Abstract
To close the continental water balance, runoff data is required. However, the number of catchments with available runoff data is low. The main objective of this study is to investigate the feasibility of extracting runoff data using satellite altimetry over all possible continental surface waters. Hence, all possible footprints in 255 largest catchments is considered as virtual gauges. The considered algorithm for extracting runoff from the satellite altimetry is based on making water level discharge relationship available runoff data within the time period of satellite (at least two years) and reliable water level time series from satellite altimetry are two major factors to derive level-discharge relationship. Considering these two factors the 255 catchments are categorized into four classes: class 1. feasible, class 2. not feasible because of unavailability of at least two years runoff data within the satellite mission period, class 3. not feasible because of bad quality of extracted water level time series class 4. impossible. Computed runoff from class 1 catchments is employed to reach a better runoff data set to close the continental water balance.

1. Data
In this study runoff data has been taken from different resources:
- GRDC (global runoff data center)
- ARCTIC/INS (A regional, integrated Hydrological monitoring system for the Pan-Arctic and Mackenzie rivers)
- HYDAT (water survey of Canada, Archived hydrometric data)
- ORE HYBM [ONR: The Environmental Research Observatory, HYBM: Geodynamical, hydrological and biogeochemical control of erosion/alteration and material transport in the Amazon basin]
- USACE (US Army corps of engineers)
- USGS (US geological survey)
- DWN (Department of water Affairs, Republic of south Africa)
- DWLBC (Department of water Land and Biodiversity conservation, government of South Australia).

3. Feasibility study
According to the methodology of modeling the level-discharge relationship, assessment of feasibility of extracting runoff from satellite altimetry depends on:
1. Available discharge data within the time period of satellite
2. Reliable water level time series from satellite altimetry with

Figure 1: Topex/poseidon track ground over the globe

Therefore, based on the two criteria the chosen 255 largest catchments are categorized into four classes as:

<table>
<thead>
<tr>
<th>Class</th>
<th>No. of catchments</th>
<th>Average area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>85</td>
<td>506181.16</td>
</tr>
<tr>
<td>Class 2</td>
<td>94</td>
<td>221122.830</td>
</tr>
<tr>
<td>Class 3</td>
<td>24</td>
<td>7.084.82</td>
</tr>
<tr>
<td>Class 4</td>
<td>25</td>
<td>8.929.120</td>
</tr>
</tbody>
</table>

Table 1: Number of catchments in each class and average area

4. Extracting Runoff
Congo basin has been chosen as an example to show the created level-discharge relationship and extracted runoff (figure 3). The available runoff data for Congo basin is from November 2002 up to October 2005 (figure 4a). On the other hand, water level time series of satellite altimetry at the point $\phi = -1.54$, $\lambda = 12.54$ is computed for the period of November 2002 up to November 2008 (figure 4b).

Figure 2: The result of feasibility study which 255 largest catchments were categorized into different classes

5. Employ to the continental water balance
The assumption is that hydrologic measurements provide the most accurate known mass changes over large areas. Based on $P - ET_a = R - \Delta M/dt$, GRACE measurements can be directly related to hydrologic storage change [3]. As $ET_a$ is considered an unknown term, for the evaluation of continental water balance, only $P$ and $R$ are considered which are the most dynamic components of the water balance.

Figure 3: Congo basin with the chosen footprint at $\phi = -1.54$, $\lambda = 12.54$ and outlet at $\phi = 4.3$, $\lambda = 15.1$.

6. Conclusion
Feasibility study of extracting runoff data from satellite altimetry (TOPEX/poseidon) leads to categorizing the catchments to different classes. Due to the results, satellite altimetry is a good remote sensing tool to derive the runoff data. However, quality of water level time series obtained from satellite altimetry must be improved in case of class 1 and 3 which can be done by wave form retracking. On the other hand, using the other resources to provide the runoff data within the period of satellite mission might be a solution for class 2 catchments.

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References