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Interactive comment on "Modifying emission scenario projections to account for the effects of COVID-19: protocol for Covid-MIP" *by* Robin D. Lamboll et al.

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Reply to reviewer 1

R Lamboll

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Many thanks for your time and encouraging feedback. We feel the changes we have made in response to it will strengthen the work. As discussed in the personal note, we appreciate that more work will be needed on several fronts, but present this as documentation for an ongoing project, some results of which have already been accepted for publication.

1 Major issues

1.1 Uncertainty in pandemic parameters

The main criticism, that we did not present a variety of cases for the initial lockdown impacts, is well-made. We will improve the paper by including an additional '4-year blip' scenario (with one year interpolating back to baseline afterwards). This will provide a reasonable upper bound to the timeframe of the direct impact. Comparing projected and recent historical emissions, we see that the 2-year blip assumed the emissions reductions would persist for longer than they have, but would not seek to add a faster-

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decaying pathway because the results of simulations for the MIP already performed indicate that it is hard to detect any long-term impact from the 2-year blip already, so adding more pathways between this and the baseline would likely just waste computer time.

While it is possible that some countries will maintain lockdowns for more than 5 years, this scenario would be better handled by a dedicated IAM team to produce a model that accounts for the length of time for vaccines to roll out in different regions. We can simplistically justify a 4-5 year lockdown (although won't in the paper itself) as a crude upper bound considering that almost all developed nations (including China) and the world on average are already vaccinating their population at over 0.06% per day, which gives around 4 years to give at least one injection to everyone. See https://ourworldindata.org/covid-vaccinations for the latest. We expect some acceleration in rollout as more vaccines are coming online and production increases. These vaccines should provide at least partial protection against different strains, and rolling out booster shots should not have a notable impact on emissions. More radical situations of long-term lockdown where the virus mutates and retains high lethality even after any of the vaccines seem unlikely given the speed and diversity of vaccine development, plus much of the population will have had natural exposure by then. We would probably see some sectors of the economy go back to baseline anyway, even if vehicle use and travel remained suppressed. We have change the text to emphasise that we do not attempt to model the time for the virus to be eliminated/habituated to, but simply for lockdowns to stop interfering with productivity.

This additional scenario obviously involves lots of text being altered across the document, we will not attempt to list all of the changes here.

1.2 Green recovery self-consistency

In response to the unclarity over the self-consistency of the SSP-nature of the various green scenarios, we have expanded the table documenting the origin of the scenarios. This was nominally covered in Forster 2020 but in practice a lot of details were omitted. The table detailing the origin of the scenarios has been significantly expanded and citations to the full calculation and the methods used to calculate the values have been added. As detailed in the informal response, you are correct that the strong green recovery involves transitioning to an SSP1-like world. The other scenarios are all based on variation between SSP2 worlds.

The primary motivation of this new set of scenarios is to allow resolution of the impact of a step-change in political behaviour now, rather than gradual trends from the point when the scenarios were constructed. A description of this has been added to the introduction: 'This aims to establish the scope of changes in climate results to be expected from the direct impacts of lockdown, and the potential impact of changes to investment structure resulting from the recovery packages.'

2 Minor issues

Spelling mistakes have been corrected.

- 'line 54: using SSP2-RCP45 is not self-evidently middle-of-the road. The authors should provide more context on why this scenario is in line with current policy': We have expanded the section justifying our choice with additional citation as follows: 'This amount of forcing is consistent with the global level of warming implied by countries' current NDC pledges (citing ClimateActionTracker) and has most recently projected values closest to the measured emissions (citing Strandsbjerg

2021).'

- 'line 100 - "interpolation between the effects of lockdown and the baseline behaviour, so does not need to be interpolated" - sentence is confusing, rewrite.': This has been rewritten into two sentences: 'The year 2022 is defined as exactly equaling the value interpolated, month-for-month, between the effects of lockdown and the baseline behaviour. This is the normal default infilling method of climate simulators so explicit values are not usually needed here.'

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