General comments

The manuscript entitled "RoadSurf 1.1: open-source road weather model library" is a good and important contribution to scientific modelling community as well as to potential end-users from road authorities/directorates and public in many countries. Providing open public access to repository (a good way to go) is crucial and important step for enlarging community of users and developers of the RoadSurf road weather model (RWM). The chosen approach and applied methods are valid as well as results presented and discussed in appropriate and balanced way in the manuscript. The given description (incl. repository) of the RoadSurf 1.1 RWM library is sufficient to reproducibility and traceability of results.

With respect to presentation quality, it would be useful to add an extra paragraph at end of Section 1 to explain content/structure of the manuscript. The section "Conclusions" needs to be re-written and, at least, included sumup paragraphs about RoadSurf Library description on included components and its content; results of evaluation containing not only "words", but also obtained "numbers" for selected studied period; applicability; plans (if any) for further development/improvement of RoadSurf Library. The illustrations should have a self-explanatory written text in captions to Figures and Tables (see attached file with detailed comments/remarks/suggestions/etc). All Tables in Annex should include additional column containing units for listed variables (Tables 1-3, 5-6) and physical constants (Table 4), or may be? include at the beginning of the manuscript as "Nomenclature". Frequently, the word "temperature" is used through the text of the manuscript, but it has different "attribution" as: air temperature, road surface temperature, soil temperature, dew point temperature, etc. – these should re- checked and accurately written to avoid a confusion or misleading. It seems that accurate spell-checking of the manuscript text is needed (before submission) to exclude accident mistyping.

Specific comments and Technical corrections are included in the attached file.

Thank you for your valuable feedback on the manuscript. I appreciate your thorough review and have taken your comments into consideration in the revised version of the manuscript. Here are answers to the general comments. Point by point replies to the specific comments can be found in the attached file.

-Paragraph explaining manuscript structure was added
-A concise summary of the most crucial features of the RoadSurf Library was added. This should provide readers with a clear understanding of its capabilities.
- I believe that listing all components in the conclusions section might be excessive. Instead, main features were highlighted.
-In the context of the conclusions, I have opted for a qualitative approach than writing the precise numbers. The focus is on conveying the overall impact and applicability of the library rather than presenting specific numerical values.
-Applicability: Explanation about library's usage was added to the conclusions
-A mention about plans to convert the library to Python was added to the conclusions.
-Figures, Tables and captions were improved based on the specific comments
-Units will be added to the appendix tables and to "where" sections of the manuscript
-Clarifications to the usage of "temperature" term were done where appropriate
-The manuscript will go through Copernicus's English language copy editing service before publication, which will ensure that the manuscript adheres to a high standard of grammar.

Once again, thank you for your thoughtful feedback. I hope these revisions enhance the clarity of the manuscript.

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Specific comments and technical corrections
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Section 1 - INTRODUCTION
PAGE 1, LINE 23: Clarify: "where the temperature drops" vs. "where the air temperature drops"
-Added "surface" before temperature

P1, L33: Clarify: "to predict road conditions" vs. "to predict road weather conditions"
-Changed to "road weather conditions"

P2: Add extra paragraph at the end of the Section 1 to explain content/structure of the manuscript
-Added

Section 2 – REQUIREMENTS
PAGE 2, LINE 14: Clarify: Which Fortran?
-version (Fortran 2008) was added

P2, L14: "The library is not guaranteed to work with older Fortran versions"; write clearly – do you mean with older version(s) of compiler(s)? (your repository has fortran95 files), or additional programs (by potential users) should be written in f95 or higher?
-chaged from "Fortran versions" to "Fortran compilers"

P2, L14: Clarify: "following variables" vs. "following input variables"?
-Added "input" before variables

P2, L17: Clarify: "or Humidity (%)" – "or" vs "and" vs "or/and" ? & "Humidity" vs "Relative Humidity"?
-"or" is correct here. Added "Relative" before humidity

P2, L19: Clarify: "Precipitation (mmh−1)" – do you mean "Intensity of Precipitation" in units mm per hour; use space between "mm" and "h-1"
-Added "intensity" after precipitation and space between units

P2, L22: Clarify: "precipitation phase" – include/list in brackets the phases;
-Added explanation in brackets

P2, L22: Declare "sky view factors" as "SVF", and use acronym afterwards;
-Added SVF and changed sky view factor -> SVF afterwards

P2, L24: Clarify: "whole hemisphere" vs. "whole sky hemisphere "
-Added "sky" before hemisphere

P2, L27: Clarify: "atmospheric variables should" vs "atmospheric variables listed above should";
-added "listed above"

P2, L29-31: Clarify: "ground temperature" – "temperature" – "road surface temperature" – "surface temperature"; confusing; write more clearly
-added "ground" before temperature profile

P2, L32: Clarify: "Library contains only function" – clarify; GitLab contains not only functions/ programs; write in brief summary on what is stored in repository;
-GitHub is used to store the library with an example program that implements library functions. It was added to the text that repository contains also example datasets and user manual.

P2, L33: Clarify: "Tow examples" vs. "Two examples"?
-Changed "Tow" -> "Two"

Section 3 - ROADSURF PHYSICS
PAGE 2, LINE 37-38: All variables given in Appendix A should have units (include 3rd Column for "Units")
-Units will be added to the revised version of the manuscript

P2, L40: Clarify: "in the model" vs "in the RoadSurf model"
-Changed to "in the RoadSurf library"

PAGE 3, FIGURE 1: captain to figure 1 should be self-explanatory; all symbols used/plotted on figure should be explained;
-Added explanations for variables

each flux given below "where" should also include units;
-These will be added to the revised version of the manuscript

P3, L2: Clarify in "where"-blocks (everywhere throughout the text): Do you mean sign "=" means the hyphen , replace to "—" & replace in all other appropriate places throughput the manuscript;
-"=" is used to indicate that G is ground heat flux, for example

P3, L4: Clarify: what do you mean "of the other fluxes"; re-write accordingly;
-added list of other fluxes

Section "3.1.1 Net radiation"
P3, L10: See comment for P3, L2 & for listed variable in "where" - should also include units;
-"=" is appropriate here

P3, L13: Clarify: "some long waver radiation" vs "some long-wave" radiation;
-Changed to "long-wave"

P3, L13: Unify throughout the text: "long wave" vs "long-wave" & "short wave" vs "short-wave";
-changed to "long-wave" and "short-wave"

PAGE 4, equations on P4, included – "mod" subscript as well as other should be clearly defined in text; define these
-Added explanation for $SW_{dif, mod}$

In equations (do you use MathEditor?): sign "*" should be replaced by correct multiplication sign "·" in MathEditor & such sign should be added where it is appropriate
-Changed throughout the text

P4, L10: Clarify/re-write: "albedo of the surrounding environment" (do you mean albedo at exact point on road? or averaged albedo over mentioned later" vs. "surrounding vegetation, terrain and buildings"
-Added "average"

P4, L13: Provide specific reference & re-phrase from "is based on book by Jean Meeus Meeus (1991)"
-Rewrote sentence "The calculation of the sun's position is based on the methods presented in the book by Jean Meeus (Meeus, 1991)"

Section "3.1.2 Albedo"
P4, L27: Replace: "Both asphalt albedo snow albedo are" -> "Both asphalt albedo and snow albedo are"
-replaced

P4, L29-30: Replace: "alpedo is" -> "albedo is" & "alpedo is calucalted" -> "albedo is calculated"; do you mean "surface albedo" (as albedo in Eq. 5 vs Eq. 10)?
-Changed, added "surface for clarification"

Section "3.1.3 Sensible heat flux"
P5, EQ12: Clarify: ρa = density of air; is it of dry air?
-"added " dry for clarification

P5, L14: Write correctly units for Rd (gas constant for dry air)
-Changed "Kg" to "kg"

P5 & OTHER PAGES: There is frequent reference to textbooks of Campbell 1985 & 1986; it could be more clearly (easily understandable) written in the text of the manuscript, when there is also, at least, a reference included to Chapters of these textbooks.
-While specific chapter references could enhance clarity, we believe that the current citations provide sufficient context for readers to locate the relevant material.

P5-P6 (Equations 16-17-18-19): there are for unstable and stable conditions; what about expression/value for neutral conditions?
-Added that equations 18 and 19 are also used in neutral conditions.

Section "3.1.4 Latent Heat Flux"
P6, L16: Clarify: "LE is set to zero if there is no water to evaporate and LE is positive."; confusing; re-write
-This was moved to the end of the section with explanation.

Section "3.2 Heat flow in the ground"
P7, EQ27: clarify: "T = layer temperature"; is it soil layer temperature?
-Added "ground" before layer

 & ρg = density; it is density of soil? or density of soil layer? all variables/constants in all equations should have clear definitions in "where"
-Changed to "density of the ground"

Section "3.2.1 Volumetric heat capacity and heat conductivity"
P8, L5: "Water density and specific heat capacity have constant values below zero degrees" – clarify, re-write & check units for cw (in kilo-Joules?)
-Re-wrote as: "Below zero degrees, ρ_w and c_w are get values of ice density and specific heat capacity of ice". Removed "k" before J

P8, EQ35: check; re-type correctly
-Corrected square root and removed brackets from mc

The word "temperature" is frequently used in different parts of the manuscript, but in different contents; and in many places it sounds confusing or misleading; please, be more specific and clearly write to which exactly temperature you are referring in different sections of the manuscript.
-Additions were made throughout the manuscript

Section "3.2.2 Temperature field and layer height initialization"
P8, L25-26: confusing; clarify; re-write - "The temperature of the layers 1-4 is set to the observed temperature (which temperature?) at the initialization. If observations are not available, the temperature of the (soil?) layers is set to the air temperature (air? or surface temperature?)."
-Added clarifications

Section "3.3 Coupling"
P9, Table 1: this Table included in section 3.3, but the first time referenced in section 3.5; update and place correctly; some listed events do not have signs (+ or -); clarify; write self-explanatory caption text to Table 1
-Added explanations for +, - and empty space and moved the table

P9, L8-9: "the simulation goes back three hours"; do you mean the model re-run? clarify, re-write
-Lines 10-11 explain that the three-hour period is rerun

P9, L11: "until the simulated surface temperature is within 0.1 ∘C from the observed temperature"; do you mean +/- 0.1 deg? clarify; re-write
-added "+/-" before 0.1 C

Section "3.5.1 Precipitation"
P10, L11-12: in written explanations, to which type exactly the values 0.3 and 0.7 are corresponded; use not only less or more math.signs
-Changed signs for sleet categorization

Section "3.5.2 Wear"
P10, EQ43: explain Δt and its units;
-Added explanation for Δt

Section "3.6 Freezing and melting"
P11, EQ47 all included variables should be declared below as "where"; not all previously has been used
-Added missing variables, changed T_s to T_1 for clarity

Section - 4 DATA
Section "4.1 Forecast"
P12, L9: Clarify: "it is updated once an hour"; re-write
-Changed "updated" to "run"

P12, L11: "different NWP models (ECMWF, MEPS, GFS)" – mixture of organizations and models; do you mean IFS, Harmonie, GFS models? re-write
-Changed to "ECMWF's high resolution forecast, MetCoOp Ensemble Prediction System's (MEPS) control member, National Centers for Environmental Prediction (NCEP) Global Forecast System (GFS) forecast"

P12, L19-20: "Because the data are in grid format, the forecast data were interpolated to the road weather station points"; do you mean: grid (or mistyped GRIB?) format - in gridded format of latitude-longitude coordinates? points – geographical coordinates? clarify; re-write
-Changed from "grid format" to "gridded format"

Section "4.2 Road weather observations"
P12, L23: Clarify: what does mean "in Finland 2"?; re-write
-Added "Figure" before 2

P12, L25: Clarify: which humidity (relative, specific?); which precipitation (type, intensity, amount?)
-Changed to "relative humidity" and "precipitation intensity"

P12, L33: "Third, the values that were greater than 50 ∘C" – can the road surface temperature (for example, for a new asphalt on a road) be more than 50 deg in hot summer days? and how many % of such days/measurements were removed from time series of observations? Or the RoadSurf is only applicable for forecasting of the winter road weather conditions (if yes, write it clearly somewhere in the Introduction-section)
-The asphalt temperature can go above 50 C in summer, but the study included only months from October to March, so no actual measurements were removed. It has been stated at the introduction (P2, L11-12) that the model is not optimized to predict very high temperatures.

Section "4.3 Simulation data structure"
P12, L37: Clarify: "To evaluate the performance of the RoadSurf library", do you mean – "To evaluate the performance of the Road Weather Model with newly implemented capabilities of the RoadSurf library"?; re-write
-As the manuscript focuses on RoadSurf library, the meaning is to evaluate the performance of the library as was written

P12, L39: "GitHub repository as "Example 2" in the examples folder …" – add here also direct path as done, for example, in section 4.1
-Added link

P12, L43: although UTC is well-known, but explain (Universal Coordinated Time), when the first time is used in text
-Added explanation

Section "4.4 Example hindcasts
P12, L50: Clarify: "Sensor 2 gives somewhat colder measurements than sensor 1." – explain/add in short on which reasons(s) could be.
-Added "Reason for this can be that sensor 2 is installed on a colder location on the road or that one of the sensors is calibrated incorrectly."

P13, Figure 2: (i) there is no reference to Figure 2 in the text of the manuscript; should be included where it is needed;
-Added at the beginning of section 4.2

(ii) caption text to Figure 2 should be self-explanatory (fx. "Geographical locations of road weather stations (operated by …) in Finland";
-Changed to "Geographical locations of road weather stations in Finland operated by Intelligent Traffic Management Finland."

(iii) plot/add to Figure names of countries, including Finland;
-As the caption now states that the map shows Finland, I don't think that adding country names is necessary.

(iv) adding latitude and latitude values would be essential to include.

-Latitudes and longitudes were added

P13, Figure 3: (i) horizontal axis marks are slightly confusing "DD Month ##" -> add "UTC", or clearly writ in caption text as "was 29th December 2022, 00 UTC";
-Added UTC

(ii) mark location of road weather station in Porvoo in Figure 2;
-I don't think it would add much value and could even add confusion, as the location is a mere example and does not have any significant value. Coordinates were added to the caption instead

(iii) as you have Figure 3a & Figure 3b -> use these instead of "The uppermost panel" & "The lower panel";
-Changed

(iv) on vertical axis: Fig3a "Tsurf" is "Ts" – road surface temperature? correct symbol, add words as in Fig3b; Fig3b – is symbol "St", add too;
-Changed "Tsurf" to "T_surface" and added explanation to caption. I think that "Storage" as the axis label is better as it can be directly understood

 (v) omit "The time on x-axis is in UTC time"
-Removed

Section 5 - ROADSURF EVALUATION"
P14, Figure 4: it would be better to include this figure after the Section 5 started, not in the previous section 4.4
-Moved

The statement "The colors were chosen with the help of colorbrewer2 (https://colorbrewer2.org)" in Figures 4,5, etc. is it necessary to include on each illustration, or just add once to the Acknowledgement-section
-Moved to acknowledgments

P14, L8-9: Update: Following presented sequence of Figures: "Figures 4 and 5 show Bias (forecast-observation) and root mean square error (RMSE) …" -> "Figures 4 and 5 show the root mean square error (RMSE) and Bias (forecast-observation), correspondingly, …" or re-number the Figures (same for Figures 6 and 7)
-Switched order

P16, L6: Clarify: "During those months", do you mean "During these months"? or to which months do you refer?
-Changed "during those months" to "during October and January"

P14-16, Clarify: in different lines: do you mean a positive bias?; replace "warm bias" -> "positive bias"
-Changed from "warm" to "positive"

P14, L13: Clarify: do you mean a negative bias?; replace "cold bias" -> "negative bias"
-Changed from "cold" to "negative"

P14, L16: May be: "are not considered reliable enough" vs. "are not sufficiently representative"
-I think that reliable is better term here, as the question is also about sensor reliability in addition how representative it is

Section 6 – CONCLUSIONS
P16-17: This section needs to be re-written and, at least, included sumup paragraphs about RoadSurf Library description on included components and its content; results of evaluation containing not only "words", but also obtained "numbers" for selected studied period; applicability; plans (if any) for further development/improvement of RoadSurf Library.
 -Please see answers to the general comments on the manuscript at the beginning of the file

Section "Appendix A"
PAGES 17-22: All Tables should include additional column containing units for listed variables (Tables 1-3, 5-6) and physical constants (Table 4).
-Units will be added to the revised version of the manuscript

Section "Competing interests"
PAGE 23: Re-write as for one person (not as plural); the list of authors includes only one person
-changed to singular

Section "Acknowledgements"
PAGE 23: As you have run/performed run a lot of simulations, do you acknowledge also using of computing resources, which & where?
-The computing was performed on FMI's own facilities

Section "References"
PAGES 23-24: Note that some references – Crevier & Delage, 2001; Fritsch et al., 2000; Glahn & Lowry, 1972 - are not accessible by doi-links provided (not correctly given?); correct as necessary & double-check the accuracy of provided references in this section.
-Links will be checked and fixed for the revised version of the manuscript