Reviewer1
We would like to thank the reviewer for the thorough review and provided comments. In the following, we list all the reviewer raised issues and aprovide an answer. We have indicated, if and what the changes were to the manuscript.
We would like to emphasis that all plots in the paper were updated to provide a higher resolution. Also figure captions were updated and not indicated by change bars in the manuscript. For all other changes in the text, we provide a pdf version of the manuscript clearly showing the changes by change-bars.

Line 80: R: FPS not defined.
A: indeed, the sentence was incomplete. Added “at a rate of 25”

Line 174: R: spelling mistake ‘controid’ should be ‘centroid’.
A: indeed. Corrected

Footnote on page 8: R: ‘xxxx’ should be specified.
A: Indeed, we are using the routine world2pix. The footnote was competed.

Figure 3: R: spectral response: Question: any uncertainty available from the star calibration?
We have not quantified the errors obtained through star calibration. We add this to our future list of activities. To give any estimation on the errors in the manuscript would raise a wrong impression and expectation against our knowledge of the errors. The error sources for the star calibrations are manifold itself, and not even sufficient as the errors done in the plasma absorption and atmospheric correction also needs to be considered in such an analysis.
We hope that the reviewer accepts that we do not provide further information in the manuscript.

Figure 4: R: “seems to me too big correction in the blue part. atm. exptinction is usually about a half ot the signal in reasonable elevations...”
A: reviewer has a good point here. The misunderstanding comes that we have shown the curve after the spectral calibration AND after the atmospheric correction. We have redone the plot, and show now in different colors the individual steps. The plot shows indeed a 50% increase between the spectral response corrected curve and the (afterwards) atmospheric corrected curve.

Line 270: R: “.level-3 datasets (see 9.3) ..”
A: not sure what the comment is, but we assume that the reviewer would like to see the plural and the reference to section 9.3. We have modified the manuscript accordingly.

Line 394: “what are the typical intervals of values from Monte Carlo simulations?”
A: *In this research, the affine-invariance sampler is used, which is freely accessible via the Python package emcee through the "EnsembleSampler" class. Thus no fixed intervals are needed for this ‘intelligent’ sampler. The choice of this sampler is*

advantageous in terms of computational time, as it allows to easily parallelise the sampling over multiple CPUs (Foreman-Mackey et al., 2013). Furthermore, this sampler allows to generate samples for a parameter without being affected by the co-variances with other parameters and without the need to manually tune the proposal distribution for all parameters (Goodman and Weare, 2010). The emcee sampler requires initialisation of the walkers; in this study, the initialisation is realised via a LSQ estimation, providing a first-guess parameter close to the maximum probability point.
We have not modified the manuscript as the information is already provided for colleagues with basic knowledge in the Bayesian approach in the paragraph for which the question was raised. It would deviate too much from the main purpose of the manuscript, if we have to explain the detailed implementation of the emcee sampler. I hope the reviewers show understanding for our answer and approach.

Figure 6+Figure 7: R: larger figure would be better visible.
Nearly all figures were enlarged to a width=0.8 (from width=0.5). We hope that the figures are large and clear now.
We also realized that the resolution of the figures was not really high, and have re-created all figure plots with high DPI.

Line 454: year of publication is wrong , should be 2020
A: indeed, corrected.

Line 456: replace “enstatite” by “and lower values of enstatite .”
A: corrected.

Line 568: DOI is missing
A: DOI was registered in the meantime and added
Not sure, if I have referenced it correctly. I have to ask the editor of the journal.

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Reviewer2
Line 48: “I do not immediately how, but will look up in Borovicka paper”
A: ok, no changes applied

Line 50: “I got at first slightly confused with what is meant with the wording ‘non-optimal’ lens: is it a lens
that suffer from imperfections (aberrations)?, or is it a lens that has a projection formula that does

not match the preferred one? From the explanation I clearly understand that the latter is meant and
that the optimal lens for this work is a lens with a gnomonic projection. These lenses indeed are rare.
Nonetheless I would suggest to replace ‘a non-optimal lens’ with ‘the lens’. Then the rest of the
section is self explanatory I believe.”
A: we have replace “non-optimal” by “the usage of a non-gnomonic lens”. Just leaving the word ‘non-optimal” out would make the sentence unreadable.

Line 57: “-> ‘imaging’ instead of ‘visual’
A: ok, thanks for the proposal of the correct wording: done

Table 1: caption is missing
A: indeed, it is corrected now

Comment on Table 2: “I think ICC8 is the spectral camera, isn’t
it? Probably you want to state that this column
shows all ICC9 hits that also have a spectrum on
ICC8. (But I’m not sure, as I would not expect
that ICC8 has so many spectra. Are ICC8 and
IC9 maybe interchanged?).”
A: oops, what an error from us! We apologize for that. Indeed, as the reviewer points out, the ICC8 and ICC9 strings were exchanged in this table. We have corrected. (Note: but not shown in color in the manuscript, as the ‘change’ and ‘table’ latex commands would make the text quite error prone.)

“Assuming that the last column is the spectral camera, is the fact
that you capture in 2012/13 the most spectra, but not the max
number of meteors in the two imaging camera’s, already to be
associated with degradation of the grating?”
A: could very well be. The problem is that we did NOT visually inspect the system in regular (i.e. yearly) intervals, and we can not after all the years not really make a statement. What we know is that in 2022, the spider that lived in the system did a good job – in addition to the dust on the lens – to avoid light entering the lens.

Line 83: reference for Molau 1999 incomplete
A: done

Line 103: “are you this way seriously affected by hot pixels, etc.?”
A: this is a good question. During the analysis of the spectra, we never ‘saw’ effects of hot or damaged pixels. This might be explained by the fact that the observable is a very dynamic environment (clouds, birds, dawn, dusk, may-be even some lights from cars coming up the hill, …).
We will do an analysis of this in the next couple of weeks – but will report outside of this manuscript.

Line 109: “I understand you change update the flatfield periodically.”
A: No, we have used a flatfield from 2015 (tbc) for all data. We have however analyzed the effects on the flatfield over the years and came to the conclusion that the flatfield itself only varies slightly. Thus we decided to use a constant flatfield. The manuscript was not modified and we hope the explanation given is sufficient for the reviewer.

Line 117: “median value chosen to avoid saturation (contrary to max value)?”
A: the choice was between ‘mean’ and ‘median’. Indeed, the max value might be oversaturated or even not linked to the meteor event for whatever reasons. And the usage of ‘median’ values is good practice. We prefer not to add an explanation on the ‘median’ to the manuscript and hope the reviewer is fine with this.

Line 124: comment to ‘angular offset’: “is this offset calibrated periodically? or is the mount that stable?”
A: it was our underlying assumption that the amount is fixed and stable. We have measured in the years a few times this angle. This can be done by on clear nights, when both ICC7 and ICC8 ‘see’ stars. From the separation of the stars we can determine this ‘angular separation’. We have not observed any deviation to the assumed angular value – but we admit that we didn’t do this measurements in a systematical way. The manuscript was not modified :
“During the operational period of the cameras, this angular offset was derived several times from measurements and confirmed to be stable.”

Formula 2, page 7: “best explain also what v_Lens means”
A: agreed, we added “$v_{Lens}(\lambda)$ represents the direction of the diffracted light in respect of the lens for each wavelength”

Line 133: replace ‘on the grating’ by “on and in the plane of the grating”
OK: agreed, done.

Line 137: comment on ‘diffraction vector’: please explain with a picture
A: agreed that this is a bit misleading. What we name here the diffraction vector is the v(lambda).
We have updated the manuscript as follows:
“With the information from ICC9, especially the right ascension and declination of the meteor, the zero-order, for each indi-
vidual frame, this diffraction vector $v_{Lens}(\lambda)$ for any wavelength λ can be calculated.”

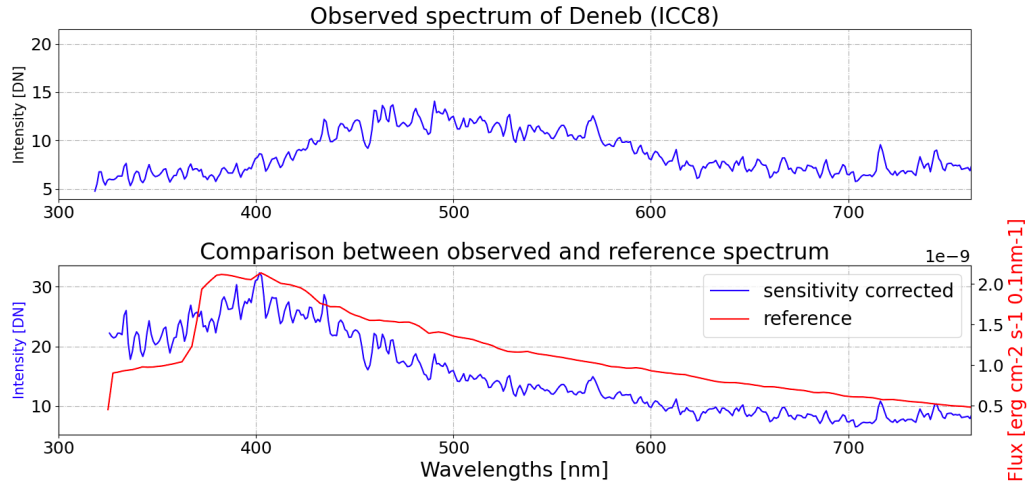
Line 153: comment to ‘boresight angle: this is the angle that the z-axis of the grating is tilted?
A: yes, we added “The boresight angle , the angle that the z–axis of the grating is tilted, allows f…” to the manuscript.

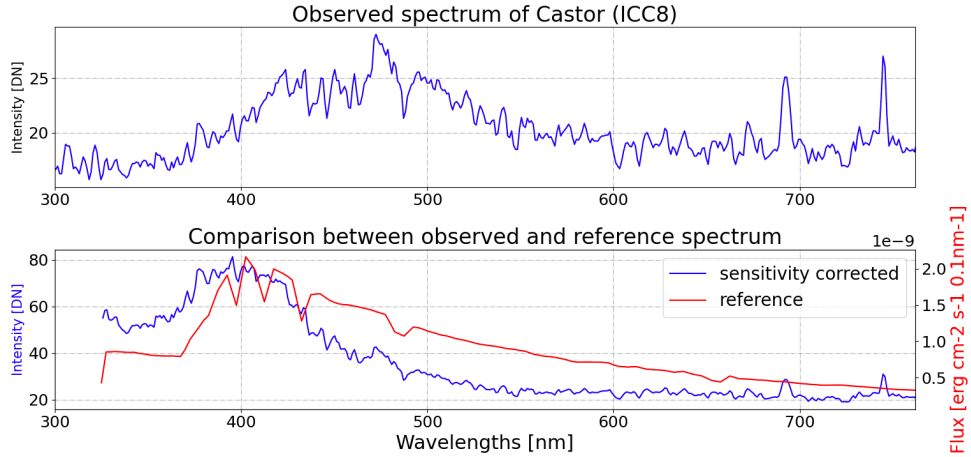
Line 161: reviewer proposes to replace by “is it not better to state that this follows from the focal length and pixelsize?”
A: good point from the reviewer, however, there are two different implementations that should lead, of course, to the same results. We have currently implemented the algorithm assuming the |z|=1, and propose not to modify the manuscript for this reason.

Line 163: add “in the CCD frame” to the sentence
A: agreed and done

Page 8, footnote one: complete
A: done

Line 187: “when compared to the spectra provided in CALSPEC or Hyperleda: “It would be interesting to report on the outcome or include a picture with the results.”
A: We are not sure if this would really fit inside this paper. It might even justify a conference paper … let’s see.
Anyhow, if the reviewer would like to see an example, we provide on of the images here.





Spectra of bright stars Deneb (left) and Castor (right). Top: Observed spectrum before sensitivity calibration. Bottom: Spectrum after the complete spectral calibration (instrument sensitivity and atmospheric extinction). In red, the reference spectrum of Elnath outside of atmosphere (Hyper Leda catalogue). In blue, observed spectra.

Page 10, formula (5) “In note that the effect of Aerosols is not considered (as described
in Vicinanza 2021. What is the reason for this?”
A: We confirm that the algorithm we apply is not different in any way that to the algorithm described in the Vicinanza2021 paper. We have forgotten to mention it: our apologies. We have correct the equation 5 and added text in the section to explain the AOT.

Page 11, Figure 4 “I would have preferred to have the zero of the y-axis
as minimum of the plot. This also shows clearly then
that the correction at shorter wavelengthes are
significant.”
A: agreed and done

Line 243 question on “EW is the equivalent width”:” I presume equivalent width of the spectral feature”
A: The scaling is according to the broadband response of the camera, or more specific the FWHM of the spectral response of the camera in units nm. The manuscript was modified as follows: “.. where C is the zero-point bias and EW is the equivalent width of the spectral response (measured as the full–width–half-maximum) of the camera (see Fig. 3) and allows to perform a correction for the instrument aperture. Equation (10) is obtained…”

Line 259: comment on “meteor speed” I presume the meteor speed always >> speed star, being sub-pixel and thus negligible.
A: Not sure, we really understand the comment by the reviewer. Indeed, the meteor speed is >> the star speed in the FOV.

Line 264: “observational setup”: what exactly?
A: we wanted to say that the intensity calibration depends on the meteor velocity (and its effects on the integration time), the atmospheric extinction, and the optical and camera characterization (“observational setup”). We have modified the manuscript as follows:
“The change mostly depends on the different exposure
times of different meteor events (related to the different meteor speed), the different conditions of atmospheric extinction
encountered at different meteor entries, ,and the optical and camera characteristics (as obtained through the zero–point bias).”

Line 295: “temperature range” you mention here a data base on temperature. On page 12 (bottom) you mention as second parameter number density of the chemical elements. That, I presume, is not part of this database (and computed with help of the Bayesian framework)?

A: The output of the PARADE simulation is the emission and absorption profile over the spectral range for each temperature step. To clarify this, we have modified on line 295 the sentence
"database is created containing for each species the spectral response over a temperature range from 2000K to 15000K in a 50K granularity"
Into
"database is created containing for each species the emission profile over the spectral regime for temperatures in a temperature range from 2000K to 15000K in a 50K granularity".
The Bayesian framework (in short) finds the optimal solution to fit the spectral profiles of chemical elements (to be clear: intensity profiles) to the measured profile.

Line 306: "ablation process": I'm a bit confused here. Is there also ablation model included in PARADE?
A: we are sorry that the text seems not to be clear enough. The section 7.2 starts with "The PARADE tool allows to compute the radiative emission of gas species … for a given temperature …" Thus indeed, the ablation process of a meteor is a thermodynamic process and PARADE can model the thermodynamic behaviour of the meteor ablation.
We have not modified the section as we believe it is clear enough, and hope for the reviewers acceptance.

Bullet 3 at line 325: why those 3 (only)? I could imagine more priors can be chosen. Are those
considered the dominant ones? Does the computation time dramatically increase with n>3?
A: agreed that our algorithm is based on many other assumptions, and we could consider to include them in the Bayesian framework. Several of the assumptions we have applied are applied in the earlier processing steps – in the steps to produce what we call level-2 data. We use the Bayesian framework in the creation of level-3 data. And for level-3 data, only the 2nd one (the spectral position accuracy) was identified as really major, the other three we considered as have lower impact on the results. If the processing time drastrically increases – we do not know, as we have not tried. But, we doubt that the effect will be very large. Our algorithm takes around 90 minutes for one spectrum to fit (one core on one cpu) and we do not expect a dramatic increase.
We have not modified the manuscript in response of the reviewers remark.

Line 330: "meteor's size in the direction of flight R": this is the radius of the emitting 'body' I presume
(not the meteoroid size)
A: That is the radius of the meteor, as defined in Table 2. So, yes, the emitting body and not the meteoroid before entering the atmosphere. piR^2 being the luminous area of the radiating body.
We correct the sentence in the manuscript as follows:
"We introduce a final uninformative prior, the size of the ablating body, the meteor,meteor's size in the direction of flight R,
assuming a uniform distribution. From R we derive the luminous area of the radiating body as $\pi * R_2$."

Line 355: “fixed temperatures””: I do not understand. How does that matter?
A: we have modified the manuscript to “discreet temperature values”, and at the same time commit that this is quite tricky. If you take equation 20, it can be rewritten for two chemical element as:
$F(T) = N_0 * j_0(T) + N_1 * j_1(T)$, but this equation is (of course) only fulfilled IF the T in the components are identical. If we would leave T as a free parameter, we could not write the equation as a linear combination.
After having described the whole algorithm, this is in one way trivial – but not really. In case we would allow different temperatures for different species e.g. in different part of the ablating sphere, our algorithm would not work anymore – as the linear combination of equation 20 would be wrong.
As the current basic assumption in the meteor community is that we can apply discreet temperatures (4000k, 1000K) – we do not know how to answer this statement of the reviewer without challenging the overall content of the full paper. In this respect, we hope the reviewer accepts the given answer.

Line 362: proposed to replace “three” by “three sequential”
A: ok, modified

Line 364: “a routine models” question is asked if this is parade?
A: Agreed that the sentence is not bullet proof. We modified the manuscript as follows: “For each species and each discreet temperature in our emission database (described in Section 7.1), the obtained spectral profile is further modelled into a set of synthetic spectra.”

L:ine 298 proposed to replace “ablation” by “meteor”
A: Indeed, the sentence is not correct and we have replaced the sentence as follows: “The meteor itself as well as its spectral signature were detected in 24 individual frames in cameras ICC7 and ICC8 respectively. The maximum apparent magnitude was -1.7.”

Line 408: “Elements = chemical elements? T1 = main, T2 = secondary”
A: ok, text improved as: “The selection of chemical elements, the main temperature, and the secondary temperature (see Section 7.2) proofed stable
through the processing of all meteor events.”

Figure 6: “Looking at the plot I wonder if the selection of chemical elements/ molecules is complete, and if not, how do the missing ones have influence in fitting model to observations?”
A: A good question in general, but the event we have analyzed and the results presented in figure 6 are pretty good. I think we got the selection of chemical elements right. And the sentence in line 408 hints that we are going to use different/more chemical elements for different events in the future.

Figure 6: “calibrated intensity unitless?”
A: figure was updated and shows units now.

Line 411 “visual analysis”: “what are your criteria exactly?”

A: we check on the convergence of the individual parameters – written in the sentence before. In Figure 7 it can be seen that all parameters are converging, thus we are confident that a good fitting solution was found.
The manuscript was not modified as the information was provided in the text. To go more into detail would break the frame of this manuscript.

Line 415: “parameter need to be taken out”: “how do you do that? The node is taken out? Or the range widened?”
A: in the following bullet list that contains the discussion, one example is given by the Ca which is not converging. We have added further explanation to this bullet as follows:

“Only Ca shows an atypical behaviour and the log function jumps between 0 and 5, thus is not converging. Consequently, the interpretation of Ca needs to be done very carefully. In a subsequent simulation run, a different initial guess for the number density of Ca could be used to check if the convergence criteria would be fulfilled afterwards.”

Table 3: “could you add the wavelength of the various elements in an extra column?”
A: as the intensity profiles of individual chemical elements often contains more than one component (multiplets), it would be misleading to specify “one” wavelength with each chemical element. Instead we have redone all the profile plots and annotate the main peaks with the chemical elements. We believe that this improves the clarity of text and figures.

Figure 7: to small to read
A: ok, redone and the plot is now in higher DPI and also larger on the page.

Line 420 “carefully” why?
A: see comment on Line 415

Figure 8: “Question: is also thermal radiation included in the PARADE simulation? If not how is the continuum formed?”
Thermal radiation is considered in the PARADE simulation, please see Loehle et al. 2021 for more detail, especially Section II.
The manuscript was modified at the end of section 7.1 to include the following sentence:
“The modelled spectra include the contribution of the Planck background at the individual temperatures.”
Below is an example to show an example clearly demonstrating the N2 background contribution to the overall spectrum.

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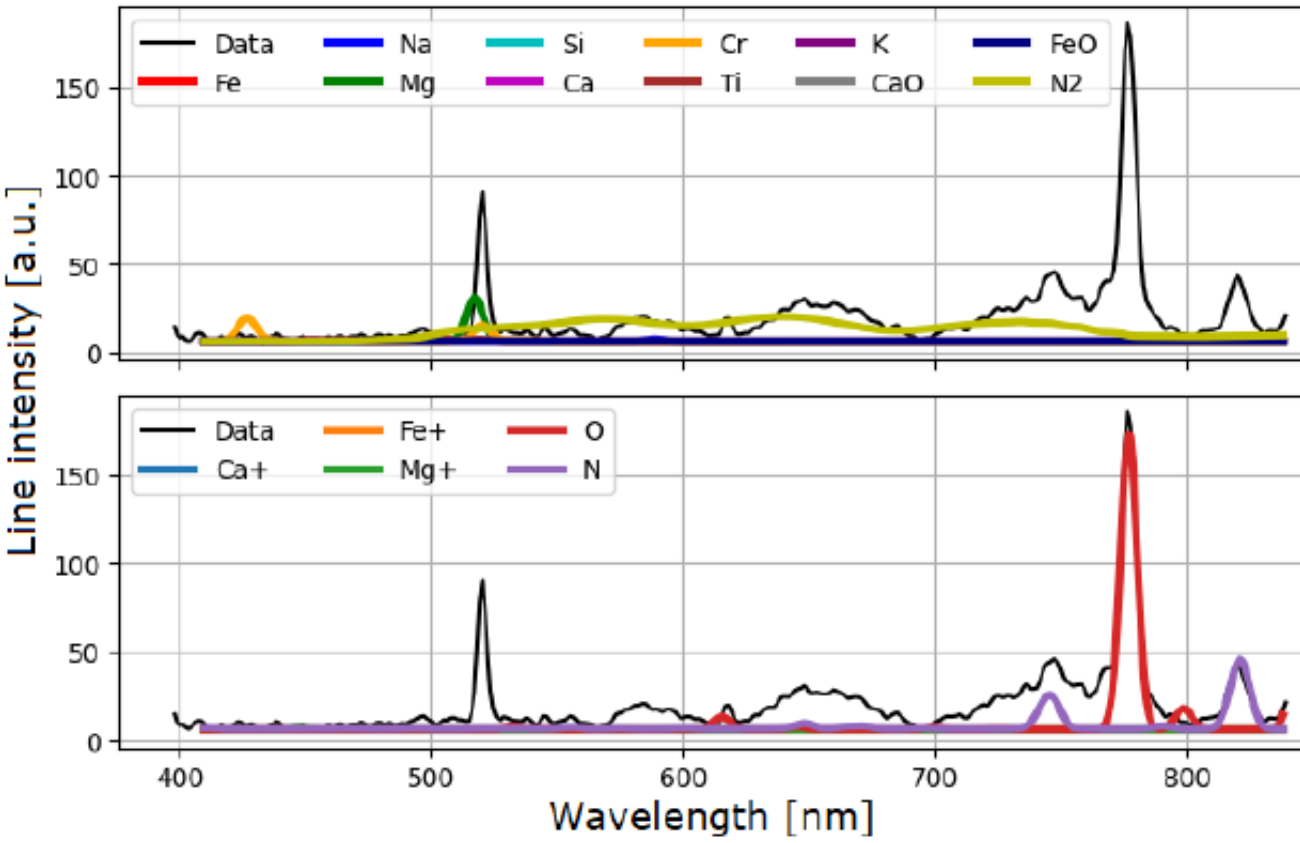

Figure 8: could you add for clarify the chemical elements?
A: all the profile plots are redone and the chemical elements of the main contributors are given.

Line 537: “several smaller building blocks”: question is asked on the meaning of building blocks
A: agreed, that this expression is a bit vague. We have replaced this part of the sentence by “stronger material without small grains” (an expression used by Vojaceck, 2019, and cited)

Line 437 comment on first bullet: Generally, I find it difficult to derive to strong conclusions when
comparing with other work, because we look only at a single event
A: we assume the reviewer wanted to say “too strong conclusions” in the comment. We do not thing that we have too strong conclusions in our text. It is clear that the manuscript is about an algorithm, and the section about the scientific interpretation is limited in scope. However, we believe that it is important to have such a section in to demonstrate what scientific questions can be tackled with the dataset in the near future. We hope that the reviewer is fine with our answer.

Line 441: Could you be more conclusive here (compute the difference between number density and line itensity?)
A: indeed, but this will be a study to be done in the future. We prefer for this manuscript not to elaborate further and decided to delete this sentence.

Line 444: I am afraid I do not understand this.
A: We want to express that we also do not understand the large difference between the ratios and it needs further investigations. We modified the last sentence of the bullet into “Further investigations are needed to explain the large difference of the CILBO derived ratios to the one provided in the cited literature.”

Line 465: “It would be very interesting to continue the work for every individual frame, the more because also altitude and velocity information exists.”
A: indeed, our work is not finished. We appreciate the comment for future work.

Line 527: “could you include examples here?”
A: ok, two plots were included with caption and references.

Line 573: comment on ‘ablation physics’: I miss a bit in the paper how this part of the work is included (or it is my lack of
knowledge). Maybe you can devote 1-2 sentences to the ablation physics?