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## FORM OF PRECIPITATION OBSERVED AT HIGH ALTITUDES

The super-cooling of water has been the subject of speculation and considerable research since a long time and it is believed that super-cooled water can exist in the free atmosphere at temperature well below the freezing point (Schaefer 1962). Further it is possible that the occurrence of super-cooled water near elevated ground surface may be significantly different from the case in the free atmosphere. Obviously this would

be directly reflected in the state of water in which precipitation occurs naturally at such places. Keeping this point in view, I observed the form in which precipitation occurred during my recent expedition to Rathang Peak in connection with the advance course at the Himalayan Mountaineering Institute, Darjeeling, in March 1963 where I was deputed by the India Meteorological Department. The route of this expedition (10 to 30 March) to Rathang Peak (Lat. 27° 36' N, Long. 88° 06' E; Height a.s.l. 22,000 ft) situated in the Western Sikkim Himalayas almost north of Darjeeling at an aerial distance of 40 miles, passes through places like

TABLE 1

Date and altitude (ft a.s.l.)	General weather during the day	Special reference on precipitation
Ascent 10-3-63 12,800 to 14,700	Occasional snowfall at times accompanied with thunder particularly in the afternoon and night	First soft snowfall (Graupel, diameter 2 mm approx.), then in flakes
Ascent 12-3-63 14,700 to 16,500	Cloudy with occasional snowfall in the afternoon	From soft snowfall to snowfall in flakes
Ascent 14-3-63 16,500 to 18,500	Variable sky becoming cloudy with occasional snowfall in the afternoon	Do.
Descent 18,500 to 16,500		
Ascent 16-3-63 18,500 to 18,600	Cirrus in the morning, developments of clouds later with snowfall at times in the afternoon accompanied with moderate to strong northerly surface wind	Do.
Descent 18,600 to 18,500		
Ascent 19-3-63 18,500 to 19,700	Developments of clouds in the afternoon—Overcast sky with temporary snowfall in the afternoon	Snowfall in flakes
Descent 19,700 to 18,500		
Ascent 21-3-63 19,700 to 21,000	Developments of clouds in afternoon with solid precipitation afternoon/evening	Do.
Descent 21,000 to 19,700		
Ascent 24-3-63 21,000 to 21,400	Clear morning. Clouds developing at about 0930 hrs, surface wind becoming gusty with advance of day temporarily becoming 65 to 70 knots. Snowfall at times heavy accompanied with strong gusty wind, prevailed throughout the period	Snowfall in flakes, drifting snow at times
Descent 21,400 to 21,000		
25-3-63 21,000	Overcast sky, strong surface wind. Snowfall with occasional snowstorm particularly in afternoon	Do.
26-3-63 21,000	Partly cloudy with moderate to strong northerly wind, snowfall afternoon/evening	Do.
27-3-63 21,000	Partly overcast—Gusty winds. Light snowfall afternoon/evening	Do.

TABLE 2

Date and altitude (ft a.s.l.)	General weather during the day	Special reference on precipitation
27-9-62 14,700	Cloud development started at about 1000 hrs. Light rain started at 1130 hrs and continued till afternoon/evening	Liquid precipitation (rain)
4-10-62 16,500	Clear morning, overcast sky since mid-day. Light rain started at about 1230 hrs and continued till evening	Do.
5-10-62 18,500	Developments of clouds after mid-day temporarily mixed precipitation rain/snow in the afternoon	Mixed precipitation rain/snow (sleet)

Yoksum, Bakim, Dzongri and Chaurikiang leading to the East Rathang Glacier (16,500 ft), keeping on the right side the Forked Peak (20,017 ft). The elevation of the route ranged between 14,000 to 21,400 ft a.s.l. On the East Rathang Glacier the Advance Base Camp was established.

In order to bring back photographic evidence of the rain drops, if any, and to try to determine the size of the drops, I carried with me some butter paper (this primitive equipment was the only one possible keeping the exigencies of the situation in view). However no photographs were taken as there was no liquid precipitation in that period in the altitude higher than 9000 ft.

In Table 1, remarks on the form in which precipitation occurred together with a general description of the weather on all such occasions are given.

I had occasion to visit the same area at the time of Basic Course Mountaineering

Training during September-October 1962. At that time also I had noted the form of precipitation encountered and the observation is shown in Table 2.

Further observations, particularly quantitative measurements would be necessary before we can suggest any hypothesis for this difference noticed or to generalise these as the representative pattern to be always encountered at these heights in different parts of the Himalayas.

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#### REFERENCE

- Schaefer, V. J. 1962 *J. Appl. Met.*, 1, p. 481.