
Specific comments and technical corrections

Section 1 - INTRODUCTION

PAGE 1, LINE 23: Clarify: “where the temperature drops” vs. “where the air temperature drops”

P1, L33: Clarify: “to predict road conditions” vs. “to predict road weather conditions”

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

Section 2 – REQUIREMENTS

PAGE 2, LINE 14: Clarify: Which Fortran?

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?

P2, L14: Clarify: “following variables” vs. “following input variables”?

P2, L17: Clarify: “or Humidity (%)” – “or” vs “and” vs “or/and” ? & “Humidity” vs “Relative 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”

P2, L22: Clarify: “precipitation phase” – include/list in brackets the phases;

P2, L22: Declare “sky view factors” as “SVF”, and use acronym afterwards;

P2, L24: Clarify: “whole hemisphere” vs. “whole sky hemisphere”

P2, L27: Clarify: “atmospheric variables should” vs “atmospheric variables listed above should”;

P2, L29-31: Clarify: “ground temperature” – “temperature” – “road surface temperature” – “surface temperature”; confusing; write more clearly

P2, L32: Clarify: “Library contains only function” – clarify; GitLab contains not only functions/ programs; write in brief summary on what is stored in repository;

P2, L33: Clarify: “Two examples” vs. “Two examples”?

Section 3 - ROADSURF PHYSICS

PAGE 2, LINE 37-38: All variables given in Appendix A should have units (include 3rd Column for “Units”)

P2, L40: Clarify: “in the model” vs “in the RoadSurf model”

PAGE 3, FIGURE 1: caption to figure 1 should be self-explanatory; all symbols used/plotted on figure should be explained; each flux given below “where” should also include units;

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 throughout the manuscript;

P3, L4: Clarify: what do you mean “of the other fluxes”; re-write accordingly;

Section “3.1.1 Net radiation”

P3, L10: See comment for P3, L2 & for listed variable in “where” - should also include units;

P3, L13: Clarify: “some long waver radiation” vs “some long-wave” radiation;

P3, L13: Unify throughout the text: “long wave” vs “long-wave” & “short wave” vs “short-wave”;

PAGE 4, equations on P4, included – “mod” subscript as well as other should be clearly defined in text; define these

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

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”

P4, L13: Provide specific reference & re-phrase from “is based on 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”

P4, L29-30: Replace: “albedo is” -> “albedo is” & “albedo is calucalted” -> “albedo is calculated”; do you mean “surface albedo” (as albedo in Eq. 5 vs Eq. 10)?

Section “3.1.3 Sensible heat flux”

P5, EQ12: Clarify: ρ_a = density of air; is it of dry air?

P5, L14: Write correctly units for R_d (gas constant for dry air)

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.

P5-P6 (Equations 16-17-18-19): there are for unstable and stable conditions; what about expression/value for 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

Section “3.2 Heat flow in the ground”

P7, EQ27: clarify: “T = layer temperature”; is it soil layer temperature? & ρ_g = density; it is density of soil? or density of soil layer? all variables/constants in all equations should have clear definitions in “where”

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 c_w (in kilo-Joules?)

P8, EQ35: check; re-type correctly

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.

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?).”

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

P9, L8-9: “the simulation goes back three hours”; do you mean the model re-run? clarify, re-write

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

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

Section “3.5.2 Wear”

P10, EQ43: explain Δt and its units;

Section “3.6 Freezing and melting”

P11, EQ47 all included variables should be declared below as “where”; not all previously has been used

Section - 4 DATA

Section “4.1 Forecast”

P12, L9: Clarify: “it is updated once an hour”; re-write

P12, L11: “different NWP models (ECMWF, MEPS, GFS)” – mixture of organizations and models; do you mean IFS, Harmonie, GFS models? re-write

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

Section “4.2 Road weather observations”

P12, L23: Clarify: what does mean “in Finland 2”?; re-write

P12, L25: Clarify: which humidity (relative, specific?); which precipitation (type, intensity, amount?)

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)

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

P12, L39: “GitHub repository as "Example 2" in the examples folder ...” – add here also direct path as done, for example, in section 4.1

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

Section “4.4 Example hindcast”

P12, L50: Clarify: “Sensor 2 gives somewhat colder measurements than sensor 1.” – explain/add in short on which reasons(s) could be.

P13, Figure 2: (i) there is no reference to Figure 2 in the text of the manuscript; should be included where it is needed; (ii) caption text to Figure 2 should be self-explanatory (fx. “Geographical locations of road weather stations (operated by ...) in Finland”); (iii) plot/add to Figure names of countries, including Finland; (iv) adding latitude and longitude values would be essential to include.

P13, Figure 3: (i) horizontal axis marks are slightly confusing “DD Month ##” -> add “UTC”, or clearly write in caption text as “was 29th December 2022, 00 UTC”; (ii) mark location of road weather station in Porvoo in Figure 2; (iii) as you have Figure 3a & Figure 3b -> use these instead of “The uppermost panel” & “The lower panel”; (iv) on vertical axis: Fig3a “Tsurf” is “Ts” – road surface temperature? correct symbol, add words as in Fig3b; Fig3b – is symbol “St”, add too; (v) omit “The time on x-axis is in UTC time”

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

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

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)

P16, L6: Clarify: “During those months”, do you mean “During these months”? or to which months do you refer?

P14-16, Clarify: in different lines: do you mean a positive bias?; replace “warm bias” -> “positive bias”

P14, L13: Clarify: do you mean a negative bias?; replace “cold bias” -> “negative bias”

P14, L16: May be: “are not considered reliable enough” vs. “are not sufficiently representative”

Section 6 – CONCLUSIONS

P16-17: This section needs to be re-written and, at least, included summary 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.

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).

Section “Competing interests”

PAGE 23: Re-write as for one person (not as plural); the list of authors includes only one person

Section “Acknowledgements”

PAGE 23: As you have run/performed run a lot of simulations, do you acknowledge also using of computing resources, which & where?

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.