We would like to thank referees for their careful review and constructive comments on our manuscript. Our response to referee 2's specific comments is given below:

1. Page 2073, line 8, authors should revise the last IPCC reports, and update the reference.

— The reference was updated as:

IPCC. 2007. Climate Change 2007: Impacts, Adaptation, and Vulnerability. IPCC Working Group II, Fourth Assessment Report. [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.).]. Cambridge University Press.

2. Page 2074, GRACE has to be explained in more details, have they been use before? Where? For what? Are they being validated? Which is the error comparing with real data?

— The following text was added to paragraph 5 and paragraph 7 of section 1 to explain GRACE data and their use:

In the study reported in this paper, satellite-based observations of water storage variations (TWS) were applied to complement discharge data in the calibration process of the SWAT model of Sub-Sahahran Africa (SWAT-SSA). Total water storage variations are derived from the Gravity Recovery And Climate Experiment (GRACE) mission, launched in 2002 by NASA and the German Space Agency (DLR) to accurately map the Earth's gravity field (Tapley et al., 2004). After corrections for tidal and atmospheric mass variations, the hydrologic cycle is the primary source of variations in the Earth's gravity field on the continents (Schmidt et al., 2008). Total water storage variations (i.e. water storages variations integrated vertically over all water storage layers) can be inferred from the GRACE gravity signal

GRACE has been widely used to monitor changes in water mass redistribution for various basins globally. For example, GRACE has also been used to quantify changes in water storage in response to droughts with a specific focus on groundwater systems (Leblanc et al., 2009; Chen et al., 2010). Water storage in East African Great Lakes has also been estimated using GRACE satellite data (Becker et al., 2010). Many studies evaluated groundwater depletion related to irrigation (NW India; Rodell et al., 2009; California, U.S. Famiglietti et al., 2011) with some studies emphasizing ground referencing using well data (Longuevergne et al., 2010; Scanlon et al., 2012). Good correspondence was found between GRACE-based storage estimates and well data within uncertainty envelopes of GRACE-based estimates. In addition to basin scale and global studies of changes in water storage, GRACE is also widely used in modeling studies to validate land surface models (Guntner et al., 2008) and for data assimilation (Zaitchik et al., 2008).

3. Page 2075, line 24, in the case of the 28 river basins, are some of them also include in this study? Are the results good? I suggest that in the author discuss if the results they got are similar that the one obtained by Werth et al. (2009 and 2010).

— Several river basins in SSA (Niger, Nile, Orange, Volta, Congo and Zambezi) are included in Werth et al.'s study. In fact, there are other reported model validation studies using GRACE data covering Sub-Saharan African river basins (e.g., Ngo-Duc et al., 2007;Syed et al., 2008; Alkama et al., 2010; Grippa et al., 2011 ; Yang et al, 2011). Different models differ in their parameterization and input data, which makes a model comparison study and identification of possible reasons for different model behaviors a highly complex issue. We consider such comparison study an interesting topic for future research.

4. Page 2075, line 28, which is the typical temporal scale that is use when using GRACE? Is it the same that was use in this research?

—The temporal scale of most GRACE products is monthly (CSR, JPL etc). In our study, we used GRACE data product with a finer temporal scale (10-day temporal integration)

5. Page 2076, line 7, include how many rivers/watersheds were modeled.

—The modeled region is divided into a total 1,488 basins.

6. Page 2077, line 11, re-aggregation procedure has to be explained.

— This essentially involves overlaying GIS layers of grid-based climate data cells and polygon-based SWAT subbasin boundaries to calculate shares of area covered by different climate data grid cells for each subbasin, and to compute area-weighted values of climatic variables as basin-wide estimates of these variables. This explanation was added to the text.

7. Page 2078, last paragraph should be put before.

— The text of this paragraph was appended to the second paragraph of this section.

8. Page 2081, line 20, it is not clear how mean of the TWSt over the GRACE data period is obtained. Explain in more detail.

— $\overline{TWS}$ is the mean of the TWS_t over the GRACE data period, or was calculated by taking the average of 10-d TWS_t's during July 2002-April 2009.

9. Page 2083, line 6, TWSVi ,j,t,SWAT is the same as TWSt?

— TWS and TWSV are two different quantities. TWS' are the absolute values of the total water storages, and TWSV's are the total storage variations, or the deviations of from TWS' mean value. In the calibration, it is the calculated total water storage variations ($TWSV_{i,j,t,SWAT}$) that are compared with the GRACE-based total storage variations ($TWSV_{i,j,t,GRACE}$).

10. Page 2083, line 8, explain in more detail how you obtain w.

— $w_{i,j,t}$ is an inverse of the standard error ($e_{i,j,t}$) of GRACE-based TWS variation estimates, or $w_{i,j,t} = 1/e_{i,j,t}$. $e_{i,j,t}$'s are derived in GRACE data processing.

11. Page 2084, line 1, multi-year average basis, what does it mean, explain in the paper. GIVE YEARS?

— The starting dates and ending dates of the discharge data series of SSA stations we received from GRDC (date of data retrieval: September 30, 2009) vary by station. The earliest discharge data date back to year 1900 and were obtained from the station near Khartoum on the Blue Nile River. The most recent data are from year 2001 and several stations on the Orange River, the Great Fish River and the Limpopo River in South Africa. For majority of stations in SSA, river discharge data are available up to 1980s the early 1990s. The point is that all GRDC observed discharge data series have a different time frame from the one of GRACE data (2002-2009). In this case, the multi-year averaged monthly discharges for each calendar month (January-December) were calculated using the simulated and available observed discharges and were compared in calibration.

The explanation above is added to text in section 5.2, and the symbology of Fig. 2 was revised to give more description about length of the observed monthly river discharge data.

12. Page 2084, line 1, last paragraph, it is not clear how the authors calculate wi, this should be explained in more detail in the text.

— Essentially, NSE values for all GRDC stations in a sub-regional model were weighted by length of observed monthly river discharge series to get a single measure for model fit. $w_i = L_i / \sum_{n=1}^{N} L_n$, and $\sum_{n=1}^{N} L_n = 1$. L_i is the length of observed monthly discharge data series at station i, and $\sum_{n=1}^{N} L_n$ is the total length of observed monthly discharges of all stations in a sub-region.

Technical corrections 1. Page 2084, line 5, there is a comma mixing after size.

— Correction was made.

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