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Interactive comment on “Validating the MYSTIC three-dimensional radiative transfer model with observations from the complex topography of Arizona’s Meteor Crater” by B. Mayer et al.

Anonymous Referee #2

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The present study investigates the 3-D radiative effects in Arizona’s Meteor Crater, which is known as a crater where extreme temperature inversions occur. 3-D radiation modelling especially in the thermal infrared domain is something rather new and may be very useful in many domains and applications. The paper is therefore of big interest for the scientific community. The paper is well written. Scientific quality of the applied methods is very good. I suggest therefore the acceptance of the paper after some revisions. My suggestions and points of criticism are the following:

1) My first point of criticism is the way obtained results are commented. At many instance you only say whether agreement e.g. between model simulations and mea-

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surements is good or less good without really mentioning what this means in terms of deviation in percent or in W/m^2 . What is good today may not be good enough in 20 years, so I think that it is more important to mention the numbers, the magnitude of the agreement than whether the agreement is good or not.

2) The uncertainty of the radiation sensors should be mentioned (see e.g. Gueymard and Myers, 2009) and taken into account in the analysis of the comparison between measurements and model. E.g. there is already an uncertainty arising from the fact that you are using shadowbands for the measurement of the diffuse radiation.

3) For scientists who are not radiation experts but whose interest is more the explanation of the observed extreme temperature inversions some sentences to explain what is the specificity of this Arizona Meteor crater (e.g. add one sentence in section 3) and what may be the impact of the presented results on temperature profile (e.g. 1 or 2 sentences in the conclusion) are missing. You may only mention some hypotheses regarding this point

Minor comments

Regarding fig 3. more explanations are needed. Since these simulations were performed using a topography, the fig presumably shows the irradiance incident at one pixel. This is however mentioned nowhere. => Change text p. 13379 line 21-29

p.13383, line 5: Please mention again whether the instruments were in horizontal position or parallel to the slope.

P.13384 line 3: "...from this lower terrain may enhance.." => "...from this lower terrain may enhance.."

P. 13385, line 9: "An underestimation of the outgoing longwave irradiance is seen at these times,..." What is the magnitude of this underestimation? (see my first remark)

Table 1 p. 13393: A location has always an inclination even if the inclination is equal 0. Therefore please replace for RIM and FLR the "-" with a number.

References

Gueymard, C.A., Myers, D.R., 2009: Evaluation of conventional and high-performance routine solar radiation measurements for improved solar resource, climatological trends, and radiative modelling. *Sol. Energy*, 83 (2), 171-185.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 10, 13373, 2010.

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