

Supplementary Information part 2: Testing the improved data sets

Abstract

This supplementary material file compares whether the inclusion of additional catchments generates fundamentally different results as the original (but improved) data. Single variable regressions on the smaller (original) dataset are compared with the extended data set.

1. Introduction

In this document we tested whether the fundamental conclusions in the single variable regressions with the improved data base differed from the original conclusions in Zhang et al. [1]. This is to check how much influence the changes to the data set and the additional data might have changed the original conclusions.

First we will read in the data

We will combine the different tables, but will keep an indicator to see where the data are from.

```
Zhang_small$From <- as.numeric(Zhang_small$From)
Zhang_small$To <- as.numeric(Zhang_small$To)
Zhang_all <- bind_rows(Zhang_large, Zhang_small) %>%
  mutate(dataset = "original Zhang et al data")
new_data <- new_data %>%
  mutate(dataset = "new data")
All_data <- bind_rows(Zhang_all, new_data)
```

1.0.1. Implementing the changes to the overall data

The following code implements the changes described in the Supplementary data part 1. However, many of the changes were implemented manually into the data set. These are simply the remaining changes not implemented manually.

1. removing the duplicates.

```
All_data <- All_data %>%
  mutate(`Possible duplicate` =
    ifelse(is.na(`Possible duplicate`)==T, 0, `Possible duplicate`),
    `Possible duplicate` = as.numeric(`Possible duplicate`)) %>%
  filter(`Possible duplicate` != 1)
```

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19 2. calculating the dryness

```
# calculate dryness index
All_data <- All_data %>%
  mutate(Dryness = EO/Pa_mm)
```

20 3. remove watershed 1 (the Amazon) from the analysis

```
All_data <- All_data %>%
  filter(`Watershed #` != 1)
```

21 4. remove data set 188 and 254 Kamakia and Sambret

```
All_data <- All_data %>%
  filter(`Watershed #` != 188) %>%
  filter(`Watershed #` != 254)
```

22 5. add a column that indicates forest loss of forest gain

```
All_data <- All_data %>%
  mutate(forest_sign = ifelse(DeltaF_perc < 0, "Forest Cover Loss", "Forest Cover Gain"))
```

23 2. Methods

24 The approach is similar to Zhang et al. [1]. We run single variable regressions
25 separating large ($> 1000 \text{ km}^2$) and small catchments ($\leq 1000 \text{ km}^2$).

26 The paper by Zhang et al. [1] calculates the sensitivity of runoff as a function
27 of runoff as:

$$28 \Delta Q_f = 100 \times \frac{\Delta Q_{f,mm}}{Q}$$

29 This first equation is superfluous in this case as the data (as extracted from
30 Zhang et al. [1]) is already defined in terms of ΔQ_f .

$$31 S_f = \frac{\Delta Q_f}{\Delta F}$$

```
All_data <- All_data %>%
  filter(is.na(DeltaF_perc) == F) %>%
  mutate(S_f = DeltaQf_perc/DeltaF_perc)
```

32 In sequence we analyse:

- 33 • the relationship between forest cover change and streamflow change for
34 small and large catchments (i.e. Figure 2 in Zhang et al. [1]);
- 35 • the relationship between catchment size and the sensitivity to runoff change
36 (i.e. Figure 3 in Zhang et al. [1]); and
- 37 • the sensitivity to forest loss as a function of dryness (i.e. Figure 4 in Zhang
38 et al. [1]).

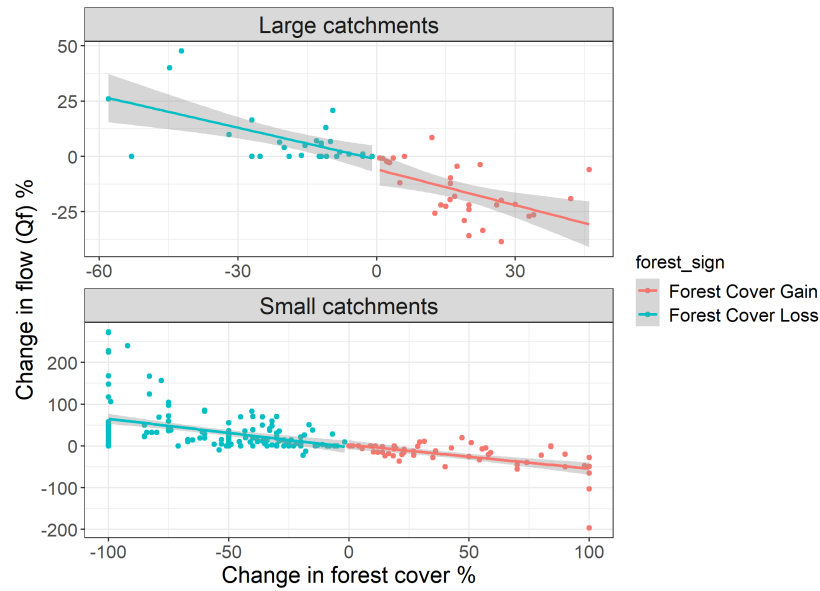


Figure 1: Changes in flow based on the catchments from the original data set

3. Results

1. The change in flow as a function of change in forest cover

First the results for the original (improved) dataset

pdf

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pdf

2

And then the results for all the catchments including the new “added” catchments.

References

- [1] Mingfang Zhang, Ning Liu, Richard Harper, Qiang Li, Kuan Liu, Xiaohua Wei, Dingyuan Ning, Yiping Hou, and Shirong Liu. A global review on hydrological responses to forest change across multiple spatial scales: Importance of scale, climate, forest type and hydrological regime. *Journal of Hydrology*, 546:44–59, 2017. ISSN 0022-1694. doi: <https://doi.org/10.1016/j.jhydrol.2016.12.040>. URL <http://www.sciencedirect.com/science/article/pii/S0022169416308307>.

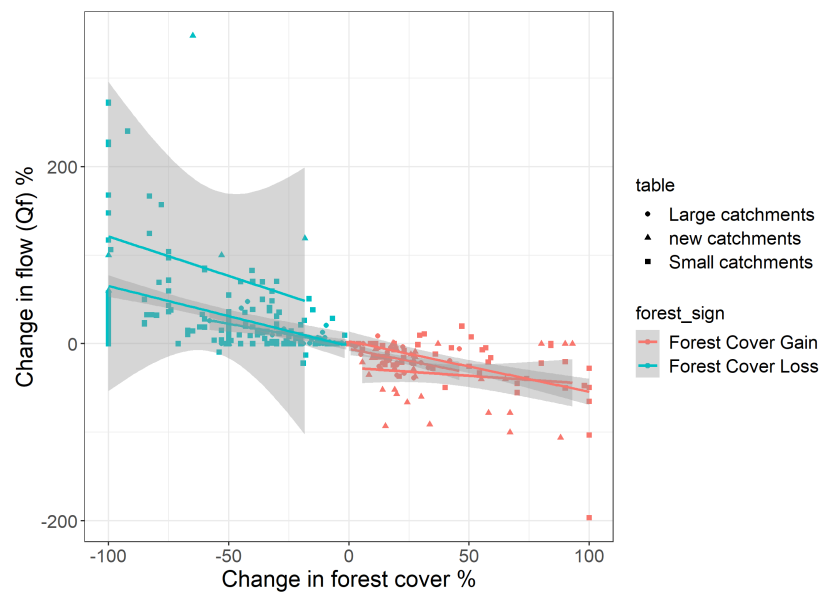


Figure 2: Changes in flow based on the catchments from the extended data set