**AUTHOR RESPONSE TO EDITOR AND REVIEWER FEEDBACK**

**LandsatTS: an R package to facilitate retrieval, cleaning, cross-calibration, and phenological modeling of Landsat time-series data**

**Recommendation by the Subject Editor (Dr. Michael Borregaard):**

The paper is much improved, however, there are still a few issues. Mainly, reviewer #1 has some very thoughtful comments on the R package itself (rather than the presentation here) which should prove highly useful in improving the software. I strongly agree with these suggestions and hope the authors will take them on. As everything seems like it should be relatively straightforward to address I suggest a verdict of "minor revision".

Author response: We thank Editor Borregaard for facilitating this review and providing further feedback on our manuscript. As detailed below, we implemented the helpful suggestions provided by both reviewer, which helped further refine the manuscript and software.

**Reviewer 1 Comments to Author:**

This manuscript describes an R package that both ingests Landsat data from GEE and performs cleaning and phenological modeling on those data.

The methods are broadly applicable, and only the first portion relies on GEE, so I strongly suggest that the workflow should be divided into two pieces, one that performs the ingestion, and one that performs the analysis steps. That would facilitate the use of the methods by researchers who don't use GEE.

Author response: We certainly want to make these methods as widely applicable as possible. The *LandsatTS* package was carefully designed to leverage GEE; however, the package can be installed, and portions utilized, without access to GEE. GEE is explicitly required only for the Landsat data export functions. The phenological modeling components of the package could be applied to time series measurements from other sensors (e.g., MODIS, phenocams). We provide an example application that divides the workflow into data extraction and subsequent data cleaning, processing, and analysis. We also added a sentence to the Introduction highlighting that, “… users who are interested in phenological modeling with other data sources (e.g., phenocams, MODIS) could utilize functions from *LandsatTS.*”

I installed the package successfully, but also ran R CMD check. The package has a bunch of issues around Imports and Namespaces that should be cleaned up. The check failed overall because I don't have GEE set up on this computer. I think it would be great to make those portions optional so the phenology components can be used independently.

Author response: We will further clean up issues around Imports and Namespaces.

There are sample data included with the package that make it possible to try out the package without using GEE, but the documentation and examples don't make it straightforward to do that. Skipping the extremely time-consuming portion for simply trying out the package is another good reason, as discussed in the manuscript.

Author response: Even without GEE, users can explore and run the package’s analysis functions several ways, including manuscript Code Boxes 2 – 4, as well as the example in the vignette and stand-alone examples provided for each function in the package documentation. These all rely on sample data provided with the package. To improve clarity, we further documented the sample datasets used in examples, including adding descriptions of the content in each column, dataset titles, and other metadata. Furthermore, in the first section of the example application, we now note that, “… Code Box 1 requires access to GEE for exporting Landsat data; however, Code Boxes 2 – 4 can be run without access to GEE because they rely on a dataset provided with the package.”

It would be extremely useful to include a vignette with the package that works through the two components of the workflow separately. That is, the basic material included in the manuscript, but as a vignette with extractable code and accompanying explanations. Some of the material that's included in the main manuscript, like the function descriptions, would be better placed in that vignette, which should be included as supplementary material. One of the previous reviewers suggested that the function descriptions were not needed in the main manuscript, and I agree.

Author response: We have a vignette with an example, extractable code, and explanations on the package’s GitHub repository. The vignette works through the data extraction and analysis workflows separately, with the analysis workflow utilizing an internal dataset. Furthermore, we moved all function descriptions to the Supplemental Material. We clarified the manuscript structure and where to find additional information by adding the following sentences to the end of the introduction:

Below, we illustrate a typical workflow (Figure 1) and briefly describe each function (Table 1), as well as provide an example application focused on vegetation dynamics across the Noatak National Preserve, USA, and instructions for package installation. Detailed descriptions of each function are included in the Supplemental Material and package user manual, with additional examples and information provided in a vignette on the *LandsatTS* GitHub repository (https://github.com/logan-berner/LandsatTS).

This is the result of a workflow that was developed for a particular project, but it is likely to be useful for other applications, and it would be great to make it as widely useful as possible.

Author response: We thank the review for providing helpful suggestions and appreciate their positive feedback.

**Reviewer 2 Comments to the Author:**

The authors made thoughtful, judicious changes to the software package and its writeup in response to comments and suggestions in the earlier review. I only have comments for superficial corrections/edits, as listed below. Overall, I think the authors have done an excellent job creating and documenting this new R package. The amount of care and effort that has gone into this process is evident. I very much appreciate their generosity and look forward to using the package in future research.

Author response: We greatly appreciate the review’s feedback, careful proofreading, and overall encouragement, and are delighted to share this software with the broader community.

Code Block 1 (L198) returned the message:

“Error in st\_area.sfc(st\_make\_grid(x, n = c(1, 1))) :

package lwgeom required, please install it first”

Installing lwgeom was unsuccessful and the code block did not complete.

Author response: We had no problems running this code block, or reinstalling the *lwgeom* or *sf* packages, and were unable to replicate this issue. Perhaps if the reviewer updated R or *sf* this issue would resolve?

Code Blocks 2-4 ran without problems.

Author response: Good to hear!

Suggested edits:

-Asking for the inclusion of Landsat 9 would be greedy considering what the authors have already assembled here. But given that data from L9 will be increasingly included in timeseries analyses, I am interested in knowing whether the authors plan to eventually modify the code to accommodate that input.

Author response: We agree it would be valuable to add Landsat 9 and potentially also Landsat 4 to the package. To add data from these platforms, we would need to modify functions that deal with data export, cleaning, and cross-sensor calibration. We do not currently have the resources to implement these improvements but will explore these possibilities in the future.

L12: The Google Earth Engine platform, or Google Earth Engine (no “the”)

Author response: We removed “the” as suggested.

Fig. 8:

- I suggest changing to color scheme from green/red to accommodate color-blind readers. I realize the color map in the code is green, white, brown, but the brown appears distinctly red on my screen in this figure and in the Leaflet map.

Author response: To improve clarity for color-bling readers, we changed the symbol color from reddish brown to orange.

- In the caption, note the significance of the point size for the trends. I assumed size indicated relative magnitude of the trend direction but the no-trend points also have a range of sizes, which is cryptic (less/more of a lack of a trend?)

Author response: We modified the figure caption as suggested. It now reads, “… The symbol for each sample point is colored based on a combination of NDVImax trend direction and significance (α = 0.10), and then sized based on the magnitude of relative change. For *leaflet* code simplicity, symbol size varies even for sample points without a significantly significant trend. Base map from ESRI World Imagery.”

L505: “Data extractions that involve many sample locations are prone to errors…” What kind of errors?

Author response: To clarify, we changed the sentence to read, “Data extractions that involve many sample locations are prone to errors related to exceeding user limits set by GEE.”

L585: Table 2 is located here, after Tables 1,3, and 4.

Author response: Good catch! We reordered the tables and moved Table 2 to the supplemental material.

L640: Typo: “cure” -> “curve”

Author response: Fixed. Thank you.

L657/9: What is “peak summer”—is that quite literally the summer solstice? Or does it refer to the peak vegetation greenness?

Author response: We used the term “peak summer” to roughly describe the period of maximum summer greenness. To improve clarity, we now explicitly say “annual maximum vegetation greenness” instead of “peak summer”.

L660-667: The description of the figure showing model fits on 9 random points appears to be duplicated.

Author response: We removed the second description of the figure so the text now reads, “To enable users to quickly experiment with different parameter settings, the function includes an optional “test run” mode that will run the function on only nine random sample locations.”

The package contents (starting on p77) may have been outside the scope of this review, but since they were included in the supplied materials, I scanned them anyway.

All examples ran except for the function lsat\_get\_pixel\_centers(), which returned the following error:

Error: Cannot open "C:\Users\username\AppData\Local\Temp\1\RtmpaShrKr\lsat\_WRS2\_scene\_bounds\_411ca9c29b0.kml"; The source could be corrupt or not supported. See `st\_drivers()` for a list of supported formats.

Author response: We had no issues rerunning the example for lsat\_get\_pixel\_centers() and were unable to replicate the error. Perhaps updating the *sf* package would resolve this issue.

Documentation typos:

lsat\_calc\_spectral\_index

- Camp-Valls -> Camps-Valls

lsat\_calibrate\_poly

- Typo: “calbirate"

- “…over the course of the growing season for each sensor and sampling sample”. “Sample sample” and “sampling sample” occur often here and throughout the next few function blocks. I assume the duplication is unintentional.

lsat\_clean data

-Duplicate (2)’s in list

-“innundated"

lsat\_evaluate\_phenological\_max

- “site x years” reappears here and in subsequent entries. I recommend alternate wording.

- Outdir: “If left as NA, then no output is only displayed…” Remove “no”.

lsat\_export\_ts

“THE Google Earth Engine” sounds off. Please remove “the” from all instances and change EE to GEE, which is the abbreviation used in the rest of the document.

lsat\_fit\_phenological\_curves

- “specifcy”

noatak.dt

- Date\_Acquired: a IDate

Author response: We greatly appreciate the reviewer bringing these issues to our attention and have fixed each one in the revised documentation.