**Comments from the editors and reviewers:**

* **Editor**

The editors of COES have secured two reviews of your manuscript. The reviewers are both positive about the manuscript, but both raise a number of issues which we deem to be critical. The editors request major revisions to the manuscript before it can be considered for publication. We are happy to invite you to do further work on your manuscript, attending carefully to each of the concerns raised, before re-submitting it for our further consideration. In this case we will likely approach Reviewer 2 for their further opinion. In your re-submitted version, please provide an accompanying letter explaining in detail the responses made to each point by the two reviewers.

We thank the editors for securing the following reviews.

Apart from the specific responses we have to each reviewer, we undertook some revisions to the dataset, and hence to the results. In our original search query we realized that a large portion of the relevant behavioral research was not captured, because we searched for behavior interventions in “buildings” but not in “households”. This change and a few other adjustments added 1400 new studies to the literature dataset.

In terms of the automated content analysis, two new topics were added following the inclusion of this buildings literature: “energy efficiency and consumption” and “heating & cooling systems”. One topic was removed – “policy instruments” – while the others remained stable, albeit with some shifts in the keywords. In our original conclusion we expressed surprise that behavioral studies for buildings were not well represented, but this is no longer the case. Our main results, which focus on the epistemic core of urban mitigation research, remain unchanged.

* **Reviewer 1**

The paper presents a systematical review of relevant literature on cities and climate change to emphasize the important role of cities in achieving ambitious climate goals. The literature mainly focuses on four key domains: transportation, buildings, waste management, and urban form. By analyzing the thematic structure of literature, the authors reveal the state and evolution of urban mitigation literature and indicate the future research direction. The content and method used in this paper have a certain meaning and innovation, but some details remain to be improved further. Overall, I recommend some major revisions before publication.

Some suggestions are as follows:

1. In Introduction, the authors put forward three key questions which would be answered by relative literature analysis. But the second question “What are the epistemic communities that drive this growing urban literature?” is not answered deeply and clearly in the following sections of the paper.

Thank you for raising this point. The lack of clarity and linkages between our research questions, methods, results and discussion were also raised by reviewers 2 and 3. We have therefore committed major edits throughout the manuscript. Regarding this specific question, we now expand on the method used:

“To digest the major themes of the document set, we perform: (1) an automated content analysis on the document titles, abstracts and keywords; and (2) a scientometric analysis on the document references…

For (2), we use the reference data from our document set to generate a bibliographic coupling network (two documents are “coupled” if they cite the same third document). The bibliographic coupling network is clustered using a community detection algorithm, identifying groups of documents that tend to cite similar literatures. Combining these results with the automated content analysis, we then describe the topics of research that are prevalent within each cluster, thereby exposing epistemic communities within urban climate change research.” [Lines 137-154]

These results are now described in the section “**Epistemic communities in urban mitigation research**” [Lines 213-250]. They support our conclusion that particular fields of research are being overlooked in the urban literature:

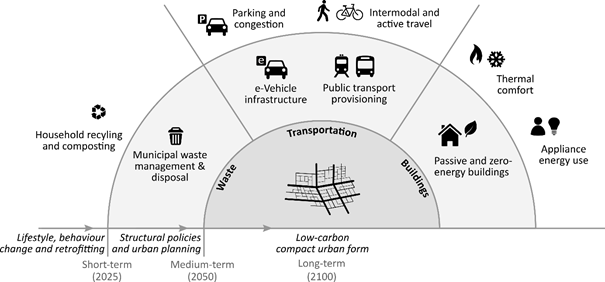
“...we apply automated content analysis and bibliographic coupling to digest the large amount of information in this literature and map-out its topic landscape. Our results suggest that mitigation-focused urban studies are so far mainly concerned with urban form and GHG emissions accounting – important topics in their own right, but not fully representative of the broad solution space. A wealth of policy-relevant research risks being overlooked: principally work on congestion, parking charges, and waste management, but also to some extent active travel and public transportation provisioning. These literatures are based in distinct epistemic communities that tend to prioritize non-mitigation, sector-specific issues. By contrast, the buildings literature is already strongly aligned towards energy efficiency, via technical as well as behavioral interventions, but is not yet clearly situated within urban systems.” [Lines 275-284]

2. There are lack of detailed description or explanation for figures, especially for Figure 2 and Figure 4. Please summarize more what we can learn or obtain from these figures.

We address this in the next point.

3. It is a little confused that Figure 2 in Section 2 “Delineating the urban mitigation literature” was described and discussed in Section 4. Please put Figure 2 in a correct place.

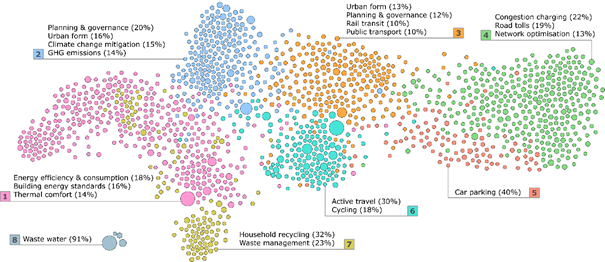
As suggested by reviewer 3, we deleted figure 1 and have replaced Figure 2 with the following:

****

**“Figure 1: Scope and time-scales of the urban mitigation literature assessed, including measures that address urban transport, buildings, waste, and urban form.** Note that neither supply-side energy production and industry, nor a broader set of provisioning infrastructures and services (e.g. healthcare access, green spaces) are captured in the scope. We do not include these as the former is assessed in other mitigation communities, and the latter is more appropriate for an assessment of sustainability, rather than climate change mitigation.” [Lines 101-106]

This figure better represents our discussion in the “**Delineating the urban mitigation literature**” section [Lines 77-126], as it captures the time-scales for urban policies, and their linkages to urban form (an issue raised by reviewers 2 & 3). As such it is now directly referred to and expanded upon in this section.

Regarding Figure 4, we have also updated and clarified the format, showing clearly each epistemic community.



**“Figure 3: Bibliographic coupling network of urban mitigation topics.** Each node (circle) represents a publication, scaled by total citations. Proximity between nodes indicates similar citing patterns. To identify epistemic communities, we specify clusters of proximate nodes using a community detection algorithm (displayed as colour), sum all document-topic scores within each cluster (derived from the preceding automated content analysis), then display the topics that exceed 10% of the total topic score in each cluster. For instance, in cluster 7 (coloured in yellow), 32% of the sum of all topic scores are related to “Household Recycling”, and 23% are related to “Waste Management”.” [Lines 234-241]

Again, this figure is the core of our results and is closely referred to in the section “**Epistemic communities in urban mitigation research**” [Lines 213-250].

4. The authors build a transparent and reproducible search query based the urban literature about mitigation measures related to transport, buildings, waste, and urban form and conducted a systematic overview of relative literature. Each of the above aspect plays an important role in cities to meet the 1.5 °C, therefore in Discussion and conclusion section, the hot issues and research tendency in different aspects (transport, buildings, waste management and urban form) of climate change would be required to discuss.

Thanks for this very good suggestion. We added the following para to the discussion (plus detailed data in the SI):

“Moreover, our research approach can also help identify the most recent trends in the literature post AR5. There is, for example, a fast-growing research cluster around e-mobility with topics on e-vehicles, charging station and parking spaces. As these topics have been comparatively small in the past, IPCC authors may want to give them more consideration in the future. Research on buildings evolves fastest on water use, energy standards and thermal comfort. Overall, urban form is the fastest growing topic post-AR5. More comprehensive data is provided in the SI. We do not suggest here that the fastest growing topics should be the focus of upcoming assessments – urban form has already had due consideration. Instead, topic mapping exercises such as this can provide the empirical foundation for discussions on what may or may not constitute a balanced assessment.” (Lines 296-304)

5. The analysis should be more in-depth and detailed. From Supplementary Material, we know that the assessment period is from AR1 to AR6. In addition to the subject area in all literature, whether the attention of four domains (transport, buildings, waste management and urban form) is different in different stages.

We combined this suggestion with the previous one - i.e. we looked at the distribution and growth of topics between AR periods, and thereby identified “hot issues”. This information is in the SI text, however we are unable to devote more time to it in the main text due to space constraints in the journal format.

* **Reviewer 2**

This article discusses the use of methods from computational linguistics to develop a systematic overview of literature related to urban climate change mitigation – specifically in the transport, buildings, urban form, and waste management sectors. More specifically, a search query is developed to identify relevant literature on cities and climate change, the thematic structure of this literature, and the important contributions and key contributors to these discussions – particularly in the context of the IPCC special report on the 1.5oC goal. The authors find that themes of urban form and transport make up a large proportion of core of the urban mitigation literature and that many urban demand-side mitigation options often remain overlooked.

For the most part, the paper is well written - although there were a few grammatical errors. It provides an interesting approach for advancing our understanding of the body of knowledge related to urban climate change mitigation. The computational linguistics methods applied by the authors appear to provide a promising approach for quickly and transparently digesting a large (and quickly expanding body of literature). This type of application seems to be particularly promising in the context of IPCC reports where the IPCC authors are required to review and synthesize the massive body of literature and knowledge related to given climate topics. In this context, the methods described by the authors can not only help with the initial characterization and cataloging of the body of literature, but also help identify key relationships across themes and key gaps in our current understanding. Nonetheless, as detailed in my comments below, it is my opinion that substantial changes and development are required before publication can occur. In particular, the manuscript would greatly benefit from correcting grammatical errors, providing clarification on certain terms/analysis, and elaborating on the implications of the work by more explicitly addressing the research questions introduced in the early parts of the manuscript. The comments below are organized into two categories: grammatical edits and content edits.

We thank the reviewer for their detailed and thoughtful comments.

*Grammatical Edits*

In the first sentence of the paragraph above Figure 1, remove ‘identify’ from “This paper systematically identifies identify relevant literature on cities and climate change, and analyzes the state of evolution…”

Done

In the third sentence of the paragraph above Figure 2, remove ‘but in addition to’ from “This procedure is expected to reproduce the 4 domains of research outlined above, but in addition to expose the relationships between these different topics…”

Done

In the first sentence of the paragraph above Figure 4, please clarify what is meant by ‘here’ in the sentence “Using a compiled set of references from the IPCC AR5 Working Group III Report, we find that the coverage of urban mitigation literature identified here extends to a total of 111 direct citations…” Does ‘here’ refer to the author’s manuscript or to the IPCC Report?

In re-structuring our manuscript, we shifted and clarified this result. At the end of the methods section, we state the following:

“Finally, we compile a list of references from the IPCC AR5 WGIII Report, allowing us to examine its direct coverage of the urban literature and topics we identify in the preceding analysis. Refer to the SM for a full description of these methods.” [Lines 155-157]

And the result is taken up at the beginning of our results section, which gives a general overview of the size and growth of the urban literature:

“Our urban mitigation search query identifies a substantial (9,525 publications) and fast growing literature (20.5% per year; see Supplementary Materials Figure 1). **The IPCC AR5 has directly cited 129 of these documents.** While this raises questions with regard to transparent literature selection in the IPCC, this low number should be contextualized within the much broader scope of the relevant chapter (WGIII, Chapter 12: Human Settlements, Infrastructure, and Spatial Planning), which included many issues not specified in our query. Moreover, more than 3500 studies have appeared since AR5 (2014 onwards) and have therefore not been assessed by the IPCC directly or indirectly. Future assessments therefore face a significant task in covering the full breadth of relevant work. In the following sections we present the major themes of the urban literature we identify (the automated content analysis), and the epistemic communities within this field (scientometric analysis).” [Lines 159-168]

Note that the number of direct citations has increased (from 111 to 129), as we expanded the scope of our search query (discussed below).

In the 5th paragraph of the Discussion and Conclusion Section, the sentence “In fact, only X out of Y publications are on urban climate policies directly” is incomplete. Please replace ‘X’ and ‘Y’ with actual values.

Apologies. We decided against conducting this analysis in the final draft, but overlooked deleting the sentence. It has now been removed.

In the 6th paragraph of the Discussion and Conclusion Section, change ‘making’ to ‘make’ in the sentence “While there might be very good reasons for those choices, we argue that systematic mappings of the literature landscape could help making assessment choices transparent and at the same time ensure that none of the major topics are neglected.”

Done

In the 6th paragraph of the Discussion and Conclusion Section, change ‘absolute’ to ‘absolutely’ in the sentence “In times when the primary studies can no longer be comprehensively assessed within the IPCC, it seems absolute key for the organization to explicitly prioritize the systematic assessment of these where available.”

Done

*Content Edits*

In my opinion, additional content is needed in the Discussion and conclusion section to fully clarify and state exactly how this approach would fit into (and benefit) the development of the upcoming IPCC special report on the 1.5oC (and subsequent IPCC reports). More specifically, at the end of the Introduction section, the authors lay out a compelling set of key questions: “What part of the urban literature should actually be considered in the upcoming special report? What are the epistemic communities that drive this growing urban literature? And how can it be organized around a coherent set of objectives and policies in the short, medium and long-term?” However, explicit answers/discussions appear to be absent for at least a portion of these questions. Thus, the manuscript would greatly benefit from a return to these questions in the Discussion and Conclusion section.

Thank you for raising this point. We agree that additional clarity was needed in the manuscript, so undertook substantial edits throughout.

First, we re-structure the questions and expand to a fourth point:

“To enable a more robust and transparent assessment of the role of cities in climate change mitigation, and to advance discussions in urban climate change research, the relevant literature base needs to be characterized to answer a few questions: How is the literature organized in terms of key objectives and/or policies for the short, medium and long-term? What are the core topic areas in the literature that currently emphasize urban climate change mitigation? What are the epistemic communities that drive this growing urban literature? Finally, what methods can be drawn upon to assist in the synthesis of urban literatures?” [Lines 59-65]

The first of these questions is dealt with in the second section, “**Delineating the urban mitigation literature”** [Lines 77-126]**,** where: “Our starting point in this study is to outline and justify the broad topics, policies and objectives that an urban mitigation assessment should focus on.” [Lines 78-79]. We also revisit and discuss this in the context of the IPCC in the first three paragraphs of the conclusion [Lines 251-274].

On the second and third question, these form the core of our results. To avoid confusion, we have restructured with a methods section, clarifying the methods used for each question: automated content analysis to identify core topics areas, and a combination of scientometric analysis and content analysis to identify communities [lines 128-154]. Additionally, we have divided the results section into “**Major themes in urban mitigation research”** and **“Epistemic communities in urban mitigation research”**, again referring to these two questions & methods. As suggested, we explicitly take up these results in the conclusion, paragraph 4:

“To this end, we apply automated content analysis and bibliographic coupling to digest the large amount of information in this literature and map-out its topic landscape. Our results suggest that mitigation-focused urban studies are so far mainly concerned with urban form and GHG emissions accounting – important topics in their own right, but not fully representative of the broad solution space. A wealth of policy-relevant research risks being overlooked: principally work on congestion, parking charges, and waste management, but also to some extent active travel and public transportation provisioning. These literatures are based in distinct epistemic communities that tend to prioritize non-mitigation, sector-specific issues. By contrast, the buildings literature is already strongly aligned towards energy efficiency, via technical as well as behavioral interventions, but is not yet clearly situated within urban systems. Apparently the topic of urban climate change policies is just emerging, which is not surprising as there are still very few comparable emissions data available at the city scale [6,12].” [Lines 275-286]

On the new fourth question - “what methods can be drawn upon to assist in the synthesis of urban literatures?” – we apply new methods throughout the paper for literature synthesis, and outline their value for this task in the final paragraph:

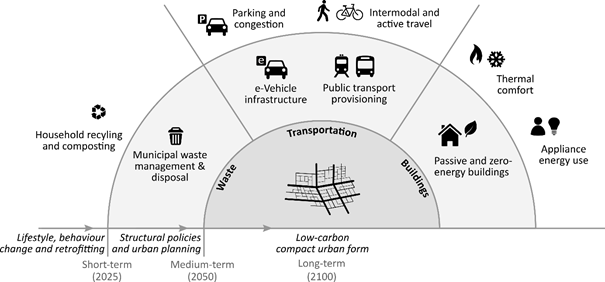
“Finally, in this paper we introduce new methods from computational linguistics to assist research synthesis. The urban mitigation literature, with its broad array of topics, disciplines, and epistemic communities, can benefit from the application of such tools. In this paper we apply these tools to characterize the research landscape, track the integration of different subject areas, and identify research gaps, particularly with reference to the IPCC. Other applications could address more fundamental challenges, such as how to synthesize and aggregate knowledge from a rich body of urban case studies – the “gold standard” for investigating causal mechanisms [51,52]. As a starting point, the reference list and topic identification provided could be used to construct a detailed case study database. This and other endeavors that facilitate collaborative knowledge learning will be key to realizing the full potential of cities to implement and deliver climate solutions.” [Lines 314-323]

The manuscript would benefit from some additional elaboration on the implications of selecting ‘urban form’ as one of key domains of examination. In particular, transportation and buildings are major (arguably to most important) components of urban form. How is the potentially high amount of overlap between transportation, buildings, and urban form handled in the development of the query and the analysis of the body of literature?

That is a true observation. With urban form we capture aspects both of buildings and transport, but put emphasis on overall spatial layout and function. We have clarified by adding a paragraph in the section delineating the urban mitigation literature:

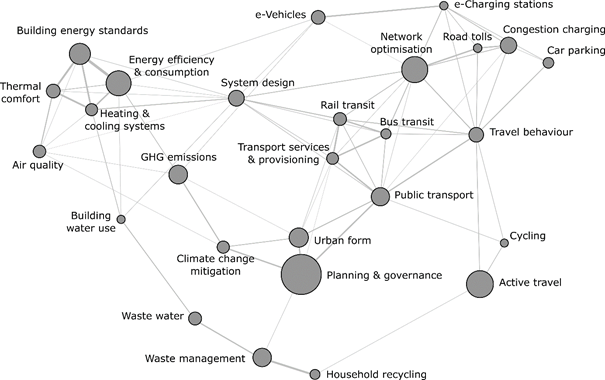
“With the efficient use of buildings and city space, underpinned by active travel and public transportation, important network externalities emerge, driving cities towards low-carbon compact urban forms towards the end of this century. Thus the “urban form” domain captures aspects of both transport and buildings, and emerges from specific transport and building interventions, but is distinct in addressing layout and wider systemic effect at larger spatial scales. Urban form also emphasizes the close entanglement of the transport and building systems, for instance through fuel prices, which shape street layouts, building heights and floor spaces, and the balance of different transport systems [35–37].” [Lines 119-126]

More importantly we modified Figure 2 (now figure 1) to provide a visualization of the relation:

****

In the discussion of the correlation and connection between urban mitigation topics, more elaboration is needed with respect to describing what exactly is meant by ‘strongly’ and ‘weakly’ connected. For example, in the paragraph below Figure 3, “The former is strongly connected to urban form (#6), planning and governance (#1), and policy instruments (#17)…”, what is meant by ‘strongly?’ Does this correspond to a certain correlation threshold? If so, what is the threshold and how/why was it chosen?

This is an important point, as the choice of correlation threshold is clearly subjective. As stated in the subtext of figure 3, the minimum correlation threshold is 0.025. This choice strikes a balance between complexity and sparsity in the network graph. The figure, updated based on our expanded query is shown here:



**“Figure 2: Correlation structure of urban mitigation topics.** Each node is a topic, scaled by the marginal distribution (see Table 1); each line represents a correlation, based on the co-occurrence of two topics within document abstracts. The highest correlation is 0.3 (between thermal comfort and building energy performance); the lowest is 0.025 (between climate change mitigation and green infrastructure). The visualisation is generated using the force-directed algorithm ForceAtlas2 in Gephi [39].” [Lines 201-206]

In the text, we have removed the imprecise language on ‘weak’ and ‘strong’. We now focus on a few selected results from Figure 2: the grouping of buildings topics, the grouping of transport issues around the ‘network optimisation’ and ‘travel behaviour’ topics, and the linkages between ‘climate change mitigation’ and other topics.

Does our choice of correlation threshold influence the interpretation of these results? In the case of the buildings and transportation topics, no, since these clusters of topics have among the highest relative correlations. E.g. both a sparser and denser network graph would still display the importance of ‘network optimisation’ in transport research.

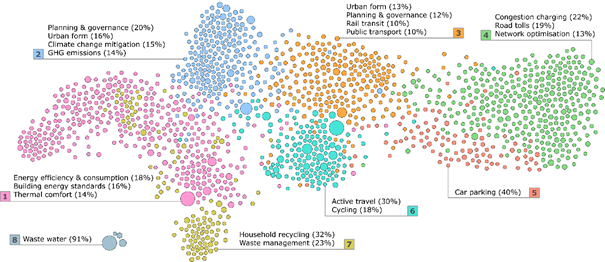
Does it influence our interpretation of which topics co-occur with climate change mitigation? Yes, but in a direction that supports our results: if we display a more dense graph (e.g. correlation threshold = 0, showing all correlations), then climate change mitigation will become connected to the cluster of buildings topics (thermal comfort, heating & cooling, energy efficiency, and building standards), in addition to those displayed above, but no further topics. We already state that buildings research is well aligned towards mitigation. The text in this section now reads as follows:

“A useful way to visualize and interpret these results is via a correlation network, showing the propensity for topics to occur together within documents (Figure 3). As might be expected, the topics on energy, heating and water use in buildings are grouped together. The transportation topics are also densely connected – in particular to network optimization (#3), which describes the modelling, simulation and optimization of traffic flow, and to a lesser extent travel behavior (#12). System design (#11) is a central but more generic topic on the efficient design of building and transport systems.

To what extent is climate change mitigation a prominent discourse in these fields? Table 1 and Figure 3 suggest that it remains rather marginal: papers with climate change mitigation as their main topic tend to focus on macro issues of urban form, GHG (greenhouse gas) emissions accounting in cities, and building interventions (via energy efficiency), but less so on waste management and specific transportation options. In these mitigation-relevant research fields, alternative framings of congestion, access, and public health dominate, instead of a climate-first perspective.” [Lines 194-212]

Please elaborate on the meaning of the different colors and percentages show in Figure 4

This figure has been redrawn as follows, with a modified caption text to explain its content:

  
“**Figure 3: Bibliographic coupling network of urban mitigation topics.** Each node (circle) represents a publication, scaled by total citations. Proximity between nodes indicates similar citing patterns. To identify epistemic communities, we specify clusters of proximate nodes using a community detection algorithm (displayed as colour), sum all document-topic scores within each cluster (derived from the preceding automated content analysis), then display the topics that exceed 10% of the total topic score in each cluster. For instance, in cluster 7 (coloured in yellow), 32% of the sum of all topic scores are related to “Household Recycling”, and 23% are related to “Waste Management”.” [Lines 234-241]

Please elaborate/clarify on what is meant by ‘mitigation-core’/ ‘core set of mitigation papers’.

We have removed the language around a “mitigation-core” and now more precisely point to clusters 1 & 2 in Figure 3, interpreting these as the main epistemic communities in which mitigation and urban issues intersect:

“More interesting are communities of research where multiple topics intersect, such as in cluster 2, which appears to be the main group of papers in which urban climate change mitigation is a key priority. Highly cited papers here include Bulkeley and Bestill’s (2005) study on cities in the multi-level governance of climate change [40], and Pataki et al. (2011), where the role of urban green spaces in reducing GHG emissions is examined [41]. Note again the macro-focus of the topics in this cluster: on planning, urban form, and GHG emissions. While we do see a promising convergence in literatures on buildings, active travel and public transportation around cluster 2, it is nonetheless only indirectly connected to a wider periphery of work on congestion charging, car parking, and waste management.

In contrast to cluster 2, the epistemic community around buildings (cluster 1) offers a more focused discourse: on direct energy demand reduction via standards [42], behaviours [43] and technical interventions [44]. This research is directly relevant to mitigation, although it is firmly framed in terms of households and buildings, not the urban areas in which they are situated.” [Lines 221-233]

This supports the following hypothesis (and later our conclusion) that urban mitigation research needs to expand in scope to capture the full breadth of topics identified in our analysis - particularly in assessments:

“To what extent are assessments of urban mitigation likely to be constrained by this community structure? If we assume IPCC authors are drawn from the mitigation-focused clusters 1 and 2, and they primarily review literature they are familiar with, then certain topics risk being overlooked. Indeed, within the 129 references in AR5 that we match with this set of urban mitigation literature, there is a predominant focus on urban form, GHG emissions accounting, building energy consumption, public transportation, and active travel (Supplementary Materials Fig 2). Topics on parking, waste management, cycling, and road tolls are underrepresented in the report (i.e. those topics that are more distant from cluster 1 and 2).” [Lines 242-249]

Above Figure 4, one sentence describes “a core set of mitigation papers focused on urban form, planning policy and emissions quantification.” However, in the subsequent paragraph, the ‘mitigation-core’ is described as “related to urban form, building energy consumption, public transportation, or active travel.” These two sentences don’t appear to fully align. Is there a single, consistent definition for ‘core’ set in the context of this manuscript?

This is related to the previous point, where we have strengthened the language and take clusters 1 and 2 in figure 3 as our interpretation of the “urban mitigation core”.

Related to the last sentence of the 1st paragraph of the Discussion and Conclusion section, the manuscript would benefit from an elaboration on some of the other options for constructing the query. What are some of those options and why were they not chosen? Would the results change if the query had been constructed in a different manner? If so, how?

We expand this section slightly, with the following wording:

“There are different ways in which an urban mitigation search query could have been constructed. For instance, we might have included supply-side options like building-scale electricity generation, or access to health, education and leisure services, which are themselves relevant for patterns of energy consumption. In choosing a more restricted scope, we focus attention on areas of demand-side research that are less well represented in current assessments – and hope to stimulate discussions on such fundamental questions of literature selection for the upcoming 1.5°C SR.” [Lines 261-266]

Due to very tight space constraints in this journal, we are unable to go further than this in the main text. We expect that the inclusion of more literature on the supply-side (e.g. industrial emissions, or building-scale energy generation) would increase the scope of the “urban mitigation core”, whereas sustainability-oriented literatures on infrastructure access, education and so forth would increase the periphery of less well-connected communities we see in Figure 3.

As mentioned below, we did take some time to review the buildings section of our query. In this process we managed to capture an additional 1,400 documents. This added several topics to our model: “Energy efficiency & consumption” and “heating & cooling”. Despite these changes the epistemic community structure (Figure 3) did not shift substantially, nor did the structure of the transport, waste, urban form and climate change mitigation topics.

Related to the second sentence of the 3rd paragraph of the Discussion and Conclusion section, the manuscript would benefit from an elaboration on what is meant by ‘behavioural aspect’, i.e., “An unexpected result is the lack of a behavioural aspect to the buildings literature”. Is thermal comfort not considered a behavioural strategy? Assuming it is a behavioural strategy, would it not fit within the buildings literature?

We agree this was unclear. As part of our revisions we expanded the keywords in our buildings query. In particular, our original search captured behavioral interventions in “buildings”, but not in “households”. Once the latter was included, it was evident that we overlooked quite a large and well-developed body of work on household interventions (e.g. refs 41 and 42 in the main text). We have edited the conclusions to reflect this change, now highlighting the maturity of the buildings literature with regards to energy demand reduction:

“By contrast, the buildings literature is already strongly aligned towards energy efficiency, via technical as well as behavioral interventions, but is not yet clearly situated within urban systems.” [Lines 282-284]

In the 4th paragraph of the Discussion and Conclusion section there is an interesting and important point about the embeddedness of building design and transportation within urban form, but the manuscript would benefit from a stronger connection between that point and the main objectives of this paper/methods. Would it be fair to say that one of the primary benefits of the methods described in the manuscript is that they can help identify gaps in cross-disciplinarity (i.e. lack of connection/overlap between transportation, buildings, urban form)? Could the methods described in the manuscript be used to assess how these relationships evolve/improve over time?

This is a good point. We have added a 4th research question: “...what methods can be drawn upon to assist in the synthesis of urban literatures?” [Lines 64-65]. This question connects to the methods we introduce in our paper, as well as the challenges we argue that an urban mitigation assessment will face (size, scope, and growth of the literature).

More concretely, we conclude with three paragraphs highlighting the use of these methods to provide an empirical foundation for discussions on balanced assessments, the need for cross-sectoral approaches, the value of these methods for research synthesis:

“Moreover, our research approach can also help identify the most recent trends in the literature post AR5. There is, for example, a fast-growing research cluster around e-mobility with topics on e-vehicles, charging station and parking spaces. As these topics have been comparatively small in the past, IPCC authors may want to give them more consideration in the future. Research on buildings evolves fastest on water use, energy standards and thermal comfort. Overall, urban form is the fastest growing topic post-AR5. More comprehensive data is provided in the SI. We do not suggest here that the fastest growing topics should be the focus of upcoming assessments – urban form has already had due consideration. Instead, topic mapping exercises such as this can provide the empirical foundation for discussions on what may or may not constitute a balanced assessment.

Ideally, the urban mitigation literature would provide a platform for converging multiple streams of research, identifying linkages and complementary policies. For instance, public transit corridors, such as bus rapid transit, placed adjacent to new affordable housing developments would provide residents with an accessible mobility option before they have purchased a personal vehicle, potentially inducing preferences and habits favoring public transportation that last for the medium to long term [46]. This suggests an important avenue of future research, towards integrating land-use and transport planning to derive additional mitigation benefits [47–50], instead of focusing on sector specific options only. Mitigating to 1.5°C will require interaction and linkages across multiple urban dimensions – and this is especially true in places with rapidly growing cities.

Finally, in this paper we introduce new methods from computational linguistics to assist research synthesis. The urban mitigation literature, with its broad array of topics, disciplines, and epistemic communities, can benefit from the application of such tools. In this paper we apply these tools to characterize the research landscape, track the integration of different subject areas, and identify research gaps, particularly with reference to the IPCC. Other applications could address more fundamental challenges, such as how to synthesize and aggregate knowledge from a rich body of urban case studies – the “gold standard” for investigating causal mechanisms [51,52]. As a starting point, the reference list and topic identification provided could be used to construct a detailed case study database. This and other endeavors that facilitate collaborative knowledge learning will be key to realizing the full potential of cities to implement and deliver climate solutions.” [Lines 296-323]

Section III of the SI would benefit from the inclusion of a diagram, set of equations, and/or an example to help add clarity to the discussion of the Tf-idf scores/weighting

As requested, we have expanded this section to provide additional detail:

“We apply Non-Negative Matrix Factorisation to identify latent topics in the document set, representing the various themes that characterize the urban mitigation literature [1]. As a first step, we prepare the data, removing common stopwords (the, and, etc.) and stemming each word (replacing both “congested” and “congestion” with “congest”). Then we construct a matrix of terms by documents. The cells of the matrix are filled with the term frequency inverse document frequency weighting (tf-idf) [2]. Briefly summarized, term Frequency refers to the frequency with which a term occurs in document . Inverse document frequency refers to the number of documents a term occurs in, or document frequency , relative to the total number of documents in a collection : . The term frequency inverse document frequency weight for term in document is then . Tf-idf scores thus assign higher weights to terms in a document, if the term appears infrequently across all documents, and vice versa.

This matrix is factorized into two matrices , whose product approximates . describes a set of topics, where rows are topics, columns are words, and each cell is a word-topic score. describes the documents, where each row is a document, each column is a topic, and each cell a document-topic score. Topics can be understood as lists of high-scoring words, and documents are combinations of those topics. The analysis was implemented using scikit-learn [3].

As the number of topics needs to be specified exogenously, we sample different numbers of topics and analyze the resulting word distributions manually. Overall, 27 topics proved to be a meaningful and manageable number, covering a broad spectrum of themes, while minimizing uninterpretable results.”

Please elaborate on the units of the Y-axis in Figure 2 of the SI. Is the graph indicating the total number of instances that a given topic is found in the 111 papers? Is it a percentage? Something else?

This refers to the number of IPCC references a topic is found in - we have adjusted the y-axis and caption to make sure this is clear.

* **Reviewer 3**

This article of approximately 10 pages, 4 figures, 1 tables, 6 tables in the appendices and 53 references focuses on an review and analysis of the literature on climate change mitigation and cities. The authors describe the “landscape” of this literature and argue that the epistemic core (the central concept of knowledge generation) revolves around urban form. Other areas of importance include demand-side options for mitigation such as congestion price, charging, parking prices, etc.

I find the article potentially interesting, but as written, is not matured and unhelpful, if not confusing. It seems that the article was written quickly and there are a multitude of English language problems and simply sloppy presentations of the material. The paper could be very useful, but as written I would reject it. I explain my review decision below. I first describe my understanding of the paper and then provide both overall comments and specific editorial comments.

Description

The author’s goal for this work is to help the “comprehensive assessment” of the state of scientific knowledge on the role of cities in keeping climate change impacts to 1.5°C as mandated by the IPCC Special Report.

Overall comments

I think the 5 bullet points and the beginning of the conclusions are the most coherent part of this paper. Without these I would have a difficult time understanding what the arguments in the paper are. The introduction needs a complete re-writing. There is contradictory and confusing statements throughout the text. Parts of the conclusion are not finished. The methods are tucked into the supplementary material or in the figures and inadequately presented in the text. This is strange as this paper is presented somewhat as a methods papers. Some of the appendix material should be in the paper (I think that figures supplementary figure 1 and perhaps 2) and other parts should be removed as useless (the pdf is 561 pages long). Importantly, the authors need to decide whether this is a research paper that presents new methods of analysis or a review paper. My impression is that the authors need more time to consider what is important and what isn’t and present the material articulately. It should not be considered for publication in this condition.

Specific comments

In the bullet points the authors argue that the urban mitigation literature core is urban form and public transport, but the abstract only mentions urban form. Are they the same?

This has been changed here, and throughout the text to “urban form and GHG emissions accounting”.

The abstract seems to state that there has been “extensive research into demand-side options such as congestion charging, parking prices…”, but, the bullet points state “urban demand-side mitigation options remain overlooked”

The abstract now states “…extensive research into demand-side options remain overlooked, including congestion and parking polices, active travel, and waste management.”

In the Introduction, 1st paragraph, second sentence is confusing “While the discussion on the 1.5°C goal so far has emphasized the role of negative emissions as well as the higher economic costs for staying within the tight and fast dwindling emission budget [1–4], it has been largely neglected that 1.5°C policy pathways also come with a distinctively different (gross) CO2 emissions profile compared to 2°C policy pathways; namely even deeper emissions reductions in the medium-run and long-run, as shown in Figure 1.” It is set up as a dependent clause relationship, “While [this]…, [that]”, but the two parts have no bearing on each other. It’s a non-sequitur. Why not “The discussion on the 1.5C goal…budget [1-4]. The debate has largely neglected..”

We address this in the next point.

Also figure 1 doesn’t convince me that the two different scenarios differ that much in the emissions reductions (1.5°C and 2.0°C). They look fairly close in the figure. I would not call these pathways distinctively different as drawn. What about providing some numbers to demonstrate differences?

We believe that the Figure 1 does make an interesting point, but maybe not effectively in within the scope of this manuscript. We have therefore removed Figure 1, which would have distracted from the major points we would like to make. The argument has been simplified, and now refers to general insights on 1.5°C mitigation pathways from IPCC AR5 and a more recent study:

“The Intergovernmental Panel on Climate Change (IPCC) has been tasked with a Special Report (SR) to comprehensively assess the state of scientific knowledge on the 1.5°C warming limit laid out in the Paris Agreement. The available evidence on the 1.5°C limit suggests that viable mitigation pathways must combine the most difficult features known from 2°C scenarios, in order to achieve faster and even deeper emissions reductions: immediate and adequate political action, development along very low energy demand pathways, the availability of all major mitigation technologies, and sustained net negative emissions across the second half of the 21st century [1,2]. Such ambition levels can only be achieved if all available mitigation options are reaped at all governance levels – from the global to the local. Cities, as hotspots of human activities and infrastructures, have direct leverage over end-use energy consumption in transport systems, buildings, and other sectors, and therefore play a key role in limiting warming to 1.5°C [3–6].” [Lines 27-37]

1st paragraph, third sentence is also a non-sequitur, the second part does not necessarily follow the first. It is essential to reduce emissions below 0 in this century, so cities have a “self-evident” role in global climate policy.” There is no lead up to this connection in the previous statements. Why not argue for the importance of cities in the dynamics before making this statement?

This sentence has been deleted (see previous point).

2nd paragraph, final sentence, “This efficiency in the organization of climate policies through the close coordination across all levels of governance is particularly important considering the depth and speed of emissions reductions required for the 1.5°C goal.” Is awkward and confusing. I’m not even sure what it means! What efficiency? Cities are efficient?

This sentence has been deleted.

Rather than all the material in paragraphs 1,2 & 3, I suggest first stating that there is a need to understand the potential role of cities in climate mitigation (with appropriate citations) and then go directly the paragraph 4 and start is with something like “The assessment of an urban mitigation literature, however, faces two fundamental challenges 1) the literature is growing rapidly and 2) urban climate change assessments, including examination of mitigation policy, are still in their infancy…” These two aspects are the problems that this paper is addressing, I think.

We have condensed paragraphs 1-3 into two paragraphs that, as suggested, build the argument for understanding the role of cities in climate mitigation. This is directly followed by the assessment challenges.

In terms of the second problem. The authors seem to suggest that with maturity, the scientific literature in disciplinary fields of study aggregate into discrete bodies of knowledge. First, I’m not sure exactly what this means and the thought could use elaboration, but also, is this true? It is an interesting claim, if I understand it correctly. Is there a citation for this? Is this a nod to Thomas Kuhn and attempts to force nature into conceptual boxes? Or something else? Second, what is “big literature”? When is this concept introduced? I can’t seem to find it mentioned prior to this paragraph?

We understand the confusion and re-wrote the text in order to make two distinct points. First, the literature on urban climate change mitigation itself is still at an early stage, where some very basic questions are not sufficiently answered. Secondly, the discourse on cities is multi-sectoral and very diverse taking place in many different communities. This makes the aggregation of knowledge particularly challenging. The text reads now:

“Second, despite recent progress [17], urban climate change assessments are still in their infancy. The available literature still shows fundamental gaps: for example, we still lack a basic understanding of the urban contribution to global emissions and the drivers thereof [15,18–20]. At the same time, the relevant multi-sectoral discourses on cities takes place in diverse communities, which makes the aggregation of evidence into discrete bodies of knowledge extremely challenging [12,18].” [Lines 53-58]

There is a literature around meta-analysis and systematic reviews that claims this aggregation of knowledge increases with the maturity of the field, if adequate synthetic research practices are applied – i.e. formal research on research results (Petticrew and McCartney, 2011). We argue elsewhere (Minx et al., 2017) that such synthetic research efforts are well-established in the climate science community, but much less so in the field of adaptation (Berrang-Ford et al., 2015) and mitigation. This is a more general argument that we believe also applied to cities. Yet, it would lead too far in the scope of this paper.

Why use the word “transparent” which is done several times in this paper? Are the authors suggesting that the previous scientific (IPCC, MA, IAASTD, etc) assessments were not transparent? If so, in what ways were they not transparent?

Indeed, a lack of transparency over identification and selection of literature is a growing problem in the IPCC as we have shown recently (Minx et al., 2017), but we presented this point too briefly - missing out on some crucial explanation. We therefore re-wrote p.2, 48pp in the following way:

“…first, like in other fields of climate change research, the body of relevant literature is large and fast-growing. Minx et al. [13] estimate that the quantity of new peer-reviewed research (as recorded by the ISI Web of Science) published during the sixth IPCC assessment cycle is roughly equal to the size of the entire climate change literature before AR6. The task of tracking scientific progress in assessments is therefore increasingly difficult to manage, even in highly specialized fields. The absence of any procedures that establish transparency over literature identification and selection in the IPCC increasingly risks bias and systematic literature omissions in the assessment.” [Lines 45-58]

Communities that have a developed a culture in research synthesis like the health sciences have standardized transparent search and selection procedures. Some scholars have already highlighted how these and additional systematic review practices could improve the IPCC (Petticrew and McCartney, 2011).

Two further notes in this context: First, we believe that it is one important contribution of this paper to provide a comprehensive body of studies relevant for the discussion on cities based on a transparent and reproducible search query as commonly required for systematic reviews (Ringquist, 2013). In fact, if this paper gets accepted, we will provide efficient webtools that can be used by IPCC authors (and other scholars) to browse the literature on particular topics, retrieve literature lists with relevant studies. Our study could then provide a valuable resource for transparent literature identification and selection in SR1.5. Second, some of the authors of this group are currently discussing with the leadership of IPCC Working Group 3 how transparency over literature selection could be improved without putting too much extra-burden on authors in AR6. Hence, the issue is also recognized by WG3 leadership.

In the “key” question paragraph, the question “What part of the urban literature should actually be considered in the upcoming special report? ”is stated in normative fashion. Scientific writing avoids the word “should” or defines the terms of this word specifically and narrowly. What do the authors mean by “should” in this statement? Also, remove “actually”. Why not state the question as something like: What are the core topic areas in the climate change literature that emphasize urban mitigation? This makes it an “identify and describe” effort, as opposed to a value driven effort.

The text has been amended as suggested:

~~What part of the urban literature should actually be considered in the upcoming special report?~~ **What are the core topic areas in the climate change literature that currently emphasize urban mitigation?**

Never start a scientific question with “how can” or “how should”! Using this construction makes the sentence normative. The true answer is then “anyway I believe is the best way”! Rather perhaps use something like this, “How is the literature organized in terms of key objectives and policies for the short, medium and long-term?” Here also would be a good place to define “short”, “medium” and “long” (is it short = to 2025, medium = to 2050 and long = to 2100 as per the figure 1, if so, please state and you might also refer to the figure again).

The text has been amended as suggested:

~~And how can it be organized around a coherent set of objectives and policies in the short, medium and long-term?~~ **How is the literature organized in terms of key objectives and/or policies for the short, medium and long-term?**

We define these time periods and closely refer to the figure in the following section (“Delineating the urban mitigation literature”), lines 78-126.

2nd page, 2nd paragraph…“This paper systematically identifies identify”

Done

2nd page, 2nd paragraph, “We build a transparent and reproducible search query…” I should hope so!!! Yes, that is a normative, value-laden statement I made. Why is “transparent” so necessary to state?

We have deleted “transparent” here, but please refer to the previous comment on this issue.

What does “endogenously identify the thematic structure” mean? Does this mean that you’re working within the structure to identify the structure?

We have amended this text for clarity:

“We build a reproducible search query based on our understanding of the urban literature, focusing on urban mitigation measures and policies related to transport, buildings, waste, and urban form. **We use automated content analysis to gain an overview of the topics and themes in this literature, and bibliometric analysis to identify epistemic communities in the field.**” [Lines 69-72]

I think “…literature corpus identified” is doubly redundant, but then again, I don’t understand this phrase at all? What is a “literature corpus”? This term appears several times throughout the document?

This confusing term has been deleted. In the methods section we now refer to the “document set”, which is the literature we identify using our search query:

“To identify the urban mitigation literature covered by these four domains, we develop a structured search query for the Web of Science (WOS) literature database. This includes specific combinations of keywords for each domain (e.g. “bicycle infrastructure provisioning”), as well as more generic strings (“low-carbon transport”). We aim to identify mitigation-relevant studies as well as mitigation-focused studies (i.e. papers on urban congestion policies that do not directly refer to emissions reductions would be included). The full search methodology is detailed in the Supplementary Materials (SM). Using the search query we acquire a document set. This is largely comprised of journal papers, but also includes conference proceedings and book chapters. For each document, we obtain the title, abstract, keywords and list of references.

To quickly digest the major themes of the document set, we perform...” [Lines 128-137]

In the Delineating the urban mitigation literature section, I find the identification of “transport, buildings, waste and urban form” as key measures very interesting. Can the authors explain a little more on why they choose 2 end uses, waste and urban form? Was this just their understanding of the literature prior to the study, or did it come out of the study? If it was their understanding prior to the study, can they provide a sentence of two background of how they came to these subjects?

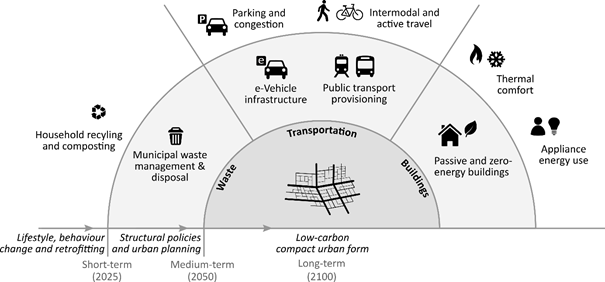
This is an important point. We addressed this issue throughout the method section, together with the related points below. Specifically, here we added the following explanation:

“Four key domains of literature can shed light on the urban drivers of greenhouse gas emissions, and opportunities for their mitigation: transportation; buildings; waste management; and urban form (Figure 2). These domains correspond to the emissions generated in cities from direct energy use and, in our judgement, are the most accessible for urban policymakers [5]. Although the lifestyles, end-user demand patterns, and infrastructures covered by these domains are hardly independent of supply-side issues, we aim to exclude the latter where they are not specific for cities or city-level policies. For instance, literature on industry is excluded as this sector is increasingly located outside urban areas, and is best regulated by national or state agencies via economy-wide policies. Although supply-side waste management also tends to be located close to or outside city boundaries, we do include it here, as demand-side aspects are of high importance.” [Lines 88-97]

Also, the authors state that they focus on the “demand side of urban energy consumption”, but is “waste management” and “urban form” demand side? Waste management can be supply side or demand side. Urban form is very supply side and as the authors point out has demand side components. Given this is a literature review, I thought so anyway, this particular point needs further elaboration not just stating that price affects urban form followed by a citation, but a few sentences explaining the connections and how this happens.

See above and we also rewrote and added to the last paragraph of the method section:

“With the efficient use of buildings and city space, underpinned by active travel and public transportation, important network externalities emerge, driving cities towards low-carbon compact urban forms towards the end of this century. Thus the “urban form” domain captures aspects of both transport and buildings, and emerges from specific transport and building interventions, but is distinct in addressing layout and wider systemic effect at larger spatial scales. Urban form also emphasizes the close entanglement of the transport and building systems, for instance through fuel prices, which shape street layouts, building heights and floor spaces, and the balance of different transport systems [35–37].” [Lines 119-126]



“In the short-term, lifestyle and behavioral options can contribute most to climate change mitigation.” Most? Compared to what, the other options, which are…? Can we get a citation for this?

We added “... compared to technological change and infrastructure provision, which are realized over long-time scales [25].” at the end of the sentence.

The reference supporting this statement is:

Salon, D., Boarnet, M. G., Handy, S., Spears, S., & Tal, G. (2012). How do local actions affect VMT? A critical review of the empirical evidence. Transportation Research Part D: Transport and Environment, 17(7), 495–508. doi:10.1016/j.trd.2012.05.006

Figure 2, nothing about industry. Aren’t industrial firms located in and around cities? Isn’t this an important part of urban economies (jobs)? Why was the industrial sector not identified in this figure or not discussed? Urbanization and industrialization have developed hand-in-hand. I understand that industry has its own chapter in the IPCC, but so does buildings. The authors should mention why this sector was left out.

See above.

The section entitled, “The structure and content of urban mitigation research” is the results of the project (I think). This section needs an introduction in which the authors state the number and name of the different analysis they describe.

We agree. The methods and results section are now labelled as such. We introduce the results section with the following paragraph:

“Our urban mitigation search query identifies a substantial (9,525 publications) and fast growing literature (20.5% per year; see Supplementary Materials Figure 1). The IPCC AR5 has directly cited 129 of these documents. While this raises questions with regard to transparent literature selection in the IPCC, this low number should be contextualized within the much broader scope of the relevant chapter (WGIII, Chapter 12: Human Settlements, Infrastructure, and Spatial Planning), which included many issues not specified in our query. Moreover, more than 3500 studies have appeared since AR5 (2014 onwards) and have therefore not been assessed by the IPCC directly or indirectly. Future assessments therefore face a significant task in covering the full breadth of relevant work. **In the following sections we present the major themes of the urban literature we identify (the automated content analysis), and the epistemic communities within this field (scientometric analysis).**” [160-169]

They authors state that the urban mitigation literature is substantial (8,120 publications) and later mention it’s greater than 610 identified in the “corer” urban mitigation literature? So, there were two different queries? How does the “target” search differ from the “core” search?

Yes, we did create a simpler query (combining synonyms for “urban”, “mitigation” and “policies”). This was to make a short point: that if we explicitly develop a literature search strategy (as outlined in the “Delineating the urban mitigation literature” section), then the scope of reviewed documents will be much broader, lessening the risk of omissions in an assessment.

To avoid confusion, we drop this point and remove all references to an “alternative query”. We make a general point instead in the conclusion:

“Justifying a literature selection and identifying it through an explicit and reproducible search query is a crucial precondition for any comprehensive scientific assessment, yet commonly neglected in practice. We aim to assist such a process through our analysis in this paper and in the material we provide.” [Lines 258-261]

I think that “2008” figure is a mistake for papers in AR5. Even the charts presented in the supplement suggest papers published up to 2012-13 were considered? I therefore then question the statement that 3000 papers “therefore were not assessed by the IPCC directly or indirectly”

You are quite correct. We now state: “Moreover, more than 3500 studies have appeared since AR5 (2014 onwards) and have therefore not been assessed by the IPCC directly or indirectly.”

2nd paragraph, please explain/define “latent topics”? How were these topics identified? Are these from the targeted query or core query? Of something else? Why are they “latent”? Also, please move the explanation of the process of identification from the table to the “methods” section (i.e., Delineating the urban mitigation literature”) text or refer the reader to the table for further clarification.

In our expanded methods section, we now attempt to clearly explain this method:

“To digest the major themes of the document set, we perform: (1) an automated content analysis on the document titles, abstracts and keywords; and (2) a scientometric analysis on the document references. For (1) we use non-negative matrix factorization [38], a method that assumes words systematically co-occur within documents, and that repeated co-occurrences across the document set indicate a shared semantic structure (“topics”). This procedure will generate a list of topics for the entire document set, where each topic is comprised of co-occurring words (e.g. the words “air”, “pollution”, “quality” likely describe a topic focused on local air pollution). Since our search query already specifies the content of research in our document set, this method may appear redundant. However it offers important advantages: it provides quantitative metrics describing the prevalence of each topic; it allows us to examine the correlations between topics (based on the likelihood that they appear together in documents); and it will discover latent topics alongside those we explicitly searched for.” [Lines 138-149]

Also, what is a document set? How many documents in the document set? Why in the footnote state “To be clear, each document is a combination of topics, hence the prevalence of this particular topic across the whole corpus.” Is a document a published paper? Is the document set the group of all papers, or partial group of papers based upon the queries? Also, why does it follow that if each document is a combination of topics then the topic of policy and planning is prevalent? I don’t see that as automatic, except if the query used “policy and governance” as a key phrase, then I would understand. Is that what happened?

We clarify this as:

“Using the search query we acquire a document set. This is largely comprised of journal papers, but also includes conference proceedings and book chapters. For each document, we obtain the title, abstract, keywords and list of references.” [Lines 134-137]

The automated content analysis identifies topics in the document set. Each document is a combination of these topics. Policy and planning is prevalent because many papers in our document set contain policy-related keywords. We rephrase as follows:

“In the automated content analysis a paper may contain multiple topics; some topics therefore represent more general discourses that appear across multiple areas of research. For instance, the most prevalent topic is “planning & governance”, a policy-oriented discourse that can be found in at least 10% of the literature we identify.” [Lines 176-179]

The authors state of a “surprising...relatively weak policy and behavior” discussion in the buildings literature. But then state that upon closer examination are correlated to national building standards. So, they are related to policy (i.e., building standards)? But then state that neither buildings nor “thermal comfort” are connected to topics such as planning or governance or policy instruments. Is this a problem with the organization of the literature or something else?

This point was also picked up by reviewer 2. We agree the original wording and results were unclear. The “building standards” topic is clearly policy-related. In addition, a large and well-developed body of work on household behavior interventions was overlooked, as our original search query had captured behavioral interventions in “buildings”, but not “households”.

We have adjusted the text to emphasize that the buildings literature is well aligned towards energy efficiency improvements, in terms of behavior and technical interventions:

“By contrast, the buildings literature is already strongly aligned towards energy efficiency, via technical as well as behavioral interventions, but is not yet clearly situated within urban systems.” [Lines 283-285]

Maybe the authors can provide a table with the four core topic areas and what their relationship between these four core topic areas are with the various literatures in the different analyses. The text is very hard to follow. How are the four core areas (buildings, transportation, waste and urban form) related to the correlation network? Can we explain for each of the four areas (one – two sentences each) the relationships?

Our main response to this is to introduce a methods section, which now describes how we go from the literature selection to the automated content analysis, and the bibliographic analysis:

“To identify the urban mitigation literature covered by these four domains, we develop a structured search query for the Web of Science (WOS) literature database. This includes specific combinations of keywords for each domain (e.g. “bicycle infrastructure provisioning”), as well as more generic strings (“low-carbon transport”). We aim to identify mitigation-relevant studies as well as mitigation-focused studies (i.e. papers on urban congestion policies that do not directly refer to emissions reductions would be included). The full search methodology is detailed in the Supplementary Materials (SM). Using the search query we acquire a document set. This is largely comprised of journal papers, but also includes conference proceedings and book chapters. For each document, we obtain the title, abstract, keywords and list of references.

To digest the major themes of the document set, we perform: (1) an automated content analysis on the document titles, abstracts and keywords; and (2) a scientometric analysis on the document references. For (1) we use non-negative matrix factorization [41], a method that assumes words systematically co-occur within documents, and that repeated co-occurrences across the document set indicate a shared semantic structure (“topics”). This procedure will generate a list of topics for the entire document set, where each topic is comprised of co-occurring words (e.g. the words “air”, “pollution”, “quality” likely describe a topic focused on local air pollution). Since our search query already specifies the content of research in our document set, this method may appear redundant. However it offers important advantages: it provides quantitative metrics describing the prevalence of each topic; it allows us to examine the correlations between topics (based on the likelihood that they appear together in documents); and it will discover latent topics alongside those we explicitly searched for.“ [Lines 129-149]

Regarding how the domains of literature (that we identify with the query) are related to the topics (that we identify with the automated content analysis), we take this up in the first paragraph of our topic results:

“The automated content analysis identifies 27 topics across the document set (table 1). These include subject areas that were explicitly specified in our search (e.g. “active travel” and “urban form”), as well as latent topics discovered by the analysis (e.g. “network optimization”, “travel behavior”, “air quality”). **There are many topics related to transportation research (#2, #9, #10, #12, #14, #16, #20, #21, #22, #24, #25, #27), fewer on buildings (#4, #5, #13, #19, #26), only 3 on waste (#8, #15, #23), and a single topic on urban form (#6).** In the automated content analysis a paper may contain multiple topics; some topics therefore represent more general discourses that appear across multiple areas of research. For instance, the most prevalent topic is “planning & governance”, a policy-oriented discourse that can be found in at least 10% of the literature we identify.” [Lines 171-179]

Although the domains and topics do map to some extent (as indicated in this paragraph), many topics do not fall within a particular domain. We therefore believe that the suggested table would confuse the results. In the following paragraphs [Lines 180-213], we instead focus on what we can learn about each domain (particularly transport and buildings), based on the structure of topics found.

Part of the confusion for me with this paper, besides the writing, is the lack of explanation and definitions. For example, the word “topic” is used often for different components of this research. There are latent topics, four core topics (i.e., “building topic”), topic names, topic nodes, topic landscape, marginal topic distributions and topic structures. Not all of these terms are defined well. What are these things and how are they related?

We have taken care to revisit the definitions, and be clear and consistent in their usage. We define a “topic” in the second section of the methods (Lines 140-142), also copied in the last response above. Thereafter we are more strict in its usage.

Why do the authors examine the AR5 report and their references? This wasn’t explicit in the goals of the paper? Is this an evaluation of the IPCC report in some way? If so, why wasn’t it part of the goals of the paper? In the conclusions they state that “some topics are better capture than others in AR5, but never state why that is important? Are they stating that from this study AR5 findings are not reliable? If not, why?

We have added this to the goals of our paper:

“As a first step towards addressing these issues, this paper systematically identifies the relevant literature on cities and climate change based on methods from computational linguistics. The state of the research field in terms of its thematic structure is analyzed to inform the upcoming special report on the 1.5°C goal. We build a reproducible search query based on our understanding of the urban literature, focusing on urban mitigation measures and policies related to transport, buildings, waste, and urban form. We use automated content analysis to gain an overview of the topics and themes in this literature, and bibliometric analysis to identify epistemic communities in the field. **Finally, we deploy these methods to examine the IPCC 5th Assessment (AR5) Working Group III (WGIII) report in terms of its coverage of urban mitigation issues, highlighting current gaps that the upcoming SR could fill**.” [Lines 66-75]

Our claim that the AR5 needs to address the huge literature growth through systematic and transparent literature selection appears already in the introduction. Further, we add a fourth research question - “what methods can be drawn upon to assist in the synthesis of urban literatures?” This question is picked up in the conclusion, where we argue that:

“…**topic mapping exercises such as this can provide the empirical foundation for discussions on what may or may not constitute a balanced assessment.**” [Lines 304-305]

We state again in the abstract and conclusion that a broad solution space is fundamental for the 1.5 degree warming limit, and as such should be considered in major assessments:

“Mitigating to 1.5°C would require harnessing all available measures and initiating them with immediacy. It is therefore instructive to examine current trends in urban mitigation research, in terms of prevailing topics and epistemic communities, to uncover the depth to which a full array of options is being considered.” [Lines 271-275]

In the “Discussion and conclusion” section the authors state they aim to “stimulate discussion on such fundamental questions”, but do not tell the reader what the questions are? What are the fundamental questions? Whether researchers have a comprehensive view of the literature? Or something else?

This is now phrased as follows:

“In choosing a more restricted scope, we focus attention on areas of demand-side research that are less well represented in current assessments – and hope to stimulate discussions on such fundamental questions of literature selection for the upcoming 1.5°C SR.” (Lines 266-267)

“In fact, only X of Y publications are on urban climate change policies directly?” Really?

We have removed this sentence.

And later in this paragraph “…particularly as large N samples [16,20,51-53](REFS)”.

Done

Finally, obviously there are two things going on here. First the results of the study, which are important and need to be published after the paper is re-written. Second, there is also the issue of promoting the use of the method to examine the literature. Do the authors suggest the use of their methods or something similar for this report and future assessments? If not, why? If so, with what limitations? If they can identify important aspects of the literature that would otherwise be missed, maybe we need to use the techniques supplied in this article in the current assessment. Combining the new methods and the results without addressing the importance of each contributes to the confusion of the paper.

Yes, thanks for raising this. As mentioned previously, we added a research question: “what methods can be drawn upon to assist in the synthesis of urban literatures?” We return to this question in the final paragraph:

“Finally, in this paper we introduce new methods from computational linguistics to assist research synthesis. The urban mitigation literature, with its broad array of topics, disciplines, and epistemic communities, can benefit from the application of such tools. In this paper we apply these tools to characterize the research landscape, track the integration of different subject areas, and identify research gaps, particularly with reference to the IPCC. Other applications could address more fundamental challenges, such as how to synthesize and aggregate knowledge from a rich body of urban case studies – the “gold standard” for investigating causal mechanisms [54,55]. As a starting point, the reference list and topic identification provided could be used to construct a detailed case study database. This and other endeavors that facilitate collaborative knowledge learning will be key to realizing the full potential of cities to implement and deliver climate solutions.” [Lines 315-324]