Reviewer’s report

Title: Time Series Non-Gaussian Bayesian Bivariate Model Applied to Data on HMPV and RSV: A Case of Dadaab in Kenya

Version: 1 Date: 08 Apr 2019

Reviewer: Justin Manjourides

Reviewer’s report:

Time Series Non-Gaussian Bayesian Bivariate Model Applied to Data on HMPV and RSV: A Case of Dadaab in Kenya

The authors aim to assess if and how incidences of HMPV and RSV affect or influence each other, by presenting a multivariate bayesian negative binomial model including lag terms and adjustments for measures of climate and seasonality. Overall, I find the method presented to be appropriate and the conclusions drawn from these methods to be well founded. However, there are a few points that could use clarification and editing.

The authors provide a thorough presentation of the autoregressive negative-binomial model used to model expected counts. A few notes on this presentation:

1) Be consistent in the subscript notation for many of the variables (commas are often included/not-included)

2) I might suggest switching the description of \( \eta_{it} \) on Line 129 to: "\( \eta_{it} \) represents the monthly varying population counts of virus type i at time t (treated as an offset term in the model)."

3) I found the description of \( \nu_{it} \) on Line 130 to be a bit confusing, and should have a straightforward explanation, in addition to the reference to the equation that follows.

4) \( w_{ji} \) in Equation 2 is not defined.

5) When decomposing Equation 2, the order listed in Equation 4 is different, and it is not immediately clear to me why. Is there a reason for switching the order of the climatic factors and viral influences (as well as factoring out the \( \phi_{i,t-1} \))? If this was just done stylistically, I would suggest keeping the order within these two equations the same, for clarity.

6) Please clarify why \( \nu_{it} = \exp(\eta_{it}) \).

Other questions/comments:
7) DIC is used to assess model fit in the application of these models to the data, why wasn't DIC used to assess model fit in the simulations?

8) In Section 2.5, why was s=2 selected?

9) Fix the format of the citation on line 242-243 (listed as just 14, not [14]).

10) Figure 4 is discussed prior to Figure 3, suggest re-numbering.

11) Line 290: Why would estimation of over-dispersion parameters greater than zero (which is capitalized and should not be) relax the assumption of a negative-binomial model? Isn't this evidence of over-dispersion, in which case the negative-binomial model is preferred?

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

Yes

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

Yes

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

Yes

Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

I am able to assess the statistics

Quality of written English
Please indicate the quality of language in the manuscript:

Acceptable

Declaration of competing interests
Please complete a declaration of competing interests, considering the following questions:

1. Have you in the past five years received reimbursements, fees, funding, or salary from an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?
2. Do you hold any stocks or shares in an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?

3. Do you hold or are you currently applying for any patents relating to the content of the manuscript?

4. Have you received reimbursements, fees, funding, or salary from an organization that holds or has applied for patents relating to the content of the manuscript?

5. Do you have any other financial competing interests?

6. Do you have any non-financial competing interests in relation to this paper?

If you can answer no to all of the above, write 'I declare that I have no competing interests' below. If your reply is yes to any, please give details below.

I declare that I have no competing interests.

I agree to the open peer review policy of the journal. I understand that my name will be included on my report to the authors and, if the manuscript is accepted for publication, my named report including any attachments I upload will be posted on the website along with the authors' responses. I agree for my report to be made available under an Open Access Creative Commons CC-BY license (http://creativecommons.org/licenses/by/4.0/). I understand that any comments which I do not wish to be included in my named report can be included as confidential comments to the editors, which will not be published.

I agree to the open peer review policy of the journal