**Supplementary information**

**Supplementary figures**

Fig.S1. Seasonal variations of components of the water budget for the catchments of this study.

**A. Combining sub catchment records**

Because of lack (Negro Basin) and partial lack (Solimoes, period 07/2013-01/2015) of river discharge records capturing the entire basin we combined records from sub-basins. For example if Ri=Qi/Ai (cm mo-1) with Qi river discharge leaving sub-catchment i and Ai area of sub-catchment i then $R\_{tot}=\frac{Q\_{tot}}{A\_{tot}}=\frac{\sum\_{i}^{}Q\_{i}}{\sum\_{i}^{}A\_{i}}=\sum\_{i}^{}R\_{i }∙\frac{A\_{i}}{\sum\_{i}^{}A\_{i}}$ . The river gauge stations used are indicated in Figure 1.

**B. Data gaps**

*Gravity anomaly data (GRACE)*

*Year and month for which data are missing*

2002-06,2002-07,2003-06,2011-01,2011-06,2011-12,2012-05,2012-10,2013-03,2013-08,2013-09,2014-02,2014-07,2014-12,2015-06,2015-10,2015-11,2016-04, 2016-09,2016-10,2016-11.

*River discharge data*

*Catchment Dates for which data are missing*

Madeira 2012.875, 2012.958, 2013.458, 2014.208, 2014.292, 2014.375, 2014.458

Solimões 2003.875, 2003.958, 2010.792, 2012.208, 2016.625

Tapajos 2005.875, 2011.292, 2012.958, 2013.042, 2014.292, 2015.292

Xingu 2008.792, 2009.792, 2010.375, 2011.458, 2011.708, 2014.792

Entire basin: 2010.792, 2012.208, 2012.875, 2012.958, 2013.458, 2014.208, 2014.292, 2014.375, 2014.458

**Table S1. River gauge stations used in this study**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| code  | Catch-ment | Station No. | Gauge station | River  | Lat (°,‘) | Lon(°,‘) | Start  | End |
| 1 | Negro | 14420000 | Serrinha | Rio Negro | 00 28  | -64 49  | 1977.63 | 2017.21 |
| 2 | Negro | 14710000 | Caracarai | Rio Branco | 01 49  | -61 07  | 1967.04 | 2017.54 |
| 3 | Madeira | 15860000 | Fazenda Vista Alegre | Rio Madeira | -04 53 | -60 01  | 2006.04 | 2016.29 |
| 4 | Solimões | 13150000 | Itapeuá | Rio Solimões/Amazonas | -04 03 | -63 01  | 1972.04 | 2016.96 |
| 5 | Solimões | 13962000 |  Arumã - Jusante  | Rio Purus | -04 43  | -62 08  | 1971.38 | 2017.71 |
| 6 | Solimões | 14100000 | Manacapuru | Rio Solimões/ Amazonas | -03 18  | -60 36  | 2007.38 | 2016.70 |
| 7 | Tapajos | 17710000 | Bubure | Rio Tapajos | -04 36  | -56 19  | 2004.88 | 2015.71 |
| 8 | Xingu | 18850000 | Altamira | Rio Xingu | -03 12  | -52 12  | 1971.04 | 2014.96 |

**Table S2. Period covered by ET estimates of this study**

|  |  |  |
| --- | --- | --- |
| Catchment | Start time | End time |
| Madeira | 01/2006 | 03/2016 |
| Negro | 05/2002 | 12/2016 |
| Solimões | 05/2002 | 12/2016 |
| Tapajos | 11/2004 | 09/2015 |
| Xingu | 05/2002 | 12/2014 |
| Entire Basin | 01/2006 | 03/2016 |

**Table S3. Amazon ET uncertainty estimates**

Month Precip Q/A dS/dt ET S ⌠P ⌠R ⌠dSdt ET\_error % error % error

 (cm/mo) (average of monthly errors)

 (from seasonal means)

1 15.05 9.50 0.66 5.43 -11.49 3.15 0.47 7.04 1.62 37.20 29.82

2 18.46 9.24 2.48 8.07 -10.61 3.83 0.46 7.04 1.44 42.69 17.86

3 21.67 10.24 5.61 5.83 -6.43 4.44 0.51 7.04 1.66 37.24 28.48

4 27.88 12.38 8.54 6.97 2.43 5.65 0.62 7.04 1.61 35.61 23.05

5 35.72 18.82 6.59 10.31 9.77 7.17 0.94 7.04 1.25 21.62 12.09

6 30.97 22.28 1.42 7.26 15.28 6.15 1.11 7.04 1.86 57.74 25.60

7 26.91 22.18 -3.71 9.22 13.04 5.31 1.11 7.04 1.66 93.64 18.04

8 20.84 18.64 -7.09 9.30 6.79 4.14 0.93 7.04 1.10 21.30 11.82

9 15.61 13.12 -7.43 9.92 -1.16 3.15 0.66 7.04 0.84 9.79 8.45

10 15.69 9.60 -4.58 10.66 -7.20 3.17 0.48 7.04 0.80 9.31 7.51

11 15.69 9.19 -1.82 8.33 -9.53 3.19 0.46 7.04 0.99 13.41 11.91

12 16.65 8.96 -0.45 8.14 -12.35 3.43 0.45 7.04 1.56 63.74 19.11

**Table S4 Comparison of ET estimates of Maeda et al. 2017 and our study**

1. **Evapotranspiration estimates (cm mo-1) of Maeda et al. 2017**

*Purus Upper Western/Upper Upper & Central Tapajos*

 *Solimões Negro Madeira*

11.9 6.6 11.5 11.1 11.2

11.8 7.4 12.7 11.6 11.9

10.7 7.2 12.8 9.9 10.8

 9.8 6.9 13.1 8.9 10.2

 9.1 7.7 13.2 8.1 10.0

 9.2 9.2 12.6 8.0 10.4

10.1 10.6 12.2 7.9 10.4

11.3 10.6 12.2 8.5 10.9

12.5 10.11 13.4 9.2 11.9

13.0 8.5 12.9 9.4 12.0

13.9 7.6 12.5 10.3 12.4

12.7 6.5 11.2 10.6 11.2

**Total**

11.3 8.2 12.5 9.5 11.1

Solimões basin of Maeda et al. 2017 includes only Western Solimões basin – which covers approximately one third of the area of the catchment area used in our study.

Madeira basin of Maeda et al. 2017 includes upper and Central basin – approximately two thirds of the area used in our study.

Negro basin of Maeda et al. 2017 includes only Western part of the basin used in our study – approximately two fifth of the area used in our study.

1. **Evapotranspiration estimates (cm mo-1) of this study based on TRMM precipitation estimates**

 **Amazon Solim**õ**es Negro Madeira Tapajos Xingu**

 9.2 8.6 4.9 10.7 10.7 15.0

 8.8 8.8 6.7 11.7 11.2 16.1

 8.9 10.0 5.8 8.7 8.3 14.0

 7.5 6.9 7.0 8.0 8.0 10.6

 7.5 7.2 10.3 6.8 7.7 9.3

 6.6 7.2 7.3 5.3 9.4 10.1

 7.4 7.2 8.4 6.6 11.3 11.4

 7.9 7.1 9.3 7.9 10.8 11.3

 9.7 8.6 9.9 9.7 11.2 13.1

10.4 10.7 10.7 11.1 13.5 14.7

10.5 10.6 8.3 10.5 13.4 13.8

 9.0 9.7 8.1 10.2 11.1 14.2

**Total**

8.6 8.9 8.1 8.6 10.5 12.8

**Table S5 Amazon annual mean precipitation (TRMM) and temperature (CRU) 1997 to 2017**

Year Tmax (C) Tmin (C) Tave (C) Annual Mean Precip

 (cm)

1997 30.17 20.07 25.12 -

1998 30.04 20.46 25.25 222.58

1999 29.25 19.77 24.51 239.62

2000 29.67 19.73 24.70 238.61

2001 30.02 20.09 25.06 235.64

2002 30.43 20.46 25.45 237.04

2003 30.43 20.37 25.40 229.06

2004 30.06 20.26 25.16 225.82

2005 30.54 20.21 25.37 224.55

2006 30.29 20.33 25.31 248.72

2007 30.24 20.06 25.15 239.13

2008 29.89 20.02 24.96 241.25

2009 30.30 20.46 25.38 247.86

2010 30.82 20.55 25.68 214.91

2011 30.42 20.54 25.48 233.40

2012 30.47 20.58 25.52 233.96

2013 30.28 20.69 25.49 237.73

2014 30.20 20.69 25.45 242.20

2015 30.87 21.12 26.00 216.30

2016 30.91 20.82 25.87 212.53

2017 - - - 233.04