribution of falling snow have been presented to our notice [1]. The present author observed the size-distribution of falling snow by employing the condenser paper coated with the powder of water blue pigment [2].

The results were accurate in that observation because the paper used was extremely thin (0.15 mm). When the snow falling on the paper was heated for a little while, the snow flakes melted away leaving their round blue traces on the paper. The sizes of the traces were various in proportion to the mass of the snow flakes.

The relation between the size of a trace and the mass of a snow flake is previously arranged according to the experiment. By measuring the diameter of a trace, that of the equivalent water drop of a snow flake was to be obtained.

The water drops of measured snow flakes were classified into several grades at intervals of 0.25 mm in diameter. Observation localities were Tokyo and Shinjo (38.7 E, 140.3 N).

## 2. Results

The size-distribution of falling snow flakes is shown in Table 1 and Fig. 1, where the diameter of equivalent water drops is indicated on the abscissa, and the frequency of the number of snow flakes and their masses on the ordinate. The diameter having been indicated on the abscissa at intervals of 0.25 mm, no minor aspect is to be discovered, but a major tendency is to be observed.

Comparing the two examples of falling snow observed in Tokyo, the frequency distribution of the number of the snow flakes is similar to each other, but the

Table 1. Size-distribution of falling snow flakes.

Date	Diameter (mm)																		
	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0	2.25	2.5	2.75	3.0	3.25	3.5	3.75	4.0			
Tokyo	Feb. 21	Snow	59 <i>3</i>	24 <i>8</i>	11 <i>17</i>	3 <i>14</i>	1 <i>13</i>	0.5 <i>9</i>	0.2 <i>7</i>	0.3 <i>11</i>	0.1 <i>7</i>	0.1 <i>9</i>	0.0 <i>2</i>		0.0 <i>2</i>				
	Mar. 17	Snow	57 <i>4</i>	26 <i>14</i>	13 <i>30</i>	3 <i>17</i>	0.9 <i>14</i>	0.3 <i>7</i>	0.1 <i>5</i>	0.1 <i>3</i>	0.0 <i>4</i>	0.0 <i>3</i>							
Shinjo	Feb. 28	Rain	71 <i>4</i>	18 <i>7</i>	6 <i>11</i>	2 <i>10</i>	1 <i>14</i>	0.5 <i>11</i>	0.4 <i>13</i>	0.3 <i>13</i>	0.1 <i>7</i>	0.0 <i>3</i>	0.0 <i>5</i>	0.0 <i>2</i>	0.0 <i>2</i>				
	Mar. 2	Graupel and rain	2 <i>0.0</i>	17 <i>0.6</i>	12 <i>2</i>	14 <i>6</i>	34 <i>33</i>	12 <i>20</i>	4 <i>10</i>	4 <i>1</i>	0.9 <i>6</i>	0.9 <i>8</i>							
	Mar. 3	Snow	46 <i>2</i>	32 <i>8</i>	14 <i>15</i>	5 <i>16</i>	2 <i>12</i>	1 <i>14</i>	0.5 <i>11</i>	0.3 <i>10</i>	0.2 <i>8</i>	0.1 <i>5</i>							
	Mar. 4	Snow	77 <i>10</i>	18 <i>18</i>	3 <i>13</i>	2 <i>19</i>	0.5 <i>16</i>	0.1 <i>7</i>	0.2 <i>16</i>										
	Mar. 5	Snow	63 <i>2</i>	30 <i>6</i>	6 <i>8</i>	1 <i>5</i>	0.5 <i>4</i>	0.2 <i>2</i>	0.0 <i>1</i>	0.0 <i>1</i>	0.2 <i>9</i>	0.1 <i>7</i>	0.1 <i>11</i>	0.0 <i>4</i>	0.0 <i>7</i>	0.0 <i>9</i>	0.0 <i>15</i>	— <i>—</i>	0.0 <i>10</i>
	Mar. 6	Snow	80 <i>8</i>	12 <i>9</i>	4 <i>13</i>	3 <i>31</i>	1 <i>25</i>	0.0 <i>1</i>	0.0 <i>4</i>	—	0.0 <i>8</i>								
	Mar. 8	Snow	46 <i>2</i>	24 <i>6</i>	15 <i>16</i>	11 <i>34</i>	4 <i>30</i>	0.4 <i>5</i>	0.4 <i>8</i>										
	Mar. 9	Snow and rain	59 <i>2</i>	25 <i>7</i>	8 <i>9</i>	3 <i>10</i>	2 <i>21</i>	0.7 <i>9</i>	0.5 <i>10</i>	0.2 <i>6</i>	0.3 <i>14</i>	0.1 <i>8</i>	0.1 <i>5</i>	— <i>—</i>	0.0 <i>1</i>				
	Mar. 11	Rain in fog	11 <i>0.3</i>	36 <i>10</i>	42 <i>32</i>	9 <i>28</i>	3 <i>19</i>	0.4 <i>5</i>	0.3 <i>5</i>										
	Mar. 12	Snow and rain	33 <i>0.3</i>	37 <i>20</i>	28 <i>65</i>	1 <i>9</i>	0.4 <i>6</i>												
	Mar. 13	Snow	44 <i>1</i>	39 <i>8</i>	8 <i>7</i>	5 <i>12</i>	3 <i>16</i>	0.8 <i>8</i>	0.6 <i>10</i>	0.4 <i>10</i>	0.2 <i>7</i>	0.2 <i>9</i>	0.2 <i>12</i>						
Mar. 18	Snow	26 <i>0.5</i>	51 <i>7</i>	12 <i>7</i>	5 <i>9</i>	3 <i>8</i>	1 <i>9</i>	0.6 <i>7</i>	0.4 <i>6</i>	0.4 <i>11</i>	0.1 <i>4</i>	0.2 <i>8</i>	— <i>—</i>	0.1 <i>5</i>	0.1 <i>11</i>	0.1 <i>7</i>			

Roman style : nos/min/100 cm<sup>2</sup>Italic style : mg/min/100 cm<sup>2</sup>

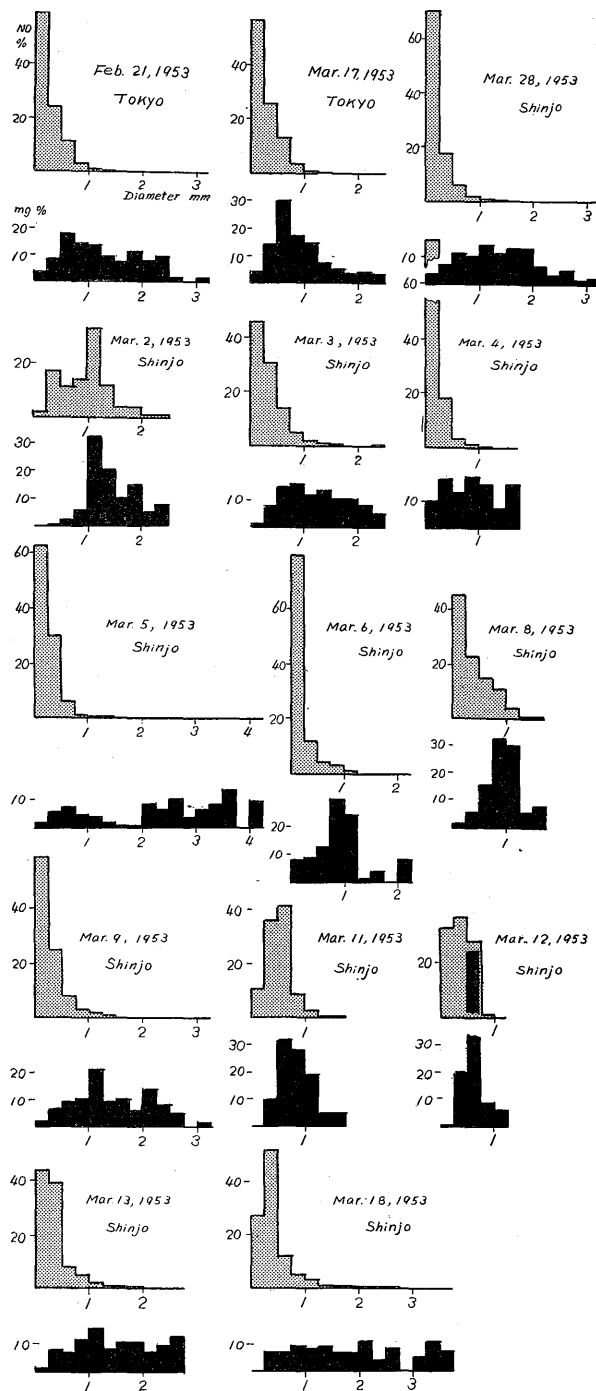
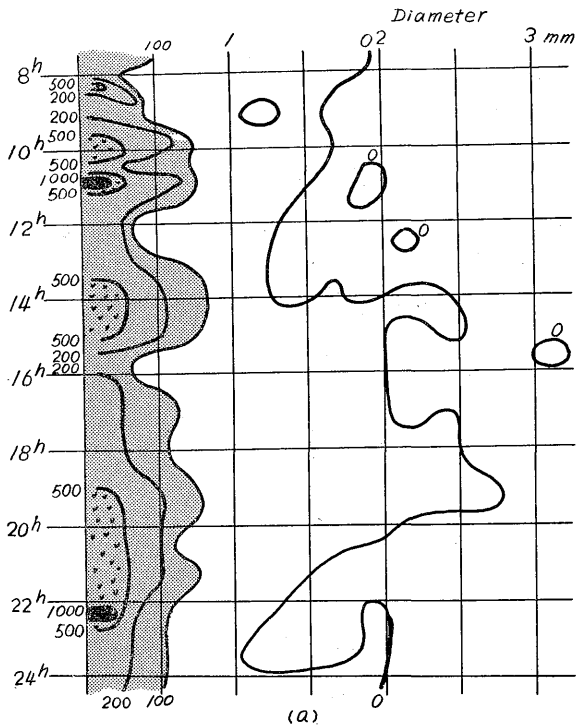


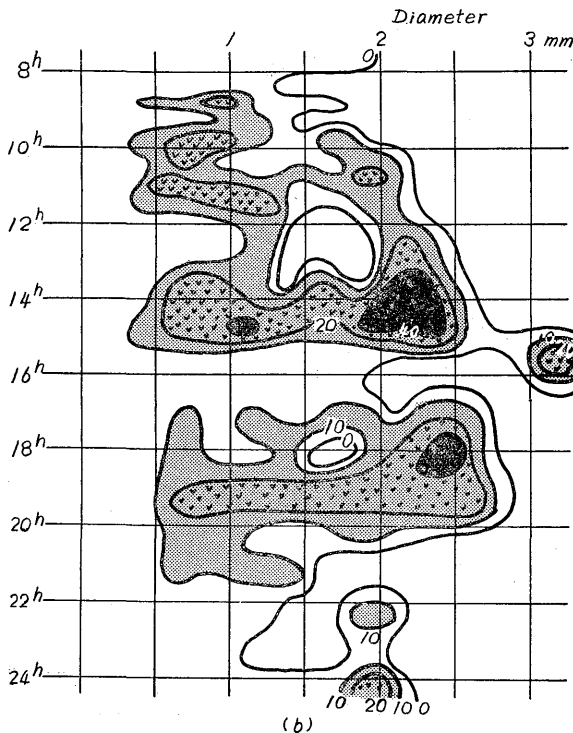
Fig. 1. Size-distribution of falling snow flakes.

Halftone : Histogram of number.

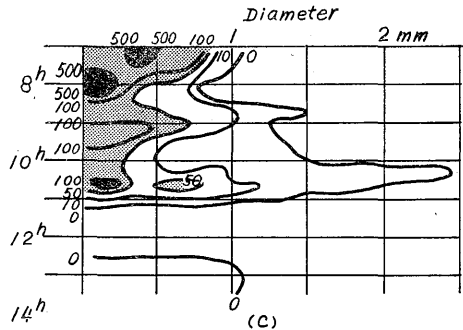
Black : Histogram of mass.



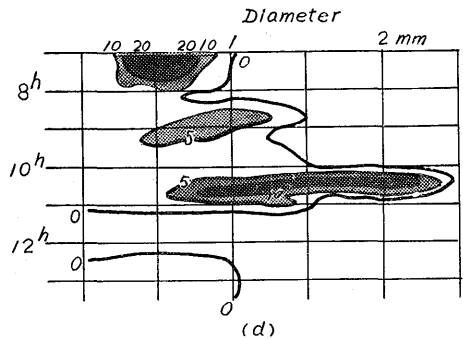
a) Variation of number, Feb. 21, 1953 at Tokyo.



b) Variation of masses, Feb. 21, 1953 at Tokyo.



c) Variation of number, Mar. 17, 1953 at Tokyo.



d) Variation of masses, Mar. 17, 1953 at Tokyo.

Fig. 2. Time variation of the size-distribution.

mass distribution is different. In other words the distribution curve of the mass on February 21, 1953, is somewhat flat, and on the contrary the curve on March 17, 1953, is narrow and peaked having larger values at diameters of 0.5 mm to 0.75 mm than at the others.

Similarly, the frequency distribution curve of the mass observed in Shinjo is classified into two forms. According to the observation on the rain and snow, and the snow there, no remarkable difference is recognized between the two size-distributions.

Time variation of the size-

distribution is shown in Fig. 2, according to which the size-distribution is always changing periodically. And also the number distribution and the mass distribution are changing. A period of one to four hours is recognized, though imperfectly. But in our observation, minor variation of, say, ten to twenty minutes, is not shown, but a major one is clearly seen. Such variation is recognized also in the number distribution, while it is more clearly recognized in the mass distribution.

When the size-distribution is wide, the amount of precipitation is large, and when the former is narrow, the latter is small. When the amount of precipitation is large, the number of snow flakes is large, but there are some places where the amount of precipitation is small in spite of the large number of snow flakes. This is almost the same with the snow in Shinjo.

### 3. Conclusion

1) There are two kinds of form in the mass distribution, flat and peaked. The average of the mass is 0.5 mm to 0.75 mm of an equivalent water drop in diameter. This value is much smaller than that obtained in thunder showers, which is 1 mm to 4 mm, but it corresponds to that obtained in graupel, which is 0.25 mm to 1.25 mm [3], [4].

2) There is no difference between the size-distribution of rain and snow, and snow.

3) A period of one to four hours is recognized in snowfalls lasting many hours.

4) When the size-distribution is wide, the amount of precipitation is large.

5) A large number of snow flakes does not always express a large amount of precipitation.

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### References

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