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**Interactive
comment**

Interactive comment on "A user-orientated column modelling framework for efficient analyses of the Martian atmosphere" *by* Mark Paton et al.

Anonymous Referee #1

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1. General Comments

The authors present a new column modelling framework that facilitates efficient analyses of vast datasets returned from Mars orbital spacecraft, potentially reducing the time needed to explore such datasets significantly. Among these, the authors focus on vertical profiles of temperatures, T(z), retrieved by the Mars Climate Sounder (MCS) aboard the Mars Reconnaissance Orbiter (MRO) mission. The authors validate the presented framework by comparing its output to T(z) retrieved from MCS, and also by comparing it to T(z) obtained from the Mars Climate Database (MCD). The manuscript shows original and relevant results, and is very well written and outlined. To increase the relevance of this manuscript, this reviewer encourages the authors to add a brief discussion about: (1) whether the authors plan to make the presented framework avail-

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Discussion paper

able, and (2) whether they plan to increase its capabilities by incorporating new orbital datasets as inputs and/or by adding new outputs. This reviewer's recommendation is that the manuscript can be accepted for publication after these two suggestions are incorporated and a few minor comments presented below are addressed.

2. Suggestions

To increase the relevance of this manuscript, I encourage the authors to add a brief discussion about the following two topics:

1. Do the authors plan to make the presented column modelling framework available? Do the authors plan to provide/share results upon request?

2. Do the authors plan to increase the capabilities of the framework by either calculating new vertical profiles (tau?) or adding new (other than MCS) orbital/ground datasets as inputs?

3. Minor Comments

L2: I suggest clarifying "additional", or using "new" instead.

L8: Please, quantify "higher altitudes". Do the authors mean altitudes between 0 and 28 km?

L33: "... the lower sections of the Martian atmosphere". Please, quantify.

L63: "which consist of". I find this line ambiguous. Soundings can be performed using limb or nadir configurations, but vertical profiles are effectively retrieved from limb soundings.

L71: Do the authors mean "limb observation"? Since MCS limb soundings have a vertical resolution of ∼5 km, nadir sounding's vertical resolution should be > 5 km.

L83: "Surface pressure and temperature...". And what about atmospheric optical depth?

L85: Figure 1.

L93: figure 2.

L107-108: More details about Eq. (2) are needed. What reference (Earth, MCD?) is used to choose the analytical form of Eq. (2)?

L119: I suggest clarifying why these specific heights are selected.

L123: "The threshold temperature was set at 3 K". Is this also the case for the vertical profiles of temperature calculated for the VL-1 and VL-2 sites at Ls = 270, which are shown in Figs. 4 and 6? It seems that such a threshold is not met by those profiles.

L130: Why are the MCD data used as a reference instead of the EDL data? Is this because MCD results have already been validated? Also, I recommend defining MCD.

L135: The authors need to clarify how tau opacities are handled by the presented framework. Are (column integrated) tau opacity values given to the 1D model as an input? If so, are such values coming from MCD or TES? Are the vertical profiles of tau retrieved by MCS somehow used?

L138: I suggest adding "limb" before "sounding data".

L143: "surface temperature and pressure". And what about atmospheric opacities?

Fig. 3, Caption: Do the MCS/T(z) shown in Figs. 3-6 correspond to any specific Martian Year/ Earth date?

L151: "Meaurement".

L165: Remove "." after "year".

Fig. 7, Caption: Which Ls?

L203: Replace "section 2.3" by section "3.2".

L215: "16 km". Based on the abstract, this altitude should be "15 km".

Fig. 9: Axes and legends in Fig. 9 are barely legible (at least on my computer). Please, improve the resolution/quality.

L232: "16 km". Based on the abstract, this altitude should be "20 km".

L248: "... and the observed dust properties of the atmosphere...". The authors have not previously explained how the presented column modelling framework handles tau values (see previous comments).