APPENDIX I

PUBLICATIONS OF THE COOPERATIVE SNOW INVESTIGATIONS

## TECHNICAL REPORTS
### Cooperative Snow Investigations

1. Instructions for the determination of snow quality. December 1944.

2. Bibliography of snow and ice (preliminary). June 1945.

3. Heat transmission constants of snow. (Draft) 9 December 1946.

4A. Terrain characteristics, Central Sierra Snow Laboratory Basin. June 1951.

5. Hydrometeorological Log of the Central Sierra Snow Laboratory 1945-1946. September 1947.

6-1. Classified outline of analytical program, Processing and Analysis Unit. 10 March 1947.

6-2. Progress Report of the Processing and Analysis Unit to 31 March 1948. August 1948.

6-3. Progress Report of the Processing and Analysis Unit to 31 March 1949. June 1949.

6-4. Progress Report, 1945-1950. March 1950 (Revised as of 1 June 1950).

6-5. Annual Progress Report, 1950-1951. November 1951.

6-6. Annual Progress Report, 1951-1952. July 1952.

7. Hydrometeorological Log of the Upper Columbia Snow Laboratory 1945-1946. July 1948.

8-1. Penetration of Solar Radiation into the Snowpack. March 1948.

13. Annotated brief bibliography of snow hydrology. 20 January 1950.

15-1. The storage and transmission of liquid water in the snowpack as indicated by dyes. March 1948.

16-2. Empirical methods of estimating snow melt runoff from temperature. March 1948.

17. Hydrometeorological Log of the Upper Columbia Snow Laboratory 1946-1947. May 1952

TECHNICAL REPORTS - Continued

18. Hydrometeorological Log of the Central Sierra Snow Laboratory 1946-1947. May 1952.

20-1. Hydrometeorological Log of the Upper Columbia Snow Laboratory 1947-1948. August 1949.

21. Hydrometeorological Log of the Willamette Basin Snow Laboratory 1947-1948, 1948-1949. August 1951.

22. Hydrometeorological Log of the Central Sierra Snow Laboratory 1947-1948. February 1952.

23. Hydrometeorological Log of the Central Sierra Snow Laboratory 1948-1949. November 1951.

24. Hydrometeorological Log of the Upper Columbia Snow Laboratory 1948-1949. January 1952.

25. Hydrometeorological Log of the Central Sierra Snow Laboratory 1949-1950. April 1952.

26. Hydrometeorological Log of the Upper Columbia Snow Laboratory 1949-1950. March 1952.

27. Hydrometeorological Log of the Willamette Basin Snow Laboratory 1949-1951. November 1952.

28. Hydrometeorological Log of the Central Sierra Snow Laboratory 1950-1951. August 1952.

29. Hydrometeorological Log of the Upper Columbia Snow Laboratory 1950-1951. June 1952.

30. Hydrometeorological Log of the Central Sierra Snow Laboratory 1951-52. April 1953.

APPENDIX I - Continued

RESEARCH NOTES

Corps of Engineers Analytical Unit, Cooperative Snow Investigations; and Corps of Engineers, Snow Investigations

1. MILLER, D. H., Albedo of the snow surface as related to weathering factors and stage of the season, December, 1950.

2. MIXSELL, J. W. and others, Influence of terrain characteristics on snowpack water equivalent, February 1951.

3. MONDRILLO, G., Estimating insolation from atmospheric conditions, March 1951.

4. HIMMEL, J. M., Lysimeter studies of rain-on-snow phenomena, June 1951.

5. BRECHEEN, K. G., Transmission of shortwave radiation through forest canopy, October 1951.

6. BERGER, P., Trial estimates of net longwave radiation from snowpacks, February 1952.

7. BERGER, P., Estimation of net longwave radiation from snow, October 1952.

8. McCLAIN, M. H. (tr.), Evaporation from the snowpack, by M. de Quervain, October 1952.

9. MILLER, D. H., Some forest influences on thermal balance over the snowpack, (reprint), December 1952.

10. BOTTORF, W. L. D. and C. E. Hildebrand, An empirical method of forecasting critical snowmelt inflows to Pine Flat Reservoir, December 1952.

11. ARNOLD, B. and P. Boyer, Heat exchange and melt of late-season snow patches in heavy forest, May 1953.

12. BERGER, P., Radiation in forest at Willamette Basin Snow Laboratory, June 1953.

13. HUMPHREY, H. N. and T. H. Pagenhart, Additional studies of the influence of terrain characteristics on snowpack water equivalent, June 1953.

14. MONDRILLO, G., Preliminary unit-graph studies, Mann Creek, Willamette Basin Snow Laboratory, June 1953.

15. MILLER, D. H., Thermal balances and snowmelt runoff associated with upper-air flow over the western United States in May 1949 and May 1950, September 1953.

16. MILLER, D. H., Snow-cover depletion and runoff, September 1953.

17. HILDEBRAND, C. E. and T. H. Pagenhart, Lysimeter studies of clear weather snowmelt at an unforested site, December 1953.

18. BOYER, P. B., Analysis of January 1953 rain on snow, observations at Central Sierra Snow Laboratory, Soda Springs, California, May 1954.

19. MONDRILLO, G. and C. E. Jencks, Clear weather snowmelt runoff in a densely forested area, Willamette Basin Snow Laboratory, May 1954.

(Supplement to Res. Note 19) MONDRILLO, G., Clear-weather snowmelt runoff in a densely forested area, North Santiam River Basin, with Appendix: Thermodynamics of transpiration in heavy forest during active snowmelt, May 1955.

20. McCLAIN, M. H., Precipitation, evapotranspiration, and runoff, Willamette Basin Snow Laboratory, July 1954.

21. HILDEBRAND, C. E. and T. H. Pagenhart, Determination of annual precipitation, Central Sierra Snow Laboratory, September 1954.

22. MILLER, S., Forecasting seasonal runoff by the water-balance method, September 1954.

23. ROCKWOOD, D. M., A coastal winter-flow index method of forecasting seasonal runoff for Columbia River near The Dalles, Oregon, September, 1954.

24. JENCKS, C. E., Analysis of February 1951 rain on snow in a densely forested area, April 1955.

25. HILDEBRAND, C. E. and T. H. Pagenhart, Lysimeter studies of snowmelt, March 1955.

APPENDIX I - Continued

TECHNICAL BULLETINS
Corps of Engineers, Civil Works Investigations
Project CW-171

1. Criteria for estimating runoff from snowmelt, (Project bulletin 1: objectives of project and administrative details.) May 1949.

2. SNYDER, F. F. Heat balance and amount available for melting snow. June 1949.

3. PARSONS, W. J. Use of snow laboratory data by Sacramento District. November 1949.

4. HULLINGHORST, D. W. Progress report on project CW-171, Criteria for estimating runoff from snow melt. April 1950.

5. MILLER, D. H. The depletion method of estimating solar radiation absorbed by the snow. April 1950.

6. MILLER, D. H. Albedo of the snow surface with reference to its age. April 1950.

7. HERING, W. S. Evaluation of outward long wave radiation from the snow surface. April 1950.

8. HULLINGHORST, D. W. and D. H. Miller. Interim report on a current study (Reconstitution of stream flow from meteorologic data). May 1950.

9. HULLINGHORST, D. W. and D. H. Miller. Refinement of flow estimates of Technical Bulletin No. 8. September 1950.

10. HAMILTON, R. M. Application of estimation procedures to independent data. September 1950.

11. MILLER, D. H. Micro-meteorological conditions over snow pack in open forest: preliminary report on factors influending convective heat-exchange. August 1950.

12. HIMMEL, J. M. Radiation heat exchange between the snowpack and its environment, Central Sierra Snow Laboratory, 27 April - 9 June 1950. September 1950.

13. HILDEBRAND, C. E. The general snowmelt equation. May 1951.

14. HILDEBRAND, C. E. A unit-hydrograph method of hydrograph synthesis for snow-covered areas. September 1952.

15. THOMS, M. E., Determination of areal snow cover by aerial reconnaissance in Kootenai and Flathead Basins, February 1954.

16. ALLISON, I. D., Melting of deep snow packs by conduction of heat from the ground, June 1954.

17. BOYER, P. B. and P. Merrill, Storage effect of snow on the flood potential from rain falling on snow, December 1954.

18. ROCKWOOD, D. M. and C. E. Hildebrand, An electronic analog for multiple-stage reservoir-type storage routing, March 1956.

## MISCELLANEOUS REPORTS


1. GERDEL, R. W. - Evaluation of snow cover distribution from horizontal photographs, Cooperative Snow Investigations Progress Report, May 6, 1949. (Unpublished)

2. GERDEL, R. W. - A review of soil moisture measuring methods and apparatus, Cooperative Snow Investigations, Technical report, March, 1949. (Unpublished)

3. MILLER, D. H. - Rain-on-snow flood of 18-20 November 1950, CSSL: Preliminary Report and outline for investigation as of 24 November 1950. Office memo to technical director, CSI, 24 November 1950. (Mimeographed)

4. PATTON, C. P. - Five-year meteorologic summary, station 3, Central Sierra Snow Laboratory. Cooperative Snow Investigations: SIPRE Analytical Unit, 1 May 1952.

5. PATTON, C. P. - Meteorologic elements and snowpack characteristics at micrometeorological project, Central Sierra Snow Laboratory, 1950-51 season, Cooperative Snow Investigations: SIPRE Analytical Unit, 1 June 1952.

6. WALSH, K. J. - Wind-speed and air-temperature gradients for January-May 1951 at micrometeorological project, Central Sierra Snow Laboratory, Cooperative Snow Investigations: SIPRE Analytical Unit, 5 January 1953.

7. WALSH, K. J. - Variations in snowpack density, Central Sierra Snow Laboratory, Cooperative Snow Investigations: SIPRE Analytical Unit, 4 February 1953.

8. Synopsis of Snow Investigations and Plans for FY 1954, August 1953, North Pacific Division, Corps of Engineers, U. S. Army, Portland, Oregon.

## APPENDIX II

### COMPLETED TOURS OF DUTY, PROJECT CW-171

1) F. F. SNYDER (OCE) June 1949 - Initiation of Project Study of heat balance and amount available for melting snow, (Tech. Bull. 2).

2) C. PEDERSEN (Portland Dist.) June 1949 - UCSL studies; Relationship of radiation to various meteorological elements; seasonal variations of albedo, snow density, water equivalent; degree-day melt rate computations.

3) R. H. CONWAY (Walla Walla Dist.) June 1949 - Preliminary reconstitution 1948 flood, UCSL, to investigate criteria governing snowmelt; inquiries concerning degree-day vs. heat-balance methods.

4) N.J. MACDONALD (Seattle Dist.) June 1949 - Relationship studies; density of new snow vs. max. temp. at Summit, Mont., and Soda Springs, Calif.; normal annual precip. vs. topog., Columbia Basin (similar to USWB study of Colorado Basin); spillway design flood methods from unit hydrographs, UCSL.

5) E. W. McCLENDON (MRD) August,1949 - Study and review of snow hydrology problems; discussion of basic snow and frost problems; discussion of basic snow and frost problems in Missouri River Basin; mountain snowmelt vs. plains snowmelt.

6) M.E. THOMS (Seattle Dist.) Sept. 1949 - Snowmelt determinations published in "Report on Derivation of Standard Project Flood, Skagit River near Sedro Woolley, Washington."

7) W. S. HERING (Walla Walla Dist.) Sept. 1949 - Empirical evaluation of condensation and outward longwave radiation over snow (Tech. Bull. 7); study on upper air temp. as index of mean surface temp.

8) S. A. MILLER (Denver Dist.) Oct. 1949 - Study of temp. index, snow cover, and runoff relationships using concept of "active snowmelt line" (daily temp. trace through melt season of degrees required at index station to produce melt).

9) J. SUMMERSETT, JR., (Portland Dist.) Oct. 1949 - Study and review of snowmelt problems in Willamette Basin Snow Laboratory.

10) S. MILLER (Walla Walla Dist.) Nov. 1949 - Use of temperature data in determining incident radiation (formulas, correlations, results, presented). Discussion of snow hydrology problems, Lucky Peak Dam.

COMPLETED TOURS OF DUTY, PROJECT CW-171 - Continued

11) C.E. JENCKS (Portland Dist.) Feb. 1950 - Study and review; streamflow study of Blue River above Quentin Creek, WBSL.

12) F. C. MURPHY (Seattle Dist.) Feb. 1950 - Review of spillway design problems in Columbia Basin; specifically at Albeni Falls dam site.

13) H. LOBITZ, JR., (Walla Walla Dist.) June 1950 - Study of hydrograph reproduction by the degree-hour method using variable S-curves for distribution of the melt.

14) E. W. McCLENDON (MRD) Aug. 1950 (2nd visit) - Study and review of current methods of estimating streamflow from snowmelt (e.g. Tech. Bull. 8); hydrograph reconstitutions, 1948 and 1950, CSSL.

15) W.S. HERING (Walla Walla Dist.) Sept. 1950 (2nd visit) - Hydrograph reconstitution by thermal-budget method, applying S-curve principles, 1949, Boise River above Twin Springs, Idaho.

16) S. MILLER (Walla Walla Dist.) Nov. 1950 (2nd visit) - Hydrograph reconstitution by degree-day method using constant loss of 7,000 d.s.f., 1949, Boise River above Twin Springs, Idaho.

17) F.C. MURPHY (Seattle Dist.) Dec. 1950 (2nd visit) - Discussion and review; spillway design problems, Libby project.

18) R. ASCHENBRENNER (Walla Walla Dist.) Jan. 1950 - Various reconstitutions by degree-day and heat-balance methods, 1943 and 1949, Boise River above Twin Springs, Idaho.

19) N. J. MACDONALD (Seattle Dist.) Jan. 1951 (2nd visit) - Libby damsite spillway design study: 1947 hydrograph reconstitution by degree-day method, Kootenai River at Libby, Montana.

20) M. J. ORD (Walla Walla Dist.) Feb. 1951 - Discussion and review of Boise River studies and of general snow hydrology for application to District snowmelt runoff problems.

21) G. L. GAY (Portland Dist.) Feb. 1951 - Green Peter Dam Study.

22) R. H. CONWAY (Walla Walla Dist.) Mar. 1951 (2nd visit) - Reconstitution of '36, '43, '48, and '50 flood hydrographs by degree-day methods, Snake River at Heise, Idaho

23) M. E. THOMS (Seattle Dist.) Mar. 1951 (2nd visit) - Spillway design studies, Kootenai River at Libby, Montana: '42 and '48 flood reconstitutions by degree-day method, '47 and '48 reconstructions by heat-balance method.

24) S. MILLER (Walla Walla Dist.) Sept. 1951 (3d visit) - Runoff volume forecast study, Boise River above Lucky Peak, Idaho.

25) J. SUMMERSETT, JR. (Walla Walla Dist.) Oct. 1951 (2nd Visit) UCSL snow cover vs. heat-exchange study; discussion and study of reconstitution methods, degree-day vs. thermal budget.

26) D. E. PHILLIPS (Walla Walla Dist.) Feb. 1952 - Snow cover depletion vs. accumulated degree-days; flood reconstitutions using maximum temperatures as index.

27) D. M. ROCKWOOD (NPD) Jan. 1952 - Forecasting flood season runoff from early-season flows and temperatures for Columbia River at the Dalles.

28) M. J. ORD (Walla Walla Dist.) Feb. 1952 (2nd Visit) - Study and review of heat-balance factors; discussion of degree-day vs. heat-balance methods for basin application.

29) F.C. MURPHY (Seattle Dist.) Feb. 1952 (3rd visit) - Discussion and review of available procedures for runoff forecasting and reservoir regulation, Libby Dam.

30) M.E. THOMS (Seattle Dist.) Feb. 1952 (3d visit) - Flood reconstitutions, Kootenai River at Libby, Montana: degree-day and heat-balance methods.

31) R. H. CONWAY (Walla Walla Dist.) Mar. 1952 (3d visit) - Synthetic reconstitutions of Boise River floods, '43, '48, heat-balance method.

32) M. LARSON (Portland Dist.) Apr. 1952 - Study and review: Snowmelt studies CSSL, '49; work on project CW-170 (Radioisotope-radiotelemetering snow gage).

33) C. JENCKS (Portland Dist.) June 1952 (2nd visit) - Rain-on-snow studies, '52, WBSL: lapse rate study, WBSL.

34) M. E. THOMS (Seattle Dist.) Mar. 1953 (4th visit) - Studies preparatory to draft; "Forecasting inflows to Libby Reservoir."

COMPLETED TOURS OF DUTY, PROJECT CW-171 - Continued

35) N. J. MACDONALD (Seattle Dist.) Mar. 1953 (3d visit) - Seasonal forecast study, Albeni Falls Dam.

36) M. LARSON (Portland Dist.) Apr. 1953 (2d visit) - Forecasting and reservoir regulation procedures, Detroit Dam, (N. Santiam River, Ore.)

37) M.E. THOMS (Seattle Dist.) Oct. 1953 (5th visit) - Preparation of draft: "Determination of areal snow cover by aerial reconnaissance in Kootenai and Flathead Basins." (Tech. Bull. 15)

38) C.W. TIMBERMAN (MRD) Oct. 1953 - Study and analyses for draft: "Reconstitution of 1950 snow-melt flood on Cannonball River at New Leipzig, North Dakota;" also 1950 flood, Heart River Basin, North Dakota.

39) N. J. MACDONALD (Seattle Dist.) Dec. 1953 (4th visit) - Seasonal forecast procedure, Albeni Falls Dam.

40) H. D. WILDERMUTH (Los Angeles Dist.) Jan. 1954 - Design floods for Gila River basin above Painted Rock damsite; (sub-basins studied: San Francisco River at Clifton, Arizona, and Verde River at confluence with Salt River.)

41) H. N. HUMPHREY (SPD) Jan. 1954 - Same as 40 above.

42) C.A. BURGTORF (Garrison Dist.) Jan. 1954 - Reconstitutions of spring 1950 and 1952 snowmelt floods on Spring Creek above Zap, North Dakota.

43) G.E. GALLAGHER (Portland Dist.) Jan. 1954 - Criteria for forecasting seasonal runoff from snowmelt, Middle Fork Willamette River above Lookout Point Dam, Oregon.

44) K.A. JOHNSON (Omaha Dist.) Jan. 1954 - Reconstitution of spring snowmelt floods on Papillion Creek at Ft. Crook, Nebraska, 1948, and Spring Creek at Zap, North Dakota, 1952.

45) F.C. MURPHY (Seattle Dist.) Mar. 1954 (4th Visit) - Discussion and review, seasonal forecast procedures, Hungry Horse Dam.

46) J. W. HANSON (Portland Dist.) Apr. 1954 - Study and review, forecasting seasonal runoff, Columbia River at the Dalles.

47) S. NAIMARK (Portland Dist.) June 1954 - Daily operation schedule for Detroit Reservoir (N. Santiam River, Ore.)

48) K.W. WISE (Walla Walla Dist.) Sept. 1954 - Forecast procedure for Snake River above Moran, Wyoming.

49) N.J. MACDONALD (Seattle Dist.) Jan. 1955 (5th visit) - Forecast procedure for seasonal runoff into Hungry Horse Reservoir (So. Fork, Flathead River, Montana)

50) R. J. DEFANT (Portland Dist.) Jan. 1955 - Standard Project Flood for Cougar Dam (So. Fork, McKenzie River, Oregon).

51) N. J. MACDONALD (Seattle Dist.) Mar. 1955 (6th visit) - Seasonal runoff forecast, Hungry Horse Reservoir.

52) O.C. JOHNSON (Portland Dist.) Mar. 1956 - Seasonal runoff forecast, Lookout Point Reservoir (Mid-Fork, Willamette River, Ore.)

# APPENDIX III

## LIST OF SNOW HYDROLOGY SYMBOLS

| Symbol | Concept |
|---|---|
| a | Albedo (reflectivity) of snow pack and/or ground ($a = I_r/I_i$) |
| A | Area (of snow cover, of drainage area, etc.) |
| b | Ablation (decrease in depth) of snow pack |
| B | Thermal quality of snow pack ($B = 1 - f_p/100$) |
| $c_p$ | Specific heat (constant pressure) |
| $C_r$ | Recession constant (ratio of current rate of flow to previous days rate of flow)($q_t = q_o C_r^{\,t}$) |
| d | Depletion (decrease in areal cover) of snow pack |
| D | Depth (of snow pack, etc.)<br>Coefficient of determination |
| e | Vapor pressure<br>a subscript denotes vapor pressure of air<br>s subscript denotes saturated vapor pressure<br>Base of Naperian logarithms<br>Emissivity |
| f | Infiltration rate |
| $f_p$ | Liquid-water content of the snowpack, in percent of W |
| $f_p'$ | Liquid-water deficiency of the snowpack, in percent of W |
| $f_p''$ | Liquid-water-holding capacity of the snowpack, in percent of W, ($f_p'' = f_p + f_p'$) |
| F | Forest cover |

| Symbol | Concept |
|---|---|
| G | Intensity of radiation (all wave)<br>$d$ subscript denotes radiation directed downward or toward the snow pack<br>$u$ subscript denotes radiation directed upward or from the snow pack |
| h | Rate of net heat transfer to snow pack from its environment ($h = h_c + h_e + h_g + h_p + h_{rl} + h_{rs}$)<br>$c$ subscript denotes convection (and conduction) from air<br>$ce$ subscript denotes convection-condensation from air ($h_{ce} = h_c + h_e$)<br>$e$ subscript denotes condensation (or evaporation) from air ($h_e = kq_e$)<br>$g$ subscript denotes conduction from ground<br>$p$ subscript denotes heat capacity of rain ($h_p = ki_rT$)<br>$r$ subscript denotes all-wave radiation ($h_r = h_{rl} + h_{rs} = G_d - G_u$)<br>$rl$ subscript denotes long-wave radiation ($h_{rl} = R_d - R_u$)<br>$rs$ subscript denotes short-wave radiation ($h_{rs} = I_i - I_r = (1 - a)\ I_i$) |
| H | Quantity of net heat transfer to snow pack from its environment ($H = H_c + H_e + H_g + H_p + H_{rl} + H_{rs}$)(subscripts as above for rate of net heat transfer) |
| i | Intensity of precipitation<br>$r$ subscript denotes rainfall<br>$s$ subscript denotes snowfall |
| I | Intensity of short-wave radiation<br>$i$ subscript denotes incident radiation<br>$o$ subscript denotes radiation at upper limit earth's atmosphere<br>$r$ subscript denotes reflected radiation ($I_r = aI_i$) |
| k | Coefficient, exponent, or conversion factor |
| $k_c$ | Thermal conductivity |

| Symbol | Concept |
|---|---|
| $K_i$ | Solar radiation transmission coefficient for forest (ratio of radiation incident on snow surface beneath forest to radiation incident in open) |
| $K_r$ | Ratio of downward long-wave radiation, $R_d$, to that of a hypothetical black body at air temperature ($K_r = R_d/\sigma T_a^4$) |
| l | Loss rate<br>e subscript denotes loss by evaporation<br>g subscript denotes loss by deep percolation<br>t subscript denotes loss by transpiration<br>et subscript denotes loss by evapotranspiration |
| L | Loss (quantity)<br>(subscripts as above for loss rate) |
| m | Rate of snow melt<br>(subscripts as above for rate of net heat transfer) |
| M | Quantity of snow melt<br>(subscripts as above for rate of net heat transfer) |
| n | Number of items |
| N | Cloud cover |
| p | Atmospheric pressure |
| P | Quantity of precipitation<br>r subscript denotes rainfall<br>s subscript denotes snowfall (water equivalent) |
| q | Rate of stream flow, runoff, or discharge (water transport)<br>e subscript denotes rate of condensation<br>g subscript denotes rate of ground water discharge<br>i subscript denotes rate of interflow<br>l subscript denotes loss rate<br>o subscript denotes initial rate |

| Symbol | Concept |
| --- | --- |
| Q | Quantity of water<br>(subscripts as above for rate of stream flow, etc.) |
| r | Correlation coefficient |
| R | Intensity of long-wave radiation<br>(subscripts as above for intensity of radiation) |
| $s_y$ | Standard deviation |
| $s_{yx}$ | Standard error of estimate |
| S | Storage (= Inflow-Outflow) |
| t | Time<br>c subscript denotes concentration time<br>s subscript denotes storage time |
| T | Temperature<br>a subscript denotes air temperature<br>d subscript denotes dew-point temperature<br>g subscript denotes ground temperature<br>s subscript denotes snow temperature<br>w subscript denotes wet-bulb temperature |
| U | Relative humdiity |
| v | Wind speed |
| V | Wind travel |
| w | Mixing ratio |
| W | Water equivalent of snow pack |
| $W_f$ | Liquid water in snow pack $W_f = f_p W/100$ |
| $W_p$ | Precipitable water in atmosphere |

## List of Snow Hydrology Symbols - Continued

| Symbol | Concept |
|---|---|
| $z$ | Altitude, height |
| $Z$ | Zenith angle of sun |
| $\lambda$ | Wave Length (lambda) |
| $\rho$ | Density, specific gravity ("density") of snow (rho) |
| $\sigma$ | Stefan-Boltzmann constant (sigma) |
| $\phi$ | Latitude (phi) |
| $\beta$ | (beta) Standard partial regression coefficient |
| $\mu$ | (mu) micron |
| $\pi$ | (pi) 3.1416 |
| $\Sigma$ | (Sigma) sum of... |
| $\infty$ | infinity |
| $>$ | greater than |
| $<$ | less than |
| $\approx$ | approximately equal to |

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