Reply to Referee #1 comments

We want to thank Referee #1 for the comments and positive feedback to our basin-scale water-balance dataset and the manuscript (essd-2016-33). We will address the comments (in italic in the following) point-by-point below.

This paper extends to an existing terrestrial water storage data set to a remarkable temporal and spatial scope, enabling a wide variety of regional or global analysis. The methods describing the derivation of this dataset are generally quite clear, however, I did not completely understand the relationship between this dataset and the previous (BSWB v2011). It is clear that the new dataset expands on the old dataset, but I did not find it clear if the datasets differ in their data sources or methodology.

The datasets are consistent in terms of methodology (see Section 2) but not in terms of data sources. On one hand, ERA-Interim has been updated and temporally extended since the release of BSWB v2011 (see Section 5). On the other hand, the new BSWB v2016 datasets relies on a consistent runoff data base from GRDC (i.e., the GRDC reference dataset) while the previous BSWB v2011 was based on various data sources for runoff (i.e., in addition to GRDC also USGS and local sources with varying data formatting and quality checks). By using the consistent GRDC reference dataset, enhanced consistency between the basins can be ensured. Also, future updates of the BSWB dataset are more easily feasible by relying on one source for runoff only. This is mentioned now in Section 5 (Comparison with previous version):

"In addition, the BSWB v2016 datasets relies on a consistent runoff data base from GRDC (i.e., the GRDC reference dataset) while BSWB v2011 was based on various heterogeneous data sources for runoff (apart from GRDC also U.S. Geological Survey and local sources with varying data formatting and quality checks). By using the GRDC reference dataset, enhanced consistency between the basins can be ensured, and future updates of the BSWB dataset are more easily feasible by relying on one source for runoff only."

The analysis of the correlation between the 2011 and 2016 datasets is, to me, suggestive of major differences in the derivation of the datasets. However, the only difference mentioned was the potential change in the ERA-Interim dataset (line 148).

The correlation analysis is meant to check the consistency between the two dataset versions. In theory, the differences between the datasets should be minor, which is confirmed by the analysis. This is also noted now in Section 5:

"Note that despite the varying data sources (see above), the differences between the two dataset versions should only be minor."

Additionally, I did not understand the modification to the GRDC data (line 90), and weather this modification is unique to the 2016 dataset, or also included in the 2011 dataset. While the correlation analysis is undoubtedly useful to users of the previous dataset, I think that a clarification of the intent of the analysis, and of the sources of differences between the datasets, would reduce the potential for confusion.

This modification is not done in our processing, but is inherent in the GRDC reference dataset files, where "original" data and "calculated" (thus modified) data is provided. We clarified this:

“GRDC provides two data streams as part of the reference dataset, “original” data from the data provider and “calculated” data that was modified by GRDC. As suggested by GRDC, we use the calculated values for times when they are available, otherwise the original values are used (GRDC, personal communication).”
As mentioned above, the previous BSWB v2011 was based on various heterogeneous sources for runoff, which are not directly comparable to the reference dataset used for BSWB v2016.

I found the data to be easily accessible via the provided DOI, and I was able to read, compare, and manipulate both the tabular and spatial datasets with free and widely available open source software. I was initially confused as to whether the deltaS.corr field contained the corrected data or the correction to the data, but this confusion was simply resolved with some experimental subtraction. I would suggest considering a modification to the field name, however, as deltaS.corr can be interpreted in either way. Additionally, I did not find the projection of the spatial data defined in this paper, dataset, or metadata, but I was able to use the data assuming a common WGS84 projection. I particularly appreciated the disclaimer regarding the use of this data for trend analysis, and the availability of both the raw and trend-corrected data, as I can imagine uses of the data which would benefit from a less sensitive drift correction.
The respective field name of the tabular data was changed to “deltaS drift-corrected”. For better readability, the tabular data is now written as tab-separated columns. Both changes are mentioned in the README file accompanying the dataset:
“The data (directory BSWBv2016/data/) is stored in individual ASCII files (tab-separated columns) for …” and “Each file contains time series of the uncorrected monthly variations in TWS ("deltaS", in units of mm/d) as well as the drift-corrected data ("deltaS drift-corrected", in units of mm/d) achieved by …”
Concerning the projection of the spatial data: this is indeed already part of the NetCDF metadata:

```
float catch(latitude=180, longitude=360);
      :_FillValue = -3.4E38; // double
      :missing_value = -3.4E38; // double
      :long_name = "fraction inside catchment";
      :projection = "+proj=longlat +datum=WGS84 +no_defs +ellps=WGS84
+towgs84=0,0,0";
      :projection_format = "PROJ.4";
      :min = 0.0; // double
      :max = 1.0; // double
```

For clarity, we added the projection information also to the README file accompanying the dataset:
“The masks are made available in NetCDF format for three spatial resolutions (1x1°, 0.5x0.5° and 0.25x0.25°, WGS84 projection, directory BSWBv2016/basinmasks/) and …”

Beyond this minor confusion, the BSWB data appeared reasonable, and I was able to validate the drift correction as well as recreate sections of the long term imbalance vs. basin area relationship (figure 2).
Overall, I found the article concise and descriptive, and the dataset to be accessible and easy to use. With a couple minor clarifications, I expect this dataset will be easily understandable and useable by anyone with access to basic analytical and spatial tools. I expect that this extended dataset will be useful to the development of regional and global climate analysis, and will also provide a useful independent constraint for regional terrestrial hydrologic models.