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Toward continental hydrologic–hydrodynamic modeling in South America

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Supplementary Material

S1. Details about the MGB hydrological–hydrodynamic model

In this section, a brief overview of the MGB structure used for hydrological modeling in South America is presented. Basically, this is a vector-based model that uses conceptual equations to simulate the terrestrial hydrological cycle, including soil water and energy budget, evapotranspiration, canopy interception, surface, subsurface and groundwater runoff, as well as flow routing along river channels (**Figure S1.1**). The following sections are described according to the initial model development by Collischonn et al., (2007) and further improvements by Paiva et al., (2011), Pontes et al., (2017) and Fleischmann et al., (2018).

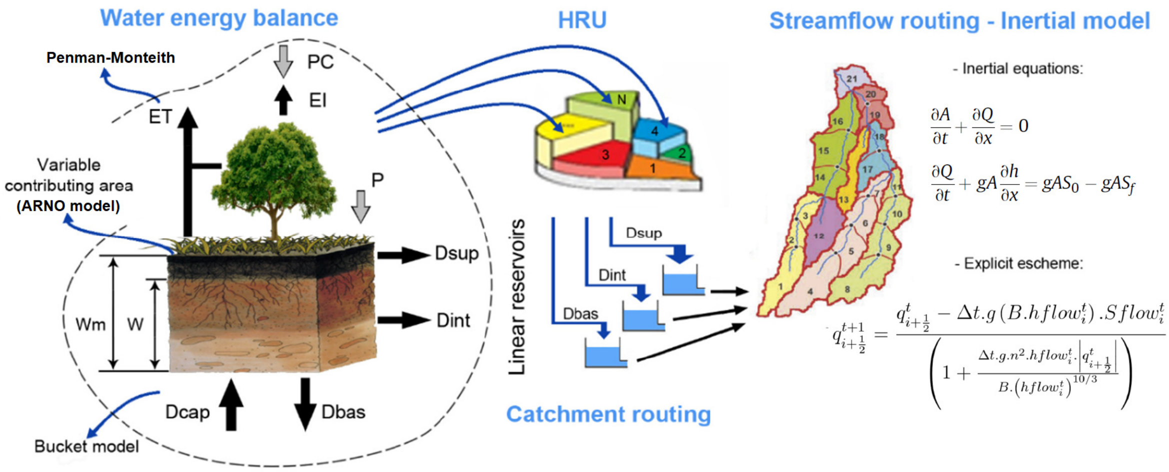


Figure S1.1. Schematic representation of MGB model general structure.

S1.1 Water and energy balance

In the model, the basin is discretized into unit-catchments, which are further divided in hydrological response units (HRU) (Beven, 2001) that are usually produced by the combination of soil and land cover maps. Vertical water and energy budgets are computed independently for each HRU of each unit-catchment. Soil water balance is computed considering a single soil layer (bucket model), according to:

$$W_{i,j}^{t} = W_{i,j}^{t-1} + \left(P_i - ET_{i,j} - Dsup_{i,j} - Dint_{i,j} - Dbas_{i,j} + Dinf_{i,j}\right)\Delta t \qquad \text{Eq. S1.1.1}$$

Where: t, i and j, are indexes related to time step, unit-catchment and HRU, respectively; Wm is the water storage capacity in the soil layer [mm]; P is the precipitation that reaches the soil [mm Δt^{-1}]; ET is the evapotranspiration from soil [mm Δt^{-1}]; $Dsup$ is the surface runoff [mm Δt^{-1}]; $Dint$ is the subsurface flow [mm Δt^{-1}]; $Dbas$ is the flow to the groundwater reservoir [mm Δt^{-1}]; $Dinf$ is the infiltration of flooded areas to the soil [mm Δt^{-1}] and; Δt is the time step for water budget, usually equal to 1 day.

Soil infiltration and runoff are computed based on the variable contributing area concept of the ARNO model (Todini, 1996):

$$Dsup_{i,j} = \Delta t P_i - \left(Wm_j - W_{i,j}^{t-1}\right), for\ y \le 0$$

Eq. S1.1.2

$$Dsup_{i,j} = \Delta t P_i - \left(Wm_j - W_{i,j}^{t-1}\right) + Wm_j \left[\left(1 - \frac{W_{i,j}^{t-1}}{Wm_j}\right)^{\frac{1}{b_j+1}} - \frac{\Delta t P_i}{Wm_j\,(b_j+1)}\right]^{b_j+1}, \quad for\ y > 0$$

Eq. S1.1.3

$$y = \left[\left(1 - \frac{W_{i,j}^{t-1}}{Wm_j}\right)^{\frac{1}{b_j+1}} - \frac{\Delta t P_i}{Wm_j\,(b_j+1)}\right]$$

Eq. S1.1.4

Where W is the current soil water storage [mm]; Wm is the maximum water storage capacity [mm]; b is a parameter that controls the distribution of water storage capacity of the soil [-]; P is the precipitation that reaches the soil [mm];

Subsurface flow is obtained using a function similar to the Brooks and Corey unsaturated hydraulic conductivity equation (Rawls et al., 1993):

$$Dint_{i,j} = Kint_j \left(\frac{W_{i,j} - Wz_j}{Wm_j - Wz_j}\right)^{\left(3+\frac{2}{\lambda_j}\right)}$$

Eq. S1.1.5

Where $Kint$ is the saturated hydraulic conductivity [mm Δt^{-1}], λ is the soil porosity index [-] and Wz is the lower limit below which there is no subsurface flow ($W_Z = 0.1Wm$).

Percolation from soil layer to groundwater is calculated according to a simple linear relation between soil water storage and maximum soil water storage:

$$Dbas_{i,j} = Kbas_j \left(\frac{W_{i,j} - Wc_j}{Wm_j - Wc_j} \right)$$

Eq. S1.1.6

Where *Kbas* is a parameter that gives the percolation rate to groundwater in the case of saturated soil [mm Δt^{-1}].

Infiltration from floodplain into soil column is computed as a two–way coupled scheme between hydrological vertical balance and hydrodynamic module (see next section, **Eq. S1.2.9**). It is assumed that infiltration rate is linearly dependent on the degree of soil saturation, thus reaching its maximum when soil is completely dry (Fleischmann et al., 2018).

$$D^t_{inf_i} = \frac{A^t_{fl_i}}{A_i} . K_{inf} \left(1 - \frac{W^t_i}{Wm} \right)$$

Eq. S1.1.7

Where Afl_i is the flooded area at unit-catchment *i* [km²], *A* is the unit-catchment area [km²], K_{inf} the infiltration rate that occurs when the whole unit-catchment is flooded and soil is totally dry [mm Δt^{-1}], *w* is the soil water content and *Wm* is the maximum soil water storage.

Runoff generated (*Dsup*, *Dint* and *Dbas*) within unit-catchments is routed to the drainage network using three independent linear reservoirs (**Eqs. S1.1.8–S1.1.10**). For surface and subsurface reservoirs, streamflow releases (*Q*) are controlled by the time of concentration computed with Kirpich formula similarly to Ludwig and Bremicker (2006).

$$Q_{sup_i} = \frac{V_{sup_i}}{Cs \left[3600 \left(0.868 \frac{L_i}{\Delta H_i} \right)^{0.385} \right]}$$

Eq. S1.1.8

$$Q_{int_i} = \frac{V_{int_i}}{Ci \left[3600 \left(0.868 \frac{L_i}{\Delta H_i} \right)^{0.385} \right]}$$

Eq. S1.1.9

$$Q_{bas_i} = \frac{V_{bas_i}}{Cb}$$

Eq. S1.1.10

Where *Vsup*, *Vint* and *Vbas* are the surface, subsurface and groundwater reservoir volumes, respectively [m³]; L_i and ΔH_i are, respectively, the length and the elevation difference of the largest flowpath between unit-catchment border and the main river [m]; *Cs* and *Ci* are parameters that correct the prior estimate of time of concentration (given by Kirpich formula) [-]; *Cb* is the groundwater residence time, which can be estimated from hydrograph recession considering a long dry period [s].

Precipitation is assumed to be stored in canopy until maximum interception storage capacity is reached, which is determined for each HRU based on the vegetation leaf area index. Energy budget and evaporation from soil, vegetation and canopy to the atmosphere is estimated by the Penman–Monteith equation (Shuttleworth, 1993), using an approach similar to Wigmosta et al., (1994):

$$E = \left[\frac{\Delta \left(R_L - G \right) + \rho_a c_p \frac{e_s - e_d}{r_a}}{\Delta + \gamma \left(1 + \frac{r_s}{r_a} \right)} \right] \frac{1}{\lambda \rho_w}$$

Eq. S1.1.11

Where E is the potential evaporation rate [m s^{-1}]; R_L is the net radiation [MJ m^{-2} s^{-1}]; *G* is the soil heat flux [MJ m^{-2} s^{-1}]; λ is the latent heat of vaporization [MJ kg^{-1}]; Δ is the gradient of the saturated vapour pressure–temperature function [kPa ºC^{-1}]; *A* is the available energy [MJ m^{-2} s^{-1}]; ρa is the air density [kg m^{-3}]; ρ_w is the specific mass of water [kg m^{-3}]; c_p is the specific heat of moist air [MJ kg^{-1} ºC^{-1}]; ($e_s - e_d$) represents the vapor pressure deficit [kPa]; γ is the psychrometric constant [kPa ºC^{-1}]; r_s is the surface resistance of the land cover [s m^{-1}] and r_a is the aerodynamic resistance [s m^{-1}].

Firstly, intercepted water is evaporated (*EI*) at the potential rate *E*. The evapotranspiration (*ET*) of the vegetated soil (soil evaporation + plant transpiration) is calculated using **Eq. S1.1.11**, weighted by the remaining evaporative demand ([*E*–*EI*]/*E*) in order to respect the overall energy balance. In addition, *ET* is reduced in situations of water stress, and it is assumed that soil conditions restrict evapotranspiration if current soil water storage is below a threshold value given by $W_L = Wm / 2$. In the range between this limit and the wilting point, surface resistance increases according to:

$$r_s = r_{s_{j,m}} \left(\frac{W_L - W_{wp}}{W_{i,j} - W_{wp}} \right)$$

Eq. S1.1.12

Where W_{wp} is the wilting point, equal to 10% of maximum soil capacity (Wm) [mm]; $r_{s_{j,m}}$ is the vegetation-dependent minimum surface resistance, in conditions not affected by soil moisture [s m^{-1}] and m is the month index.

S1.2 Flow routing (local inertial equation)

Flow in natural channels is governed by 1D full Saint–Venant equations (Cunge et al., 1980), expressed by continuity (**Eq. S1.2.1**) and momentum conservation (**Eq. S1.2.2**):

$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} = q, \qquad \text{Eq. S1.2.1}$$

$$\underset{\text{Local Acceleration}}{\frac{\partial Q}{\partial t}} + \underset{\text{Convective Acceleration}}{\frac{\partial}{\partial x}\left(\frac{Q^2}{A}\right)} + \underset{\text{Pressure + Bed gradients}}{gA\frac{\partial\left(h+z\right)}{\partial x}} + \underset{\text{Friction}}{\frac{gn^2\left|Q\right|Q}{R_h^{4/3}A}} = 0 \qquad \text{Eq. S1.2.2}$$

Where Q is the river discharge [m³ s^{-1}], q is the lateral inflow [m³ s^{-1}], A is the flow cross-section area [m²], h is the flow depth [m], z is the channel bed elevation, relative to a datum [m]; R_h is the hydraulic radius [m], g is the acceleration due to gravity [m s^{-2}], and n is the Manning coefficient [s m$^{-1/3}$].

In order to deal with a wide range of flow conditions, the MGB solves the momentum equation using the local inertial approximation proposed by Bates et al., (2010). Using a forward in time finite difference scheme and neglecting the convective acceleration term, the momentum equation can be written as:

$$\frac{Q^{t+1}-Q^t}{\Delta t} + gA\frac{\partial\left(h^t+z\right)}{\partial x} + \frac{gn^2\left|Q^t\right|Q^t}{R_h^{4/3}A} = 0 \qquad \text{Eq. S1.2.3}$$

In **Eq. S1.2.3**, flow variables in the friction term ($|Q^t|Q^t$) are written semi-implicitly ($|Q^t|Q^{t+1}$), which in turn can be rearranged into an explicit form of flow calculation:

$$Q^{t+1} = \frac{Q^t - \Delta t g A\frac{\partial\left(h^t+z\right)}{\partial x}}{\left(1+\frac{\Delta t g n^2\left|Q^t\right|}{R_h^{4/3}A}\right)} \qquad \text{Eq. S1.2.4}$$

Assuming a rectangular channel and approximating the hydraulic radius with the flow depth (*h*) for wide, relatively shallow rivers, we can divide **Eq. S1.2.4** by the flow constant width (*B*) to obtain an equation in terms of flow per unit width:

$$q^{t+1} = \frac{q^t - \Delta t g h^t \frac{\partial\left(h^t+z\right)}{\partial x}}{\left(1 + \frac{\Delta t g h^t n^2 |q^t|}{(h^t)^{10/3}}\right)}$$

Eq. S1.2.5

The resulting local inertial equation (Bates et al., 2010) plays an important role for large-scale simulations in lowland rivers and floodplains areas, and some advantages over a diffusive wave model (which neglects both acceleration terms) include a better physical representation of shallow water flows, as well as the stability improvement for both large depths and small surface water slopes (Yamazaki et al., 2013; de Almeida et al., 2013). Following Almeida et al., (2012) and Neal et al., (2012), the explicit finite difference scheme is applied to a "staggered grid", so that flows at interfaces are used to update water depths at the centers of the numerical grid (i.e., centered in space approximation). Therefore, the momentum equation is written at its final form:

$$q_{i+\frac{1}{2}}^{t+1} = \frac{q_{i+\frac{1}{2}}^{t} - \Delta t.g\left(B.hflow_i^t\right).Sflow_i^t}{\left(1 + \frac{\Delta t.g.n^2.hflow_i^t.\left|q_{i+\frac{1}{2}}^{t}\right|}{B.\left(hflow_i^t\right)^{10/3}}\right)}$$

Eq. S1.2.6

Where: Δt is the routing model time step [s]; $q^t{}_{i+1/2}$ and $q^{t+1}{}_{i+1/2}$ are, respectively, the flow from previous and current time step divided by channel width, at the outlet of unit catchment *i* [$m^2\ s^{-1}$]; $Sflow_i$ and $hflow_i$ are, respectively, the water surface slope [$m\ m^{-1}$] and the effective water depth at the interface between current (*i*) and downstream (*i+1*) unit-catchment [m].

Note that indexes *i+1/2* are positions of the numerical grid corresponding to the outlets of unit-catchments, which are defined at grid interfaces. Using a similar approach of Neal et al., (2012), *Sflow* and *hflow* are computed as:

$$Sflow_i^t = \frac{\left(h_{i+1}^t + z_{i+1}\right) - \left(h_i^t + z_i\right)}{\Delta x_i}$$ Eq. S1.2.7

$$hflow_i^t = max\left[h_{i+1}^t + z_{i+1}; h_i^t + z_i\right] - max\left[z_{i+1}; z_i\right]$$ Eq. S1.2.8

Where Δx_i is the flow distance, computed as the average between channel lengths L_i and L_{i+1} ($\Delta x_i \approx L_i \approx L_{i+1}$, according to the fixed-length river discretization, see **sect. S1.3**); h_i and h_{i+1} are the flow depths; z_i and z_{i+1} are the channel bed elevations, respectively, at unit-catchments i and i+1.

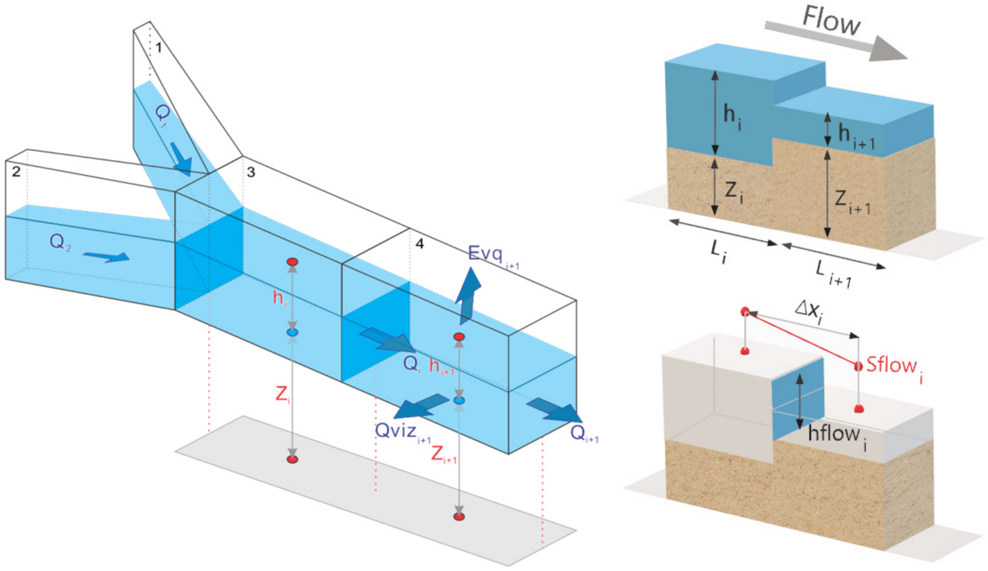


Figure S1.2.1. Schematic representation of MGB flow calculation units.

Discharge is computed after solving **Eq. S1.2.6** and multiplying the q variable by channel width (B), which means that the effective flow area is limited by the rectangular channel geometry. Similar to Yamazaki et al., (2011) and Luo et al., (2017), water mass is instantaneously exchanged between channel and floodplain when bankfull depth is exceeded, whereas water surface elevation of both storages is assumed equal within a given unit-catchment. Total volume (channel + floodplain) is updated using the continuity equation, expressed in terms of:

$$V_i^{t+1} - V_i^t = \left[\sum Q_{in}^t - \sum Q_{out}^t - \left(Evq_i^t - D_{inf_i}^t\right) A_{fl_i}^t / 1000\right] \Delta t$$ Eq. S1.2.9

Where V_i is the total volume stored in channel and floodplains, for unit-catchment *i* [m^3]; Q_{in} and Q_{out} are, respectively, the inflow and outflow discharge of unit-catchment *i* [m^3 s^{-1}]; Evq_i is the evaporation loss [mm Δt^{-1}] and; $Dinf_i$ is the infiltration from floodplains to soil column [mm Δt^{-1}]. Note in **Figure S1.2.1** that MGB can also route water in multiple directions downstream (Q_{viz}) (Pontes et al., 2017), but this configuration is not used in the current South America version.

Evaporation losses are considered by assuming flooded area as open water (i.e., $r_s = 0$) and applying the Penman–Monteith equation (**Eq. S1.1.11**). Therefore, when flooding occurs in a given unit-catchment, the surface area available for soil water budget is reduced proportionally from each HRU, while rainfall over flooded area produces direct surface runoff.

After solving all V^{t+1} in **Eq. S1.2.9**, these values are used to obtain flow depths by interpolating the water volume at each unit-catchment using channel/floodplain profiles (see section **S1.6** for details). Updated flow depths are then used to recompute both *Sflow* and *hflow* variables using **Eqs**. **S1.2.7** and **S1.2.8**, so that flows can be obtained for next time step.

An advantage of the explicit inertial formulation is that model time step is governed by the Courant–Friedrichs–Lewy (CFL) condition. Therefore, the maximum acceptable time step is adaptive and changes according to maximum water depth (**Eq. S1.2.10**):

$$\Delta t = \alpha \frac{\Delta x}{\sqrt{g h_{max}}} \qquad \text{Eq. S1.2.10}$$

Where Δx is the flow distance (according to fixed-length discretization); h_{max} is the maximum flow depth in model domain and α is a coefficient that varies between 0.2–0.7 (Bates et al., 2010).

Despite the CFL condition provides the optimum time step needed for flow computation, some issues can arise especially in rivers with higher slopes, which are expected to produce model instabilities. In cases where supercritical flows occur, a flow limiter (**Eq. S1.2.12**) is then invoked to force the Froude number (**Eq. S1.2.11**) below to unity, so that model stability can be further enhanced:

$$F = \frac{v}{\sqrt{gh}} = \frac{Q/A}{\sqrt{gh}} < 1$$

Eq. S1.2.11

$$Q \begin{cases} min\left[Q; B\sqrt{hflow^{1.5}g}\right] & for \;\; Q \geq 0 \\ max\left[Q; -B\sqrt{hflow^{1.5}g}\right] & for \;\; Q < 0 \end{cases}$$

Eq. S1.2.12

Where *F* is the Froude number [-]; *v* is the mean flow velocity [m s^{-1}]; *B* is the channel width [m]. Note that the flow limiter also considers reverse flows, which can occur due to backwater effects.

S1.3 Spatial representation of river network in MGB model: definition of unit-catchments by a fixed-length river discretization

As unit-catchments derived from topography (sub-basin approach) are defined between river junctions (Maidment, 2002), the resulting river reaches are characterized by a high variability of lengths that are not suitable for hydrodynamic routing. Therefore, we adopted a fixed-length vector river discretization in order to provide even (and predefined) flow distances between unit-catchments, as well as to facilitate coupling of both hydrological and hydrodynamic modules of MGB. This approach was first mentioned in Pontes et al., (2017) and has been included in the IPH-Hydro Tools GIS package (Siqueira et al., 2016b). Using grids of flow direction, flow accumulation and river networks, the fixed length discretization can be conducted through the following sequence of steps:

S1.3.1. Step 1 – Marking outlets

The first step is to identify all the intermediate outlet points in the stream network. An "intermediate outlet" refers to the very downstream pixel of a given river reach (i.e., between two junctions), as can be seen in the orange boxes presented in **Figure S1.3.1a**. For each pixel in the flow direction grid, if two or more neighboring pixels are drained to the analyzed one, provided that all of them are over the extracted drainage, then a junction is found. Using a 3 × 3 window centered at this point, the grid positions of nearby upstream draining pixels (i.e., intermediate outlets) are stored together with their respective flow accumulated areas. This procedure is repeated until the entire grid is evaluated, and by the end the positions and accumulated area of basin outlet are also stored in conjunction with the intermediate outlets.

S1.3.2. Step 2 – Delineating reaches and unit-catchments by a length threshold

The second step is to segment streams using a specific length as a threshold value, thus providing an even distribution of flow distances. For this, grid positions of the intermediate outlets are initially sorted descending according to their flow accumulated area, so the outlet of the main stream is processed at first. Following the schematic presented in **Figure S1.3.1b**, the procedure then starts at the basin outlet point (green square) using a value of accumulated length equal to 0. Tracing in the upstream direction, the length is accumulated pixel by pixel using Euclidean local distances and the Distance Transforms method (Butt and Maragos, 1998; Paz and Collischonn, 2007), and an identifier value (ID) is assigned to each pixel along the flow path to further distinguish between reaches. Whenever the threshold value of distance is exceeded, as highlighted by the break lines in **Figure S1.3.1b**, the ID is increased by one unit and the accumulated length is reset to zero. This procedure must be constantly repeated, but when a junction is found along the current flowpath, the algorithm selects the upstream pixel with the highest accumulated area (blue squares) to keep tracing until the threshold value of length is met. However, if the length threshold is not achieved when the headwater pixel is found, an extension of the drainage network (dashed line in **Figures S1.3.1b**, **S1.3.1c** and **S1.3.1d**) is created following the pixel with the highest upstream accumulated area. In other words, it results in a "dynamic area threshold" for first order streams, but in this case, length can be lesser than the threshold value once it is topographically limited by headwater catchment boundaries.

After defining all branches in the basin main river, the next intermediate outlet with the highest value of accumulate area is selected (green square) to proceed with the segmentation process, as shown in **Figure S1.3.1c**. However, it is important to mark outlet pixels over the previously segmented flow path as "checked" (white squares). Because the algorithm starts from an intermediate outlet (accumulated length = 0) when tracing in upstream direction, checked pixels must be neglected to avoid redefinition of already processed reaches. Following these constraints, the procedure continues until the entire river network is segmented (**Figure S1.3.2a**).

Finally, all pixels draining to a given reach (i.e., with the same ID) belong to the same unit-catchment, as presented in **Figure S1.3.2b**. The discretization procedure also creates an irregular grid according to topography, despite of the unit-catchment bending at tributaries due to the length threshold constraint.

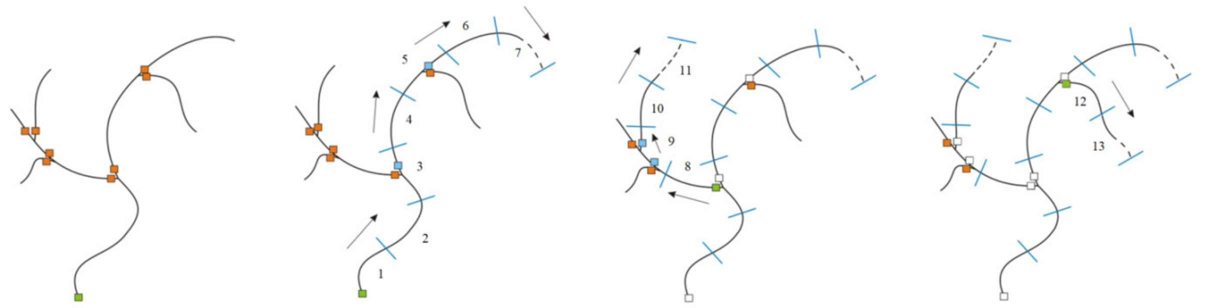


Figure S1.3.1. Procedure of delineating reaches by a length threshold value: (a)Marking intermediate (orange squares) and basin outlet (green square) points, (b)Segmentation starting from basin outlet (green square) and junction overpass following outlet pixels with highest accumulated area (blue squares), (c)Segmentation starting from the next intermediate outlet (green square), ranked in descending order of accumulated area. Intermediate outlet pixels located at previously traced flowpaths (white squares) are ignored if selected for starting a new segmentation.

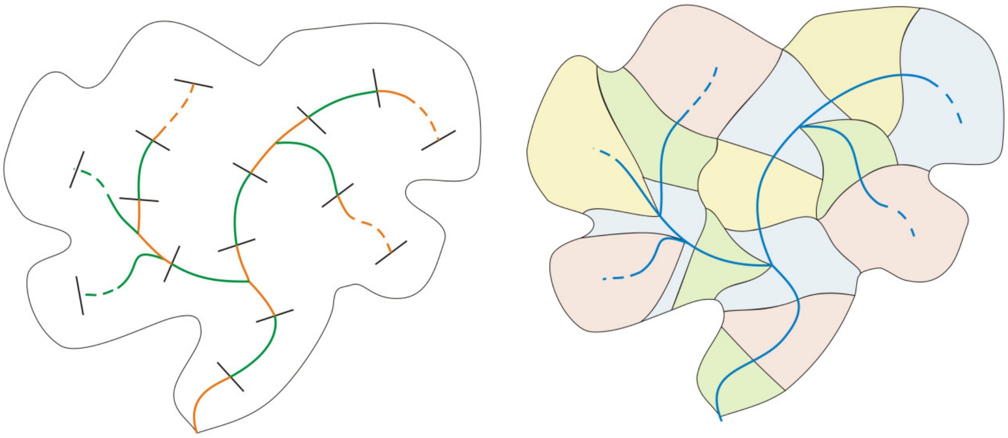


Figure S1.3.2. Schematic representation of the resulting fixed-length vector-based discretization: (a)Final river segmentation: river reaches are separated by break lines and distinguished by colors (orange and green) for visualization purposes; (b)All pixels draining to the same river reach correspond to a given unit-catchment.

Figure S1.3.3 shows an example of the resulting unit-catchments for South America version of MGB, using the above fixed-length discretization approach. Unit-catchments were produced using the flow direction map of HydroSHEDS (Lehner et al., 2008), an upstream area threshold of 1000 km² for river networks and a length threshold of Δx = 15 km. Each unit-catchment centroid represents the location for which precipitation fields are interpolated, as required for the rainfall-runoff module of MGB.

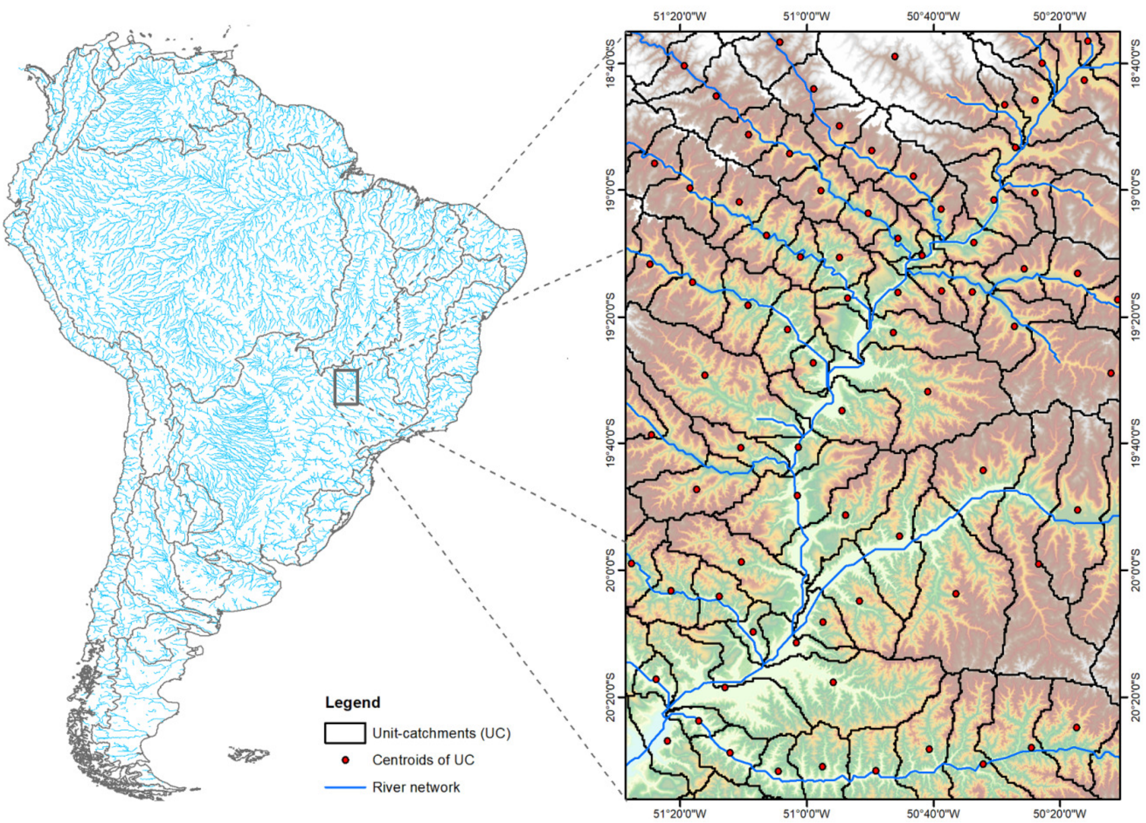


Figure S1.3.3. River drainage networks of South America derived from HydroSHEDS flow direction map (Lehner et al., 2008) (left); Unit-catchments defined with a fixed-length river discretization, using a threshold of Δx = 15 km) (right). Red points represent unit-catchment centroids where rainfall is interpolated.

S1.4 Channel geometry

For the assumption of a rectangular channel, river cross-section geometry is parameterized using downstream hydraulic geometry relationships (HG):

$$W_{bf_i} = aA_i^b \qquad \text{Eq. S1.4.1}$$

$$D_{bf_i} = cA_i^d \qquad \text{Eq. S1.4.2}$$

Where D_{bf_i} is the bankfull depth [m] for unit-catchment i; W_{bf_i} is the channel width [m] for unit-catchment i; A_i is the drainage area for unit-catchment i [km²]; a, b, c and d are fitting parameters, respectively, for river depth and width according to drainage area.

Table S1.4.1 and Figure S1.4.1 show an overview of channel geometries adopted for South America version of MGB, which were retrieved from literature. It is worth noting that Paiva et al., (2011, 2013) and Pontes (2016) are past applications of MGB model in Amazon and La Plata basins, respectively.

Table S1.4.1. Sources of river geometry parameters (bankfull width and depth) for South American rivers.

Basin/River	Reference	River Geometry	Local adjustments
Amazon main stem (A_d> 2500000 km^2)	Beighley and Gummaldi (2011)	HG based on drainage area	-
Japura, Negro, Solimoes, Xingu and Tapajos	Paiva et al., (2013)	HG based on drainage area	-
Purus and Jurua	Paiva et al., (2011)	HG based on drainage area	-
La Plata (Parana, Paraguay and Uruguay)	Pontes (2016)	*HG based on drainage area (Uruguay and Upper Parana basins) *Widths of main rivers obtained from Satellite imagery (Paraguay and lower Parana basins)	Bermejo River (A_d> 55000 km^2): $W = 270.82\exp(-0.00005\ A_d)$ Uruguay River (A_d > 50000 km^2): $W = 0.01A_d^{0.95}$
Other South American Rivers	Andreadis et al., (2013)	HG based on mean annual peak flow	Sao Francisco river (A_d> 120000 km^2): D = 12m

A_d = Drainage Area; W = Width; D = Depth;

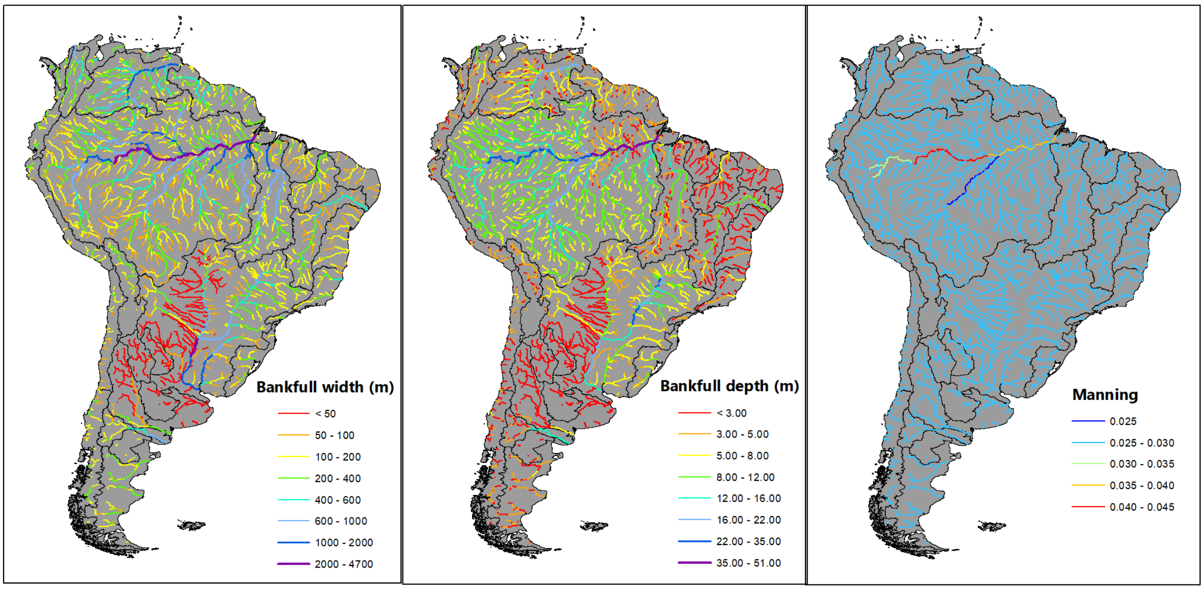


Figure S1.4.1. Adopted bankfull width and depth values based on works by Beighley e Gummaldi (2011), Andreadis et al., (2013), Paiva et al., (2011, 2013) and Pontes (2016). Manning coefficient was globally set to 0.03, with further adjustments based on Paiva et al., (2013)

A1.5 Adjustment of river bed profiles

River bed elevations (*z* in **Eq. S1.2.8**) are estimated subtracting the channel depths from the river bank heights derived from a spaceborne DEM (in this case, the Bare-Earth SRTM version 1 DEM, (O'Loughlin et al., 2016)). However, for large-scale hydrodynamic routing it is essential to reduce noise in river bed profiles to avoid the excess of water leaving channels to the floodplains, especially when coarse resolution (both spatial and vertical) DEMs are used (Paiva et al., 2011; Yamazaki et al., 2012; Chen et al., 2018). Also, noise in river bed profiles are likely to be even more pronounced because of the superposition of HydroSHEDS drainage networks over the Bare-Earth SRTM, since the latter is not hydrologically corrected (for instance, after using a depression-filling correction (e.g. Jenson and Domingue, 1988)).

To handle this, we applied a noise reduction method based on a simple linear regression to obtain smoothed river bank heights. For a given unit-catchment, all DEM pixels located over the river reach of Δx = 15 km (according to fixed-length discretization) are used to adjust a linear regression. River bank height is set as the smoothed elevation associated to the center pixel of the river reach (**Figure S1.5.1**), without modifying DEM original values. Indeed, a larger benefit of the smoothing procedure is expected if a large number of pixels is sampled, i.e., by adopting a larger Δx, albeit this is not a good option due to the potential numerical instabilities associated to flow routing. **Figure S1.5.2** shows an example of the smoothed bed profile in comparison to the original one extracted from Bare-Earth SRTM (O'Loughlin et al., 2016).

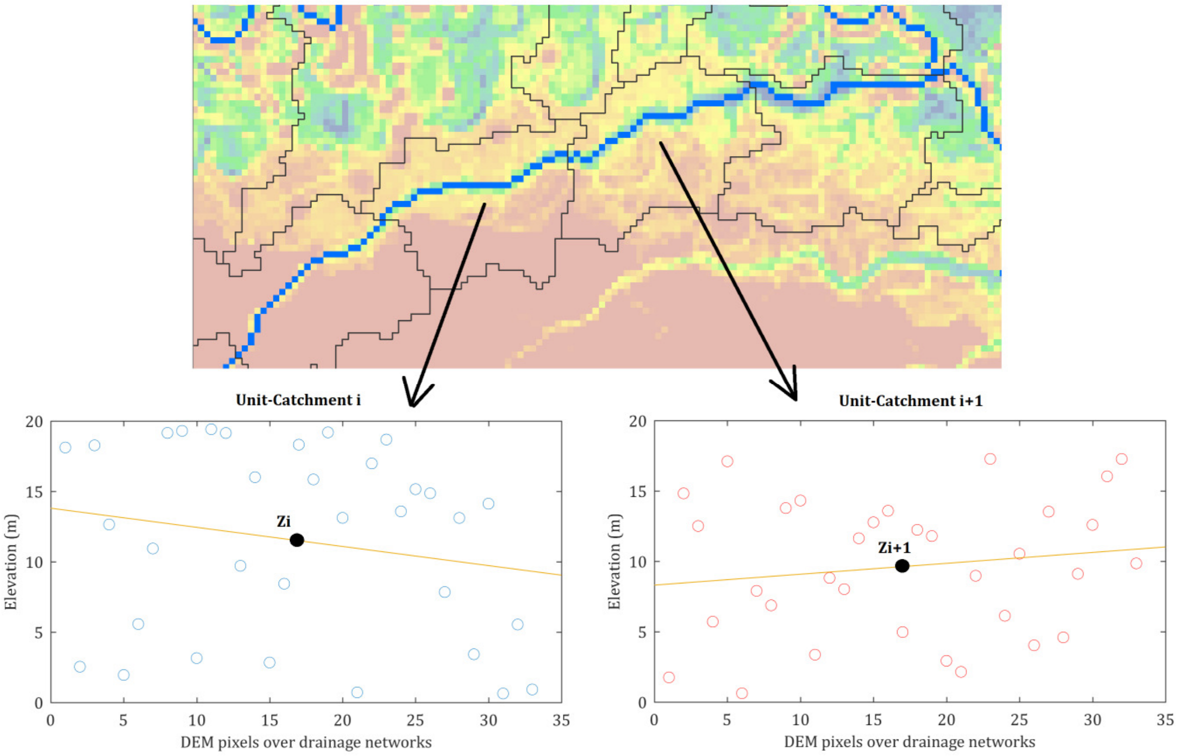


Figure S1.5.1. Schematic representation of noise reduction in river bed profiles. Circles represent the elevation of DEM pixels located over river networks, which are used to adjust a linear regression (yellow line) within a same unit-catchment. Pixel numbers are ordered from upstream to downstream, so that bank heights are set in the middle of river reaches using the linear regression slope.

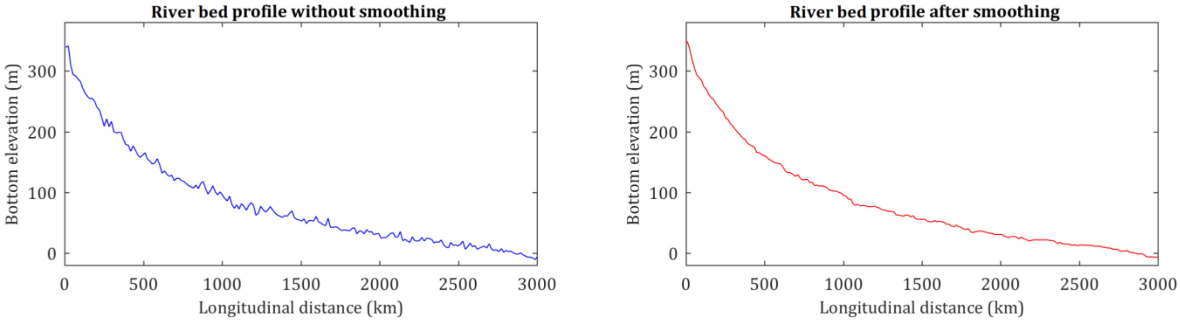


Figure S1.5.2. Comparison between non-smoothed (left) and smoothed (right) river bed profile extracted from Bare-Earth SRTM. River profiles in this example were extracted for Purus (380000 km²) mainstem, a tributary of the Amazon.

S1.6 Sub-grid (or sub- unit-catchment) floodplain topography

In order to represent floodplain inundation, a hypsometric curve relating flow depth, flooded area and water volume stored in both floodplain and channel for a given unit-catchment is derived from its underlying DEM. Regarding the floodplain, concepts of the HAND model (Rennó et al., 2008) were adopted to compute water volume emulating the inundation process from lower to higher elevations (**Figure S1.6.1**), which is the same approach adopted in CaMa-Flood by Yamazaki et al., (2013).

In this method, pixels characterized as main channels, i.e., over the drainage network, are initially set as null values defining the interface between channel bank height and floodplain region. The relative elevation between a given floodplain pixel and its nearest downstream channel pixel is computed as the height above channel top bank, which means that the pixel is only inundated if floodplain water level (current flow depth subtracted from channel bankfull depth) is equal or exceeds its respective HAND value. Thus, flooded area is calculated summing the individual areas of inundated pixels for a given HAND value, and volume of water stored in floodplain (plus channel below bankfull depth) is then computed considering vertical increments according to DEM vertical resolution. **Figure S1.6.2** shows a schematic representation of channel and floodplains (and their parameters) for a given unit-catchment.

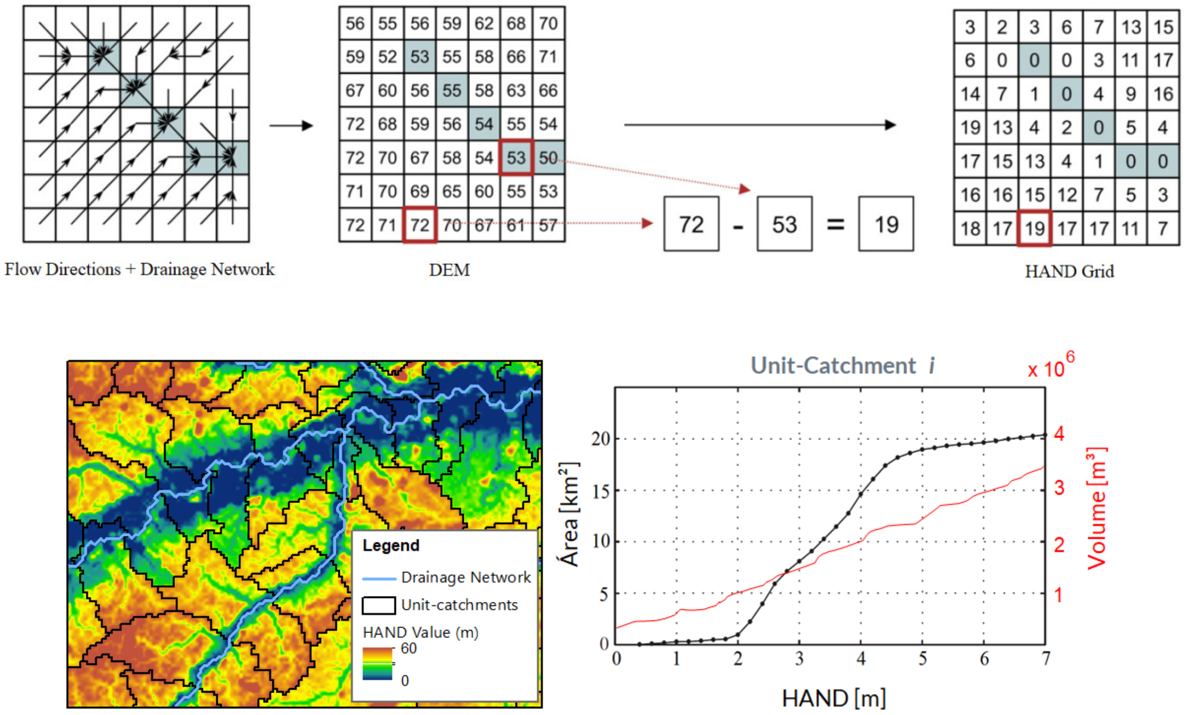


Figure S1.6.1. Procedure to compute sub-grid floodplain profile. Top: Derivation of HAND grid using flow directions, DEM and drainage map extracted from a given area threshold. White and shaded cells represent pixels located over floodplain and drainage networks (channel), respectively (adapted from Rennó et al., 2008). Bottom: Floodplain area and volume are obtained through vertical increments in the HAND Grid, within a given unit-catchment.

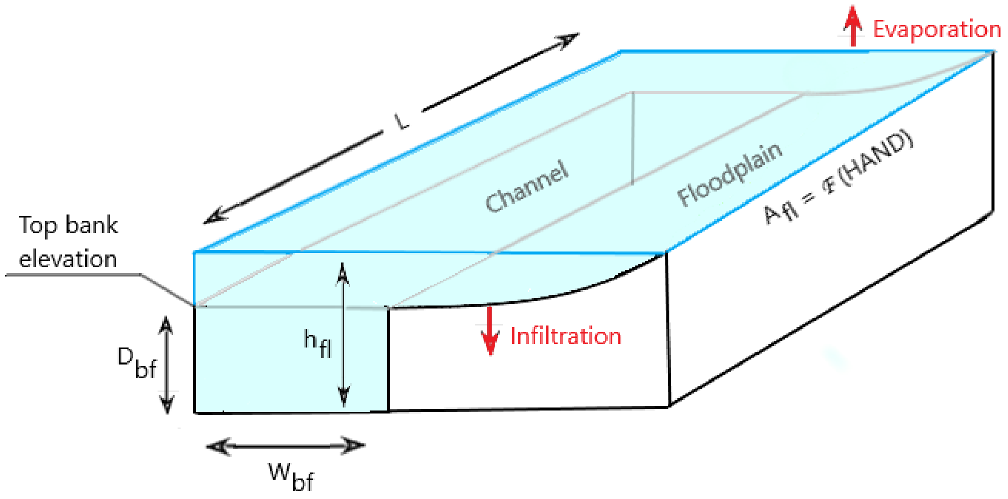


Figure S1.6.2. Schematic representation of channel and floodplain within a given unit-catchment. L = Channel length; D_{bf} = Bankfull depth; W_{bf} = Bankfull Width; h_{fl} = Flow depth; A_{fl} = Floodplain area, expressed as a function of HAND value (derived from sub-grid topography).

Following these assumptions, floodplain profiles relating HAND value to flooded area (A_{fl}) and flooded volume (V_{fl}) are defined as:

$$A_{fl}(z,i) = \sum_{\langle y,x\rangle \in S} A\,\langle y,x\rangle \qquad \text{Eq. S1.6.1}$$

$$V_{fl}(z,i) = W_{bf\,i} D_{bf\,i} L_i + \sum_{k=1}^{z} 0.5\left[A_{fl}(k,i) + A_{fl}(k-1,i)\right]\Delta z \qquad \text{Eq. S1.6.2}$$

Where z is the HAND value analyzed [m], i is the unit-catchment analyzed; A_{fl} is the flooded area above channel top bank, for a given HAND and unit-catchment [km²]; V_{fl} is the total water stored in the control volume (channel + floodplains), for a given HAND and unit-catchment [m³], $\langle y, x\rangle$ are the pixel coordinates, located at row y and column x, A$\langle y, x\rangle$ is the pixel surface area [m²], $S = \{\langle y, x\rangle | UC\langle y, x\rangle = i, HAND\langle y, x\rangle \le z\}$, UC$\langle y, x\rangle$ is the pixel element from the unit-catchment grid; HAND$\langle y, x\rangle$ is the pixel element from the HAND grid [m], Δz is the vertical resolution of the HAND grid, equal to 1 m.

Finally, HAND values in the floodplain profile are further converted to water levels, in such a way that the latter are equivalent to HAND plus bankfull depth. For the submerged part of topography (i.e., inside channel), volume is calculated through the numerical integration of flooded area with flow depth, the former approximated by channel width times river length (Pontes et al., 2017). As described in **section S1.2**, this enables flow depths to be derived from stored water volume, by interpolating the channel/floodplain profile for a given unit-catchment.

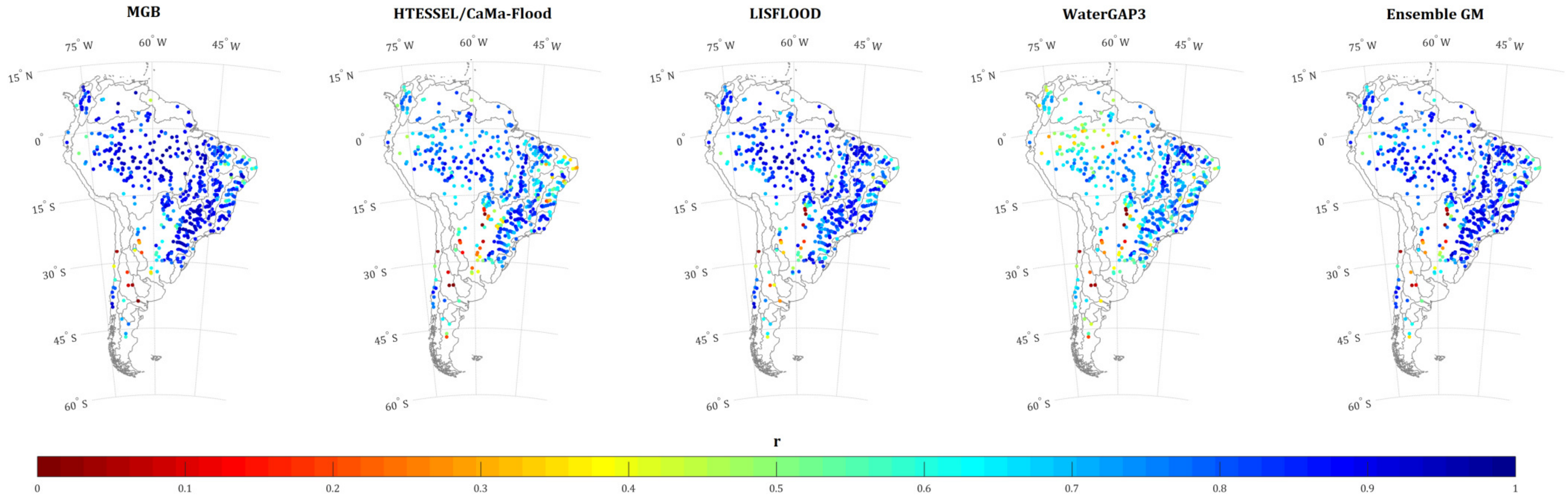
S2. Structure of models (continental and global) evaluated in this study

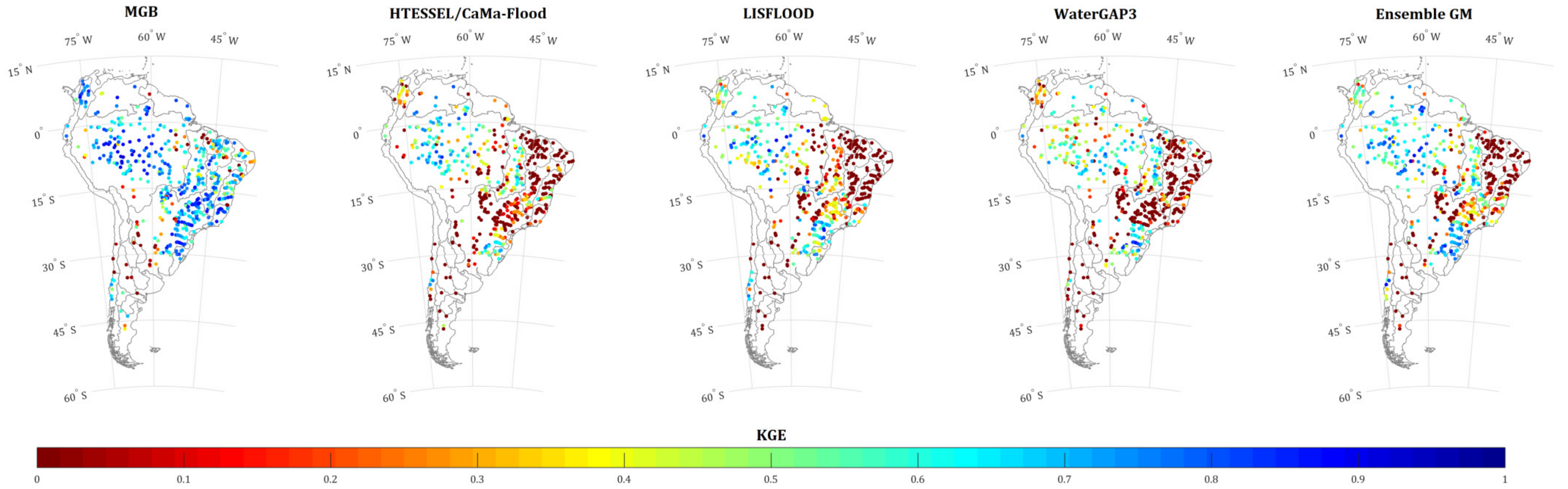
General information about the structure of MGB continental model, as well as the global models HTESSEL/CaMa-Flood, LISFLOOD and WaterGAP3 is summarized in **Table S2.1**.

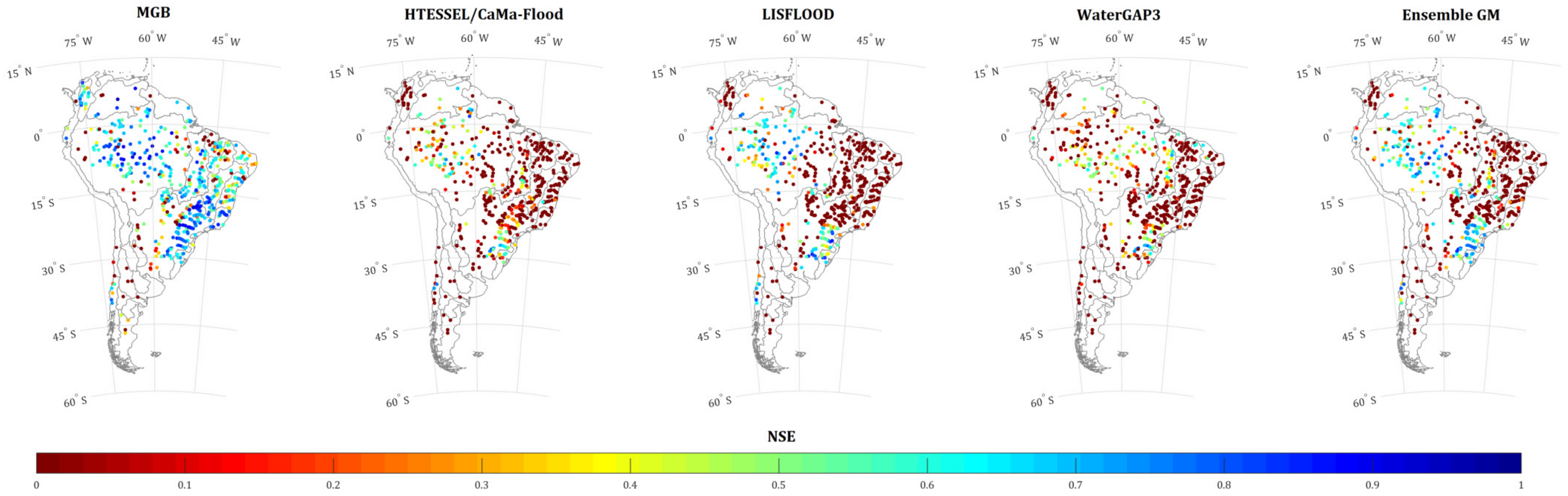
Table S2.1. Summary of the structure of models used in this study, acquired from eartH2Observe Water Resources Re-analysis run 2 (WRR-2) (Adapted from Schellekens et al., 2017 and Dutra et al., 2017).

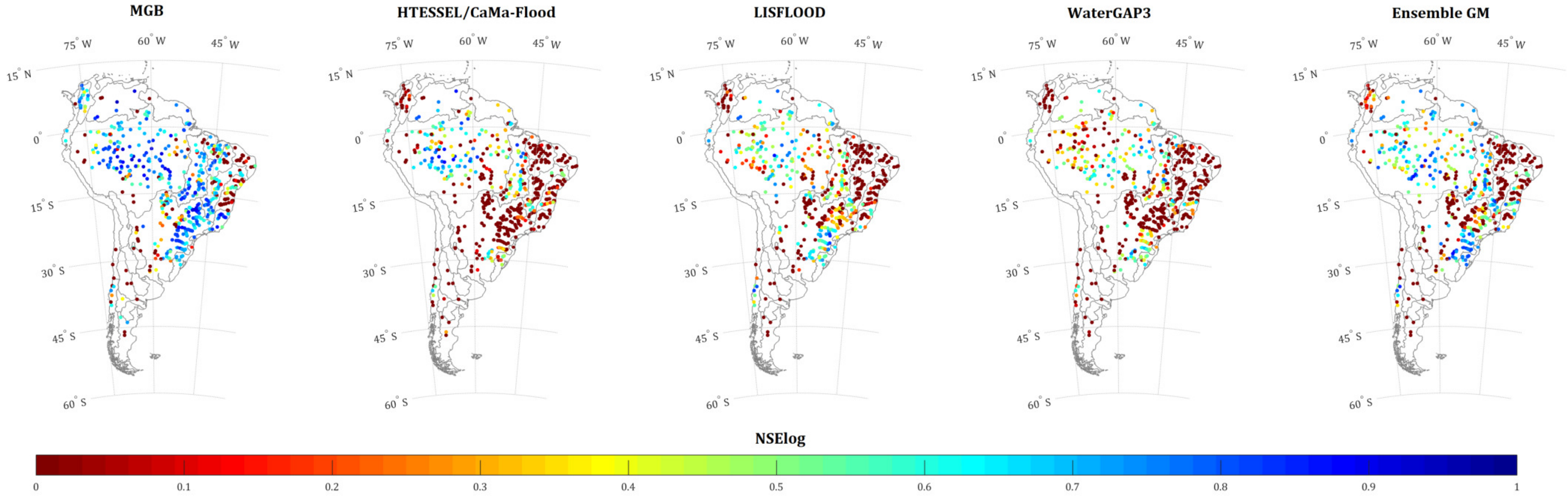
Model	MGB	HTESSEL/CaMa-Flood	LISFLOOD	WaterGAP3
Interception	Single reservoir, potential evaporation	Single reservoir, potential evaporation	Single reservoir, potential evaporation	Single reservoir
Evaporation	Penman–Monteith	Penman–Monteith	Penman–Monteith	Priestley–Taylor
Snow	No	Energy balance, single layer (5 layers)	Degree-day, single layer	Degree-day, single layer
Soil layers	Single layer	9 layers	3 layers	Single layer
Groundwater	Yes	No	Yes	Yes
Runoff generation	Saturation excess	Saturation excess	Saturation and infiltration excess	Beta function
Reservoir/Lakes	No	No	Yes	Yes
Routing	1D inertial routing (Channel), floodplain as a storage	CaMa-Flood (1D inertial routing)	1D Double Kinematic wave (Channel + Floodplain)	Manning–Strickler
Vertical processes in floodplains	Evaporation and infiltration	No	No	No
Water use	No	No	Yes	Yes
Time step	1 day water and energy balance, CFL for routing	1 h	1 day	1 day
Grid/Sub-basin	Sub-basin (unit-catchments)	Grid	Grid	Grid
Model resolution	Fixed-length (15 km)	0.25°	0.1°	0.0833° (5 arc minutes)

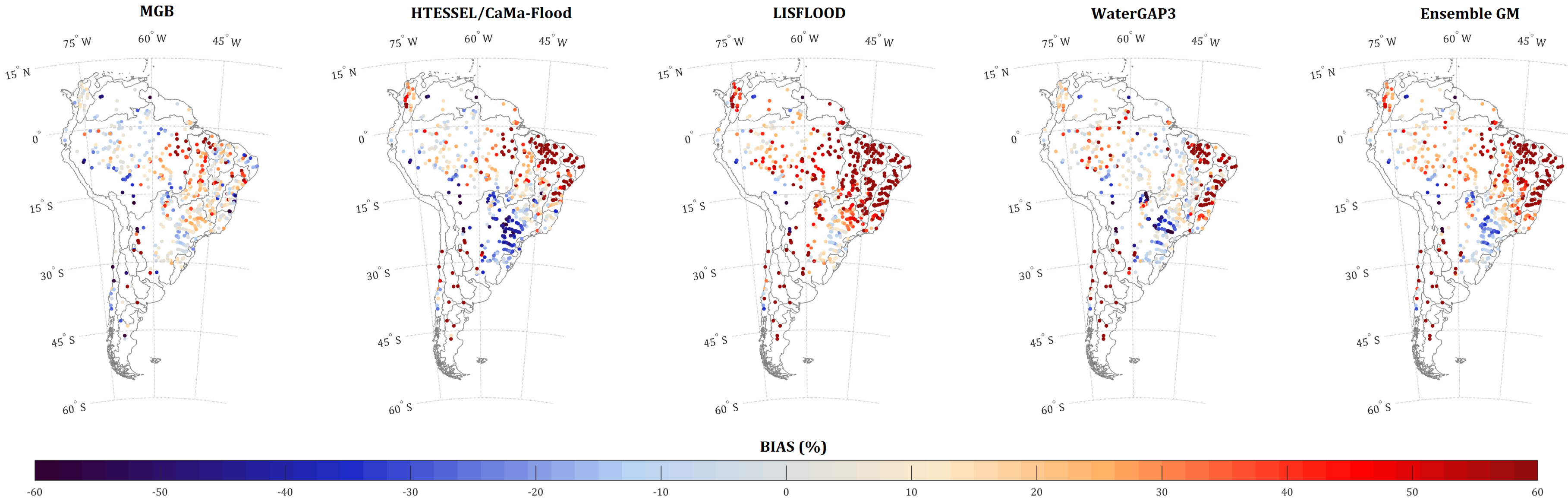
S3. Metrics for individual continental and global models (considering all gauge stations)

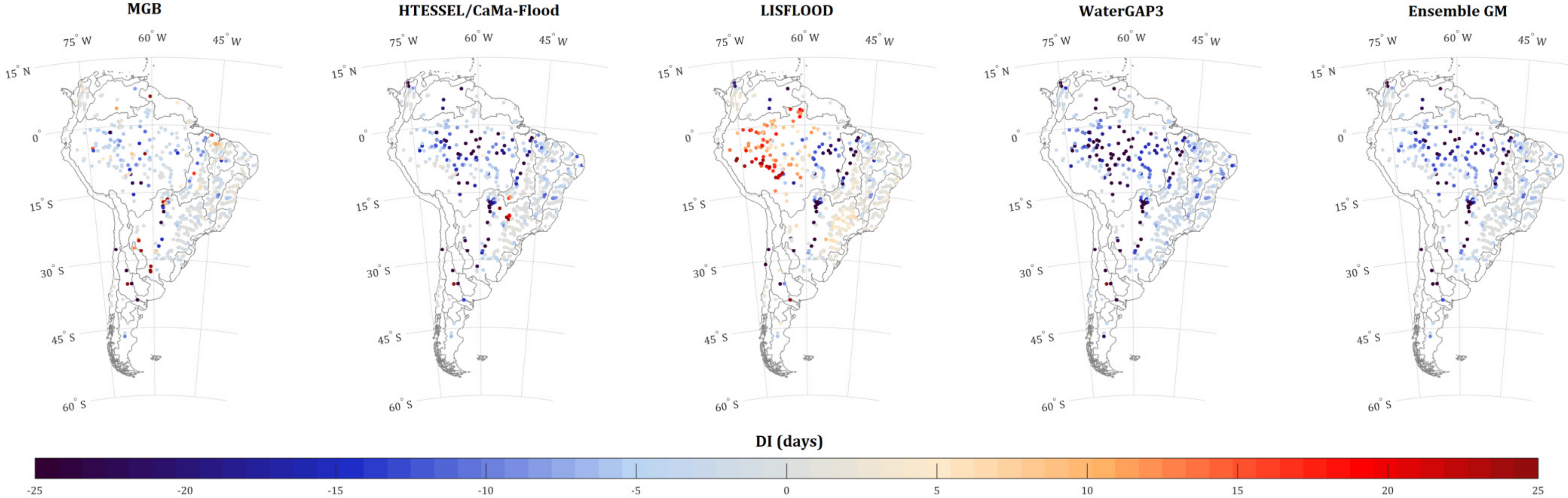





MGB
HTESSEL/CaMa-Flood
LISFLOOD
WaterGAP3
Ensemble GM
75° W
60° W
45° W
15° N
0°
15° S
30° S
45° S
60° S
NSE
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


MGB
HTESSEL/CaMa-Flood
LISFLOOD
WaterGAP3
Ensemble GM
75° W
60° W
45° W
15° N
0°
15° S
30° S
45° S
60° S
NSElog
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


MGB
HTESSEL/CaMa-Flood
LISFLOOD
WaterGAP3
Ensemble GM
75° W
60° W
45° W
15° N
0°
15° S
30° S
45° S
60° S
BIAS (%)
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60


MGB
HTESSEL/CaMa-Flood
LISFLOOD
WaterGAP3
Ensemble GM
75° W
60° W
45° W
15° N
0°
15° S
30° S
45° S
60° S
DI (days)
-25
-20
-15
-10
-5
0
5
10
15
20
25

S4. Station list

Table S4.1. List of discharge gauge stations used for this study.

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'10200000'	'PALMEIRAS DO JAVARI '	-5.133	-72.800
ANA (Brazil)	'10300000'	'SANTA MARIA '	-4.567	-71.417
ANA (Brazil)	'10500000'	'ESTIRÃO DO REPOUSO'	-4.367	-70.933
ANA (Brazil)	'10910000'	'LADÁRIO - JUSANTE '	-4.584	-70.281
ANA (Brazil)	'11400000'	'SÃO PAULO DE OLIVENÇA'	-3.450	-68.750
ANA (Brazil)	'11444900'	'IPIRANGA NOVO '	-2.867	-69.667
ANA (Brazil)	'11450000'	'IPIRANGA VELHO'	-2.983	-69.583
ANA (Brazil)	'11500000'	'SANTO ANTÔNIO DO IÇÁ'	-3.083	-67.933
ANA (Brazil)	'12100000'	'COLOCAÇÃO CAXIAS '	-5.400	-69.000
ANA (Brazil)	'12150000'	'CONCEIÇÃO (EX. ILHA DA NOVA SORTE)'	-4.897	-68.663
ANA (Brazil)	'12180000'	'TANIBUCA'	-4.745	-68.135
ANA (Brazil)	'12200000'	'BARREIRA ALTA '	-4.221	-67.893
ANA (Brazil)	'12240000'	'PORTO SEGURO'	-3.337	-67.492
ANA (Brazil)	'12370000'	'TAUMATURGO'	-8.946	-72.795
ANA (Brazil)	'12500000'	'CRUZEIRO DO SUL '	-7.611	-72.681
ANA (Brazil)	'12520000'	'IPIXUNA'	-7.051	-71.684
ANA (Brazil)	'12550000'	'EIRUNEPÉ - MONTANTE '	-6.684	-69.881
ANA (Brazil)	'12600001'	'TARAUACÁ - JUSANTE'	-8.136	-70.717
ANA (Brazil)	'12640000'	'SERINGAL SÃO FRANCISCO (SANTA HELENA)'	-8.686	-70.551
ANA (Brazil)	'12650000'	'FEIJÓ'	-8.152	-70.368
ANA (Brazil)	'12680000'	'ENVIRA '	-7.428	-70.023
ANA (Brazil)	'12700000'	'SANTOS DUMONT'	-6.440	-68.246
ANA (Brazil)	'12840000'	'GAVIÃO'	-4.839	-66.849
ANA (Brazil)	'12845000'	'VILA BITTENCOURT '	-1.400	-69.417
ANA (Brazil)	'12850000'	'ACANAUI '	-1.817	-66.600
ANA (Brazil)	'12880000'	'ESTIRÃO DA SANTA CRUZ '	-4.321	-65.201
ANA (Brazil)	'13150000'	'ITAPEUÁ '	-4.058	-63.028
ANA (Brazil)	'13180000'	'MANOEL URBANO '	-8.884	-69.268
ANA (Brazil)	'13300000'	'SERINGAL SÃO JOSÉ '	-9.319	-68.718
ANA (Brazil)	'13410000'	'SERINGAL DA CARIDADE '	-9.044	-68.577
ANA (Brazil)	'13600002'	'RIO BRANCO'	-9.976	-67.800
ANA (Brazil)	'13650000'	'FLORIANO PEIXOTO'	-9.051	-67.368
ANA (Brazil)	'13710001'	'VALPARAÍSO - MONTANTE'	-8.683	-67.400
ANA (Brazil)	'13740000'	'FAZENDA BORANGABA '	-7.550	-67.550
ANA (Brazil)	'13750000'	'SERINGAL FORTALEZA '	-7.717	-66.985
ANA (Brazil)	'13849000'	'JURENÉ'	-8.768	-65.884

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'13880000'	'CANUTAMA '	-6.534	-64.384
ANA (Brazil)	'13886000'	'BACABA '	-6.317	-64.884
ANA (Brazil)	'14110000'	'CUCUÍ '	1.215	-66.853
ANA (Brazil)	'14230000'	'MISSÃO IÇANA '	1.074	-67.595
ANA (Brazil)	'14250000'	'SÃO FELIPE'	0.372	-67.313
ANA (Brazil)	'14260000'	'UARAÇU'	0.477	-69.128
ANA (Brazil)	'14280001'	'TARAQUA '	0.130	-68.539
ANA (Brazil)	'14325000'	'TUMBIRA'	-0.344	-67.536
ANA (Brazil)	'14330000'	'CURICURIARI'	-0.200	-66.801
ANA (Brazil)	'14350000'	'JUSANTE DA CACHOEIRA DO CAJU'	-0.244	-67.016
ANA (Brazil)	'14420000'	'SERRINHA'	-0.482	-64.827
ANA (Brazil)	'14440000'	'POSTO AJURICABA '	0.884	-62.622
ANA (Brazil)	'14450000'	'JALAUACA'	-0.301	-62.762
ANA (Brazil)	'14488000'	'UAICAS '	3.550	-63.169
ANA (Brazil)	'14495000'	'FAZENDA CAJUPIRANGA '	3.438	-61.037
ANA (Brazil)	'14515000'	'FAZENDA PASSARÃO'	3.208	-60.571
ANA (Brazil)	'14680001'	'FÉ E ESPERANÇA '	2.871	-61.441
ANA (Brazil)	'14690000'	'MUCAJAÍ '	2.471	-60.918
ANA (Brazil)	'15030000'	'JATUARANA'	-3.052	-59.678
ANA (Brazil)	'15120001'	'VILA BELA DA SANTÍSSIMA TRINDADE'	-15.008	-59.949
ANA (Brazil)	'15130000'	'PIMENTEIRAS'	-13.480	-61.046
ANA (Brazil)	'15150000'	'PEDRAS NEGRAS'	-12.851	-62.899
ANA (Brazil)	'15250000'	'GUAJARÁ-MIRIM '	-10.793	-65.348
ANA (Brazil)	'15320002'	'ABUNÃ'	-9.703	-65.365
ANA (Brazil)	'15326000'	'MORADA NOVA - JUSANTE'	-9.785	-65.528
ANA (Brazil)	'15550000'	'SANTA ISABEL '	-8.799	-63.711
ANA (Brazil)	'15558000'	'PIMENTA BUENO'	-11.684	-61.192
ANA (Brazil)	'15559000'	'SÍTIO BELA VISTA'	-11.653	-61.215
ANA (Brazil)	'15560000'	'JIPARANÁ '	-10.874	-61.936
ANA (Brazil)	'15580000'	'TABAJARA '	-8.933	-62.054
ANA (Brazil)	'15630000'	'HUMAITÁ '	-7.505	-63.020
ANA (Brazil)	'15670000'	'NOVA ESPERANÇA '	-6.359	-61.766
ANA (Brazil)	'15700000'	'MANICORÉ '	-5.817	-61.302
ANA (Brazil)	'15750000'	'HUMBOLDT'	-10.168	-59.464
ANA (Brazil)	'15795000'	'LEONTINO'	-7.767	-60.567
ANA (Brazil)	'15800000'	'BOCA DO GUARIBA '	-7.708	-60.586
ANA (Brazil)	'15820000'	'CONCISA '	-9.800	-60.691
ANA (Brazil)	'15828000'	'FAZENDA BOA LEMBRANÇA '	-7.650	-60.833
ANA (Brazil)	'15830000'	'PRAINHA VELHA '	-7.208	-60.650
ANA (Brazil)	'15910000'	'SANTAREM SUCUNDURI'	-6.796	-59.042
ANA (Brazil)	'16205000'	'BASE SIDERAMA -	-1.683	-58.533

Data Provider	Code	Name	Latitude	Longitude
		JUSANTE '		
ANA (Brazil)	'16430000'	'GARGANTA'	-0.998	-57.043
ANA (Brazil)	'16460000'	'CARAMUJO'	-1.065	-57.061
ANA (Brazil)	'16480000'	'ALDEIA WAI-WA '	-0.695	-57.975
ANA (Brazil)	'16500000'	'ESTIRÃO DA ANGÉLICA'	-1.101	-57.057
ANA (Brazil)	'17090000'	'BOCA DO INFERNO '	-1.503	-54.873
ANA (Brazil)	'17093000'	'FONTANILHAS'	-11.358	-58.343
ANA (Brazil)	'17095000'	'FAZENDA TOMBADOR '	-11.777	-58.073
ANA (Brazil)	'17120000'	'PORTO DOS GAUCHOS'	-11.536	-57.423
ANA (Brazil)	'17122000'	'RIO DOS PEIXES'	-10.823	-57.726
ANA (Brazil)	'17123000'	'RIO ARINOS'	-10.640	-58.003
ANA (Brazil)	'17200000'	'PORTO RONCADOR '	-13.557	-55.334
ANA (Brazil)	'17210000'	'TELES PIRES '	-12.674	-55.792
ANA (Brazil)	'17280000'	'CACHOEIRÃO '	-11.651	-55.703
ANA (Brazil)	'17300000'	'FAZENDA TRATEX'	-10.956	-55.549
ANA (Brazil)	'17340000'	'INDECO'	-10.113	-55.570
ANA (Brazil)	'17380000'	'JUSANTE FOZ PEIXOTO DE AZEVEDO'	-9.643	-56.018
ANA (Brazil)	'17410000'	'SANTA ROSA '	-8.860	-57.420
ANA (Brazil)	'17420000'	'TRÊS MARIAS'	-7.615	-57.950
ANA (Brazil)	'17430000'	'BARRA DO SÃO MANUEL - JUSANTE'	-7.340	-58.155
ANA (Brazil)	'17500000'	'FORTALEZA '	-6.045	-57.643
ANA (Brazil)	'17650002'	'ACARÁ DO TAPAJÓS'	-4.886	-56.723
ANA (Brazil)	'17675000'	'JARDIM DO OURO'	-6.258	-55.773
ANA (Brazil)	'17730000'	'ITAITUBA '	-4.283	-55.983
ANA (Brazil)	'18200000'	'ARAPARI '	-1.779	-54.397
ANA (Brazil)	'18415000'	'POUSADA MATRINXA '	-13.569	-53.076
ANA (Brazil)	'18436000'	'JUSANTE RIO PRETO'	-10.047	-52.114
ANA (Brazil)	'18460000'	'BOA SORTE '	-6.750	-51.983
ANA (Brazil)	'18500000'	'BOA ESPERANÇA'	-6.719	-51.783
ANA (Brazil)	'18510000'	'SÃO FELIX DO XINGU'	-6.600	-52.050
ANA (Brazil)	'18520000'	'BELO HORIZONTE'	-5.408	-52.902
ANA (Brazil)	'18590000'	'MANOEL JORGE (TERRA PRETA)'	-6.203	-54.074
ANA (Brazil)	'18650000'	'CAJUEIRO'	-5.654	-54.521
ANA (Brazil)	'18700000'	'PEDRA DO Ó'	-4.542	-54.001
ANA (Brazil)	'18850000'	'ALTAMIRA'	-3.212	-52.211
ANA (Brazil)	'18870000'	'ALDEIA BACAJÁ'	-4.916	-51.428
ANA (Brazil)	'19150000'	'SÃO FRANCISCO '	-0.568	-52.569
ANA (Brazil)	'20050000'	'PONTE QUEBRA LINHA'	-14.978	-48.676
ANA (Brazil)	'20250000'	'CERES (POSTO BIQUINHA)'	-15.309	-49.553
ANA (Brazil)	'20490000'	'COLÔNIA DOS AMERICANOS'	-14.740	-49.064
ANA (Brazil)	'20500000'	'PORTO URUAÇU'	-14.519	-49.042

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'21050000'	'SÃO FELIX (A/B)'	-13.533	-48.138
ANA (Brazil)	'21500000'	'NOVA ROMA (FAZ.SUCURI)'	-13.763	-46.838
ANA (Brazil)	'21600000'	'PONTE PARANÃ'	-13.424	-47.132
ANA (Brazil)	'21650000'	'MONTANTE DA BARRA DO PALMA'	-12.603	-47.861
ANA (Brazil)	'21850000'	'RIO DA PALMA'	-12.416	-47.199
ANA (Brazil)	'21890000'	'BARRA DO PALMA'	-12.603	-47.861
ANA (Brazil)	'21900000'	'PARANÃ '	-12.622	-47.886
ANA (Brazil)	'22150000'	'JACINTO'	-11.981	-48.658
ANA (Brazil)	'22220000'	'PORTO JERÔNIMO - FAZ. PIRACICABA '	-11.759	-47.836
ANA (Brazil)	'22250000'	'FAZENDA LOBEIRA'	-11.533	-48.289
ANA (Brazil)	'22350000'	'PORTO NACIONAL '	-10.704	-48.418
ANA (Brazil)	'22680000'	'JATOBÁ (FAZENDA BOA NOVA) '	-9.995	-47.473
ANA (Brazil)	'22700000'	'NOVO ACORDO'	-9.963	-47.675
ANA (Brazil)	'22900000'	'PORTO REAL'	-9.307	-47.929
ANA (Brazil)	'23100000'	'TUPIRATINS'	-8.392	-48.111
ANA (Brazil)	'23250000'	'GOIATINS'	-7.708	-47.312
ANA (Brazil)	'23300000'	'CAROLINA'	-7.338	-47.473
ANA (Brazil)	'23600000'	'TOCANTINÓPOLIS'	-6.289	-47.392
ANA (Brazil)	'23700000'	'DESCARRETO'	-5.789	-47.469
ANA (Brazil)	'24200000'	'TORIXOREU'	-16.201	-52.550
ANA (Brazil)	'24700000'	'BARRA DO GARÇAS (ARAGARÇAS)'	-15.891	-52.228
ANA (Brazil)	'24800000'	'PERES'	-15.890	-51.853
ANA (Brazil)	'24850000'	'ARAGUAIANA'	-15.738	-51.828
ANA (Brazil)	'24950000'	'MONTES CLAROS DE GOIÁS'	-15.572	-51.634
ANA (Brazil)	'25200000'	'ARUANÃ'	-14.902	-51.082
ANA (Brazil)	'25700000'	'BANDEIRANTES'	-13.690	-50.800
ANA (Brazil)	'25800000'	'JUSANTE DO RIO PINTADO'	-13.561	-50.401
ANA (Brazil)	'25950000'	'LUIZ ALVES'	-13.210	-50.585
ANA (Brazil)	'26015000'	'JUSANTE BARRA DO FORQUILHA'	-12.884	-50.832
ANA (Brazil)	'26050000'	'TORIQUEJE'	-15.249	-53.055
ANA (Brazil)	'26100000'	'XAVANTINA '	-14.672	-52.355
ANA (Brazil)	'26200000'	'TRECHO MÉDIO'	-14.087	-51.696
ANA (Brazil)	'26300000'	'SANTO ANTÔNIO DO LEVERGER'	-12.292	-50.963
ANA (Brazil)	'26350000'	'SÃO FELIX DO ARAGUAIA '	-11.620	-50.663
ANA (Brazil)	'26800000'	'BARREIRA DA CRUZ '	-10.565	-49.934
ANA (Brazil)	'27500000'	'CONCEIÇÃO DO ARAGUAIA'	-8.269	-49.259

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'28300000'	'XAMBIOÁ '	-6.410	-48.542
ANA (Brazil)	'28850000'	'ARAGUATINS'	-5.634	-48.130
ANA (Brazil)	'29050000'	'MARABÁ '	-5.339	-49.124
ANA (Brazil)	'29100000'	'FAZENDA ALEGRIA'	-5.514	-49.221
ANA (Brazil)	'29200000'	'ITUPIRANGA '	-5.128	-49.324
ANA (Brazil)	'30080000'	'CAPIVARA'	1.071	-51.671
ANA (Brazil)	'30300000'	'SERRA DO NAVIO '	0.901	-52.010
ANA (Brazil)	'30400000'	'PORTO PLATON'	0.708	-51.439
ANA (Brazil)	'31680000'	'FAZENDA MARINGA '	-3.161	-48.099
ANA (Brazil)	'31700000'	'BADAJÓS'	-2.513	-47.768
ANA (Brazil)	'32540000'	'FAZENDA RURAL ZEBU'	-3.341	-46.877
ANA (Brazil)	'32620000'	'ALTO BONITO'	-1.801	-46.316
ANA (Brazil)	'33070000'	'FAZENDA VARIG'	-4.213	-46.495
ANA (Brazil)	'33080000'	'ALTO ALEGRE'	-3.665	-45.842
ANA (Brazil)	'33190000'	'PINDARÉ-MIRIM '	-3.661	-45.458
ANA (Brazil)	'33250000'	'BARRA DO CORDA '	-5.500	-45.243
ANA (Brazil)	'33260000'	'SANTA VITÓRIA'	-5.106	-44.961
ANA (Brazil)	'33281000'	'PEDREIRAS II'	-4.567	-44.600
ANA (Brazil)	'33286000'	'SÃO LUIZ GONZAGA'	-4.383	-44.667
ANA (Brazil)	'33290000'	'BACABAL '	-4.219	-44.765
ANA (Brazil)	'33333000'	'ITAIPAVA'	-5.144	-45.795
ANA (Brazil)	'33365000'	'FAZENDA SABESA'	-4.538	-45.326
ANA (Brazil)	'33380000'	'ARATOI GRANDE'	-3.770	-45.218
ANA (Brazil)	'33480000'	'COLINAS'	-6.019	-44.243
ANA (Brazil)	'33530000'	'MONTEVIDEU'	-5.337	-43.884
ANA (Brazil)	'33550000'	'CAXIAS'	-4.865	-43.358
ANA (Brazil)	'33590000'	'CODÓ '	-4.458	-43.875
ANA (Brazil)	'33630000'	'COROATA'	-4.128	-44.128
ANA (Brazil)	'33680000'	'CANTANHEDE'	-3.628	-44.379
ANA (Brazil)	'33780000'	'NINA RODRIGUES'	-3.459	-43.899
ANA (Brazil)	'34020000'	'ALTO PARNAÍBA'	-9.113	-45.926
ANA (Brazil)	'34040000'	'FAZENDA PARACATI'	-8.281	-45.667
ANA (Brazil)	'34040500'	'FAZENDA PARACATI II'	-8.271	-45.668
ANA (Brazil)	'34060000'	'RIBEIRO GONÇALVES'	-7.567	-45.254
ANA (Brazil)	'34070000'	'SÍTIO DO VELHO'	-7.381	-44.827
ANA (Brazil)	'34090000'	'FAZENDA BANDEIRA'	-7.391	-44.614
ANA (Brazil)	'34170000'	'SÃO FÉLIX DE BALSAS'	-7.068	-44.813
ANA (Brazil)	'34251000'	'CRISTINO CASTRO II'	-8.793	-44.206
ANA (Brazil)	'34270000'	'BARRA DO LANCE'	-7.248	-43.643
ANA (Brazil)	'34470000'	'SANTA CRUZ DO PIAUÍ'	-7.190	-41.770
ANA (Brazil)	'34471000'	'SANTA CRUZ DO PIAUÍ II'	-7.189	-41.770
ANA (Brazil)	'34480000'	'FAZENDA TALHADA'	-6.973	-42.106
ANA (Brazil)	'34571000'	'SÃO FRANCISCO DO PIAUÍ'	-7.233	-42.544

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'34600000'	'FRANCISCO AYRES'	-6.625	-42.698
ANA (Brazil)	'34750000'	'FAZENDA BOA ESPERANÇA'	-5.223	-41.738
ANA (Brazil)	'34760000'	'FAZENDA CARNAIBA'	-5.714	-42.100
ANA (Brazil)	'34770000'	'PRATA DO PIAUÍ'	-5.666	-42.214
ANA (Brazil)	'34789000'	'FAZENDA CANTINHO II'	-5.203	-42.697
ANA (Brazil)	'34879500'	'LUZILÂNDIA'	-3.454	-42.370
ANA (Brazil)	'34940000'	'ESPERANTINA'	-3.903	-42.230
ANA (Brazil)	'34980000'	'TINGUIS'	-3.724	-41.974
ANA (Brazil)	'35275000'	'SOBRAL'	-3.689	-40.341
ANA (Brazil)	'36070000'	'SÍTIO PATOS'	-6.521	-39.639
ANA (Brazil)	'36160000'	'IGUATU'	-6.373	-39.293
ANA (Brazil)	'36290000'	'ICÓ'	-6.406	-38.867
ANA (Brazil)	'36320000'	'JAGUARIBE'	-5.901	-38.632
ANA (Brazil)	'36390000'	'PEIXE GORDO'	-5.229	-38.199
ANA (Brazil)	'36580000'	'MORADA NOVA II'	-5.121	-38.444
ANA (Brazil)	'37410000'	'SÍTIO VASSOURAS'	-6.729	-37.794
ANA (Brazil)	'37470000'	'JARDIM DE PIRANHAS '	-6.378	-37.353
ANA (Brazil)	'37710150'	'SÍTIO ACAUA II'	-5.616	-36.891
ANA (Brazil)	'38860000'	'BODOCONGO'	-7.528	-36.000
ANA (Brazil)	'38880000'	'GUARITA'	-7.334	-35.373
ANA (Brazil)	'38895000'	'PONTE DA BATALHA'	-7.130	-35.048
ANA (Brazil)	'40070000'	'PONTE DO CHUMBO'	-19.776	-45.479
ANA (Brazil)	'40100000'	'PORTO DAS ANDORINHAS'	-19.279	-45.286
ANA (Brazil)	'41650002'	'PONTE DO LICÍNIO - JUSANTE'	-18.673	-44.194
ANA (Brazil)	'41818000'	'SANTO HIPÓLITO (ANA/CEMIG)'	-18.306	-44.226
ANA (Brazil)	'41990000'	'VÁRZEA DA PALMA'	-17.595	-44.714
ANA (Brazil)	'42395000'	'SANTA ROSA'	-17.255	-46.473
ANA (Brazil)	'42690001'	'PORTO DA EXTREMA'	-17.030	-46.014
ANA (Brazil)	'42750000'	'CAATINGA '	-17.143	-45.880
ANA (Brazil)	'42930000'	'PORTO DO CAVALO '	-17.031	-45.539
ANA (Brazil)	'42980000'	'PORTO ALEGRE'	-16.907	-45.383
ANA (Brazil)	'43200000'	'SÃO ROMÃO '	-16.373	-45.070
ANA (Brazil)	'43429998'	'ARINOS - MONTANTE'	-15.924	-46.109
ANA (Brazil)	'43670000'	'VILA URUCUIA '	-16.133	-45.742
ANA (Brazil)	'43880000'	'SANTO INÁCIO'	-16.281	-45.414
ANA (Brazil)	'43980002'	'BARRA DO ESCURO '	-16.268	-45.237
ANA (Brazil)	'44200000'	'SÃO FRANCISCO'	-15.949	-44.868
ANA (Brazil)	'44290002'	'PEDRAS DE MARIA DA CRUZ'	-15.610	-44.395
ANA (Brazil)	'44500000'	'MANGA'	-14.757	-43.932
ANA (Brazil)	'44670000'	'COLÔNIA DO JAIBA'	-15.343	-43.676
ANA (Brazil)	'44950000'	'BOCA DA CAATINGA'	-14.783	-43.538

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'45210000'	'LAGOA DAS PEDRAS'	-14.283	-44.409
ANA (Brazil)	'45260000'	'JUVENÍLIA '	-14.260	-44.152
ANA (Brazil)	'45298000'	'CARINHANHA'	-14.304	-43.763
ANA (Brazil)	'45480000'	'BOM JESUS DA LAPA'	-13.257	-43.435
ANA (Brazil)	'45910001'	'SANTA MARIA DA VITÓRIA '	-13.397	-44.199
ANA (Brazil)	'45960001'	'PORTO NOVO'	-13.291	-43.909
ANA (Brazil)	'46035000'	'GAMELEIRA'	-12.869	-43.380
ANA (Brazil)	'46105000'	'PARATINGA'	-12.697	-43.226
ANA (Brazil)	'46150000'	'IBOTIRAMA'	-12.183	-43.223
ANA (Brazil)	'46295000'	'PONTE BR-242'	-12.245	-42.764
ANA (Brazil)	'46360000'	'MORPARÁ '	-11.558	-43.283
ANA (Brazil)	'46550000'	'BARREIRAS'	-12.153	-45.009
ANA (Brazil)	'46610000'	'SÃO SEBASTIÃO'	-11.979	-44.877
ANA (Brazil)	'46650000'	'TAGUA'	-11.721	-44.502
ANA (Brazil)	'46675000'	'FAZENDA MACAMBIRA'	-11.611	-44.157
ANA (Brazil)	'46790000'	'FORMOSA DO RIO PRETO '	-11.051	-45.197
ANA (Brazil)	'46830000'	'IBIPETUBA'	-11.006	-44.524
ANA (Brazil)	'46870000'	'FAZENDA PORTO LIMPO'	-11.236	-43.949
ANA (Brazil)	'46902000'	'BOQUEIRÃO'	-11.355	-43.846
ANA (Brazil)	'47900000'	'ABREUS'	-10.010	-40.695
ANA (Brazil)	'48860000'	'FLORESTA'	-8.609	-38.577
ANA (Brazil)	'50169000'	'PONTE SE-302'	-10.621	-37.751
ANA (Brazil)	'50169500'	'CAMINHO DO RIO'	-10.639	-37.698
ANA (Brazil)	'50191000'	'FAZENDA BELÉM'	-10.943	-37.347
ANA (Brazil)	'50465000'	'QUEIMADAS'	-10.973	-39.633
ANA (Brazil)	'50494000'	'AMBRÓSIO'	-10.998	-39.224
ANA (Brazil)	'50520000'	'PONTE EUCLIDES DA CUNHA'	-11.060	-38.837
ANA (Brazil)	'50540000'	'CIPÓ'	-11.098	-38.513
ANA (Brazil)	'50591000'	'FAZENDA TRIANON'	-11.664	-37.936
ANA (Brazil)	'50595000'	'USINA ALTAMIRA'	-11.735	-37.803
ANA (Brazil)	'51240000'	'ITAETÉ '	-12.993	-40.961
ANA (Brazil)	'51280000'	'IAÇU'	-12.762	-40.214
ANA (Brazil)	'51330000'	'FAZENDA SANTA FÉ'	-12.516	-39.848
ANA (Brazil)	'51350000'	'ARGOIM '	-12.586	-39.522
ANA (Brazil)	'51460000'	'PONTE RIO BRANCO'	-12.233	-39.046
ANA (Brazil)	'52264000'	'TOCADAS'	-14.109	-41.429
ANA (Brazil)	'52265000'	'ROÇADOS'	-14.113	-41.414
ANA (Brazil)	'52270000'	'SANTO ANTÔNIO '	-14.096	-41.292
ANA (Brazil)	'52404000'	'AREIÃO'	-14.031	-40.983
ANA (Brazil)	'52405000'	'LAGOA DO TAMBURI'	-13.878	-40.896
ANA (Brazil)	'52570000'	'JEQUIÉ'	-13.864	-40.081
ANA (Brazil)	'52680000'	'IPIAÚ'	-14.140	-39.687

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'52695000'	'VAPOR'	-14.209	-39.546
ANA (Brazil)	'52831000'	'UBAITABA - JUSANTE'	-14.319	-39.328
ANA (Brazil)	'53540001'	'VEREDA DO PARAÍSO (SUDENE)'	-15.494	-41.450
ANA (Brazil)	'53620000'	'CÂNDIDO SALES'	-15.513	-41.237
ANA (Brazil)	'53630000'	'INHOBIM'	-15.340	-40.933
ANA (Brazil)	'53650000'	'ITAMBÉ '	-15.248	-40.631
ANA (Brazil)	'53880000'	'FAZENDA NANCY'	-15.604	-39.517
ANA (Brazil)	'53950000'	'MASCOTE'	-15.559	-39.308
ANA (Brazil)	'54150000'	'PORTO MANDACARU'	-16.679	-42.486
ANA (Brazil)	'54195000'	'BARRA DO SALINAS'	-16.618	-42.309
ANA (Brazil)	'54390000'	'PEGA'	-16.860	-42.348
ANA (Brazil)	'54500000'	'ARAÇUAÍ'	-16.850	-42.063
ANA (Brazil)	'54530000'	'ITIRA'	-16.761	-42.003
ANA (Brazil)	'54580000'	'ITAOBIM'	-16.568	-41.503
ANA (Brazil)	'54710000'	'JEQUITINHONHA'	-16.428	-41.014
ANA (Brazil)	'54780000'	'JACINTO'	-16.139	-40.307
ANA (Brazil)	'54950000'	'ITAPEBI'	-15.948	-39.524
ANA (Brazil)	'55699998'	'NANUQUE - MONTANTE'	-17.841	-40.381
ANA (Brazil)	'55960000'	'BOCA DA VALA'	-18.651	-40.089
ANA (Brazil)	'56425000'	'FAZENDA CACHOEIRA D''ANTAS'	-19.994	-42.674
ANA (Brazil)	'56539000'	'CACHOEIRA DOS ÓCULOS - MONTANTE'	-19.777	-42.476
ANA (Brazil)	'56719998'	'CENIBRA'	-19.328	-42.398
ANA (Brazil)	'56825000'	'NAQUE VELHO'	-19.188	-42.423
ANA (Brazil)	'56850000'	'GOVERNADOR VALADARES '	-18.883	-41.950
ANA (Brazil)	'56920000'	'TUMIRITINGA'	-18.971	-41.639
ANA (Brazil)	'56948005'	'RESPLENDOR - JUSANTE'	-19.343	-41.246
ANA (Brazil)	'56994500'	'COLATINA'	-19.531	-40.623
ANA (Brazil)	'58974000'	'CAMPOS - PONTE MUNICIPAL'	-21.753	-41.300
ANA (Brazil)	'60040000'	'FAZENDA SÃO DOMINGOS'	-18.103	-47.695
ANA (Brazil)	'60510010'	'ENGENHEIRO AMORIM'	-17.036	-47.941
ANA (Brazil)	'60544990'	'PIRES DO RIO - ME'	-17.328	-48.239
ANA (Brazil)	'60545000'	'PIRES DO RIO '	-17.327	-48.239
ANA (Brazil)	'60680000'	'PONTE MEIA PONTE'	-18.339	-49.611
ANA (Brazil)	'60772000'	'FAZENDA SANTA MARIA'	-17.981	-50.247
ANA (Brazil)	'60798000'	'MAURILÂNDIA'	-17.974	-50.337
ANA (Brazil)	'60805000'	'PONTE SUL GOIANA'	-18.071	-50.172
ANA (Brazil)	'60907000'	'FAZENDA RONDINHA'	-19.083	-50.648
ANA (Brazil)	'61145000'	'MACAIA '	-21.145	-44.914
ANA (Brazil)	'61855000'	'FAZENDA BELA VISTA '	-20.909	-48.089
ANA (Brazil)	'61902000'	'PORTO FERREIRA'	-21.842	-47.475

Data Provider	Code	Name	Latitude	Longitude
ANA (Brazil)	'61912000'	'PONTE GUATAPARA'	-21.502	-48.041
ANA (Brazil)	'61915000'	'PASSAGEM'	-21.017	-48.177
ANA (Brazil)	'61915005'	'PASSAGEM'	-21.019	-48.181
ANA (Brazil)	'61925000'	'PONTE JOAQUIM JUSTINO'	-20.454	-48.450
ANA (Brazil)	'63002000'	'SÃO JOSÉ DO SUCURIU'	-19.965	-52.219
ANA (Brazil)	'63003100'	'PORTO GALEANO'	-20.094	-52.160
ANA (Brazil)	'63350100'	'ÁGUA CLARA'	-20.444	-52.899
ANA (Brazil)	'63390000'	'ESTRADA QUEIROZ'	-20.889	-52.355
ANA (Brazil)	'63950280'	'FAZENDA BARRA GRANDE'	-21.574	-53.618
ANA (Brazil)	'63955000'	'DELFINO COSTA'	-21.614	-53.051
ANA (Brazil)	'63970000'	'FAZENDA BURITI'	-21.662	-52.866
ANA (Brazil)	'64390000'	'PORTO SANTA TEREZINHA'	-23.123	-50.450
ANA (Brazil)	'64482000'	'TELÊMACO BORBA'	-24.359	-50.595
ANA (Brazil)	'64501000'	'PORTO LONDRINA'	-23.650	-50.883
ANA (Brazil)	'64506000'	'CHACARA ANA CLAÚDIA'	-23.283	-50.967
ANA (Brazil)	'64507000'	'JATAIZINHO ANA/CESP'	-23.251	-50.982
ANA (Brazil)	'64611000'	'RETIRO GUARUJÁ'	-21.901	-54.054
ANA (Brazil)	'64614000'	'FAZENDA IPACARAI'	-21.956	-53.768
ANA (Brazil)	'64617000'	'IVINHEMA '	-22.383	-53.529
ANA (Brazil)	'64655000'	'UBÁ DO SUL'	-24.042	-51.623
ANA (Brazil)	'64689005'	'TAPIRA JUSANTE'	-23.231	-53.052
ANA (Brazil)	'64693000'	'NOVO PORTO TAQUARA'	-23.198	-53.304
ANA (Brazil)	'64795000'	'PONTE DO PIQUIRI'	-24.517	-53.167
ANA (Brazil)	'64820000'	'PORTO FORMOSA'	-24.200	-53.333
ANA (Brazil)	'64830000'	'BALSA SANTA MARIA '	-24.166	-53.736
ANA (Brazil)	'65220000'	'FLUVIÓPOLIS'	-26.019	-50.593
ANA (Brazil)	'65310000'	'UNIÃO DA VITÓRIA '	-26.228	-51.080
ANA (Brazil)	'66015000'	'PORTO ESTRELA'	-15.326	-57.226
ANA (Brazil)	'66070004'	'CÁCERES (DNPVN) '	-16.063	-57.688
ANA (Brazil)	'66090000'	'DESCALVADOS'	-16.733	-57.748
ANA (Brazil)	'66120000'	'PORTO CONCEIÇÃO'	-17.143	-57.359
ANA (Brazil)	'66250001'	'ROSÁRIO OESTE '	-14.834	-56.414
ANA (Brazil)	'66255000'	'ACORIZAL'	-15.204	-56.367
ANA (Brazil)	'66260001'	'CUIABÁ '	-15.616	-56.109
ANA (Brazil)	'66280000'	'BARÃO DE MELGAÇO'	-16.192	-55.966
ANA (Brazil)	'66340000'	'PORTO CERCADO (EX-Retiro Biguacal) '	-16.500	-56.333
ANA (Brazil)	'66360000'	'SÃO JOÃO'	-16.944	-56.632
ANA (Brazil)	'66370000'	'ILHA CAMARGO'	-17.057	-56.586
ANA (Brazil)	'66450001'	'RONDONÓPOLIS'	-16.479	-54.651
ANA (Brazil)	'66460000'	'ACIMA DO CÓRREGO GRANDE'	-16.608	-55.206
ANA (Brazil)	'66470000'	'SÃO JOSÉ DO BORIRÉU'	-16.921	-56.223

Data Provider	**Code**	**Name**	**Latitude**	**Longitude**
ANA (Brazil)	'66600000'	'SÃO JERÔNIMO '	-17.201	-56.008
ANA (Brazil)	'66650000'	'SÃO JOSÉ DO PIQUIRI'	-17.291	-56.385
ANA (Brazil)	'66710000'	'POUSADA TAIAMÃ (Ex-Porto Jofre)'	-17.368	-56.773
ANA (Brazil)	'66750000'	'PORTO ALEGRE'	-17.623	-56.965
ANA (Brazil)	'66800000'	'AMOLAR'	-18.039	-57.489
ANA (Brazil)	'66810000'	'SÃO FRANCISCO '	-18.394	-57.391
ANA (Brazil)	'66870000'	'COXIM '	-18.508	-54.761
ANA (Brazil)	'66895000'	'PORTO DA MANGA'	-19.258	-57.235
ANA (Brazil)	'66910000'	'MIRANDA'	-20.241	-56.396
ANA (Brazil)	'66941000'	'PALMEIRAS (JANGO)'	-20.448	-55.428
ANA (Brazil)	'66945000'	'AQUIDAUANA '	-20.459	-55.781
ANA (Brazil)	'66950000'	'PORTO CIRIACO'	-19.697	-56.281
ANA (Brazil)	'67100000'	'PORTO MURTINHO'	-21.700	-57.891
ANA (Brazil)	'67170000'	'SÃO CARLOS'	-22.224	-57.304
ANA (Brazil)	'71550000'	'PASSO CARU'	-27.538	-50.860
ANA (Brazil)	'72300000'	'PASSO DO VIRGILIO'	-27.501	-51.714
ANA (Brazil)	'73010000'	'MARCELINO RAMOS '	-27.461	-51.904
ANA (Brazil)	'73550000'	'PASSO CAXAMBU'	-27.171	-52.868
ANA (Brazil)	'74100000'	'IRAÍ'	-27.190	-53.265
ANA (Brazil)	'74800000'	'PORTO LUCENA '	-27.854	-55.023
ANA (Brazil)	'75550000'	'GARRUCHOS'	-28.183	-55.643
ANA (Brazil)	'75780000'	'PASSO SÃO BORJA '	-28.630	-56.039
ANA (Brazil)	'76310000'	'ROSÁRIO DO SUL '	-30.243	-54.916
ANA (Brazil)	'76500000'	'JACAQUA'	-29.686	-55.194
ANA (Brazil)	'76560000'	'MANOEL VIANA '	-29.596	-55.481
ANA (Brazil)	'76800000'	'PASSO MARIANO PINTO '	-29.308	-56.055
ANA (Brazil)	'77150000'	'URUGUAIANA '	-29.748	-57.089
ANA (Brazil)	'81350000'	'IPORANGA'	-24.585	-48.591
ANA (Brazil)	'83800002'	'BLUMENAU'	-26.918	-49.065
ANA (Brazil)	'85642000'	'PASSO SÃO LOURENÇO'	-30.009	-53.016
ANA (Brazil)	'85900000'	'RIO PARDO'	-29.996	-52.374
ANA (Brazil)	'86460000'	'MONTE CLARO'	-29.033	-51.517
ANA (Brazil)	'86470000'	'PONTE DO RIO DAS ANTAS'	-29.045	-51.567
ANA (Brazil)	'86510000'	'MUÇUM'	-29.166	-51.868
ANA (Brazil)	'86720000'	'ENCANTADO'	-29.234	-51.854
ANA (Brazil)	'87905000'	'PASSO DO MENDONÇA'	-31.010	-52.053
DGA (Chile)	'09140001-4'	'ALMAGRO'	-38.785	-72.952
DGA (Chile)	'10122001-K'	'BALSA SAN JAVIER'	-39.778	-72.990
DGA (Chile)	'05748001-7'	'CABIMBAO'	-33.724	-71.557
DGA (Chile)	'03450001-0'	'CIUDAD COPIAPO'	-27.369	-70.341
DGA (Chile)	'08141001-1'	'COELEMU'	-36.467	-72.694
DGA (Chile)	'08334001-0'	'COIHUE'	-37.550	-72.593

Data Provider	Code	Name	Latitude	Longitude
DGA (Chile)	'07383001-K'	'FOREL'	-35.410	-72.212
DGA (Chile)	'07359001-9'	'LAS BRISAS'	-35.617	-71.768
DGA (Chile)	'04558001-6'	'PANAMERICANA'	-30.667	-71.533
DGA (Chile)	'09437002-7'	'THEODORO SCHMIDT'	-39.020	-73.089
GRDC (Global Runoff Data Centre)	'330830'	'APAIKWA'	6.380	-60.380
GRDC (Global Runoff Data Centre)	'384410'	'D J SADE'	0.523	-79.415
GRDC (Global Runoff Data Centre)	'384440'	'LA CAPILLA'	-1.696	-79.996
IDEAM (Colombia)	'11057010'	'TAGACHI'	6.217	-76.717
IDEAM (Colombia)	'11057020'	'SAN ANTONIO PADUA'	6.283	-76.767
IDEAM (Colombia)	'21237010'	'NARIÑO AUTOM'	4.383	-74.850
IDEAM (Colombia)	'21237020'	'ARRANCAPLUMAS'	5.183	-74.717
IDEAM (Colombia)	'23037010'	'PTO SALGAR AUTOM'	5.467	-74.667
IDEAM (Colombia)	'23157080'	'MALDONADO'	7.200	-73.933
IDEAM (Colombia)	'23167010'	'PENAS BLANCAS'	6.950	-73.950
IDEAM (Colombia)	'23187280'	'SITIO NUEVO'	7.833	-73.800
IDEAM (Colombia)	'25027050'	'MARGENTO'	8.033	-74.950
IDEAM (Colombia)	'25027270'	'LAS FLORES'	8.117	-74.783
IDEAM (Colombia)	'25027330'	'PENONCITO'	8.983	-73.950
IDEAM (Colombia)	'25027640'	'TRES CRUCES'	8.700	-74.517
IDEAM (Colombia)	'25027940'	'TACAMOCHO'	9.483	-74.800
IDEAM (Colombia)	'26167070'	'IRRA'	5.267	-75.683
IDEAM (Colombia)	'26187110'	'LA PINTADA AUTOM'	5.733	-75.600
IDEAM (Colombia)	'26207030'	'PTE IGLESIAS'	5.817	-75.700
IDEAM (Colombia)	'26237050'	'PTE PESCADERO'	7.083	-75.700
IDEAM (Colombia)	'26237100'	'OLAYA'	6.650	-75.817
IDEAM (Colombia)	'26247030'	'APAVI'	7.483	-75.333
IDEAM (Colombia)	'29037020'	'CALAMAR'	10.250	-74.917
IDEAM (Colombia)	'31097010'	'GUAYARE'	3.967	-67.817
IDEAM (Colombia)	'32097010'	'MAPIRIPAN'	2.867	-72.167
IDEAM (Colombia)	'32107010'	'PTO ARTURO'	2.583	-72.700
IDEAM (Colombia)	'37057040'	'ANGELITOS LOS'	7.000	-71.100
IDEAM (Colombia)	'37057060'	'PTE INTERNACIONAL'	7.083	-70.767
IDEAM (Colombia)	'38017030'	'RONCADOR'	5.883	-67.567
IDEAM (Colombia)	'44137020'	'GUAQUIRA'	-0.333	-74.033
IDEAM (Colombia)	'44137080'	'PTO LAS BRISAS'	-0.583	-72.467
IDEAM (Colombia)	'44157010'	'MERCEDES LAS'	-0.533	-72.167
IDEAM (Colombia)	'44157030'	'MARIA MANTECA'	-1.400	-70.600
IDEAM (Colombia)	'44167020'	'STA ISABEL'	-1.133	-71.100
IDEAM (Colombia)	'44187010'	'PTO CORDOBA'	-1.267	-69.733
IDEAM (Colombia)	'44187030'	'BACURI'	-1.234	-69.470
IDEAM (Colombia)	'44197020'	'VILLAREAL'	-1.300	-69.617

Data Provider	Code	Name	Latitude	Longitude
INA (Argentina)	'1453''	'CARMENSA'	-35.185	-67.726
INA (Argentina)	'0693'	'POZO SARMIENTO'	-23.217	-64.200
INA (Argentina)	'2602'	'EL COLORADO'	-26.334	-59.362
INA (Argentina)	'3223'	'PUEBLO ANDINO'	-32.673	-60.866
INA (Argentina)	'2207'	'LOS ALTARES'	-43.889	-68.398
INA (Argentina)	'3249'	'RUTA NACIONAL Nº 168'	-31.661	-60.602
INA (Argentina)	'1801'	'PICHI MAHUIDA'	-38.821	-64.981
INA (Argentina)	'3803'	'PASO LUCERO'	-28.994	-58.561
INA (Argentina)	'3821'	'LOS LAURALES'	-29.757	-59.217
INA (Argentina)	'1219'	'EL ENCON'	-32.225	-67.807
INA (Argentina)	'1452'	'CANALEJAS'	-35.169	-66.495
INA (Argentina)	'2824'	'RUTA PROVINCIAL Nº 039'	-46.724	-69.593
INA (Argentina)	'3265'	'AUTOPISTA'	-32.393	-60.941
INA (Argentina)	'3004'	'ROSARIO DEL TALA'	-32.308	-59.077
INA (Argentina)	'2211'	'GUALJAINA'	-42.654	-70.439
INA (Argentina)	'0686'	'FINCA AGROPECUARIA'	-25.162	-64.105
INA (Argentina)	'0695'	'EL QUEBRACHAL'	-25.344	-64.046
INA (Argentina)	'3231'	'RUTA PROVINCIAL Nº 32'	-28.491	-59.388
INA (Argentina)	'3804'	'PASO LEDESMA'	-29.846	-57.675
INA (Argentina)	'2004'	'PASO DE INDIOS'	-38.532	-69.413
INA (Argentina)	'2401'	'PUERTO BERMEJO'	-26.926	-58.507
INA (Argentina)	'2606'	'PUERTO PILCOMAYO'	-25.420	-57.651
INA (Argentina)	'0631'	'LA PAZ'	-22.378	-62.523
INA (Argentina)	'0804'	'SUNCHO CORRAL'	-27.950	-63.433
INA (Argentina)	'0810'	'CANAL DE DIOS'	-25.630	-63.949
INA (Argentina)	'0811'	'RUTA PROVINCIAL Nº 092 - AÑATUYA'	-28.503	-62.881
INA (Argentina)	'3126'	'RUTA PROVINCIAL Nº 070'	-31.491	-60.781
INA (Argentina)	'0470'	'RUTA PROVINCIAL Nº 323'	-27.133	-65.316
INA (Argentina)	'0016'	'CAIMANCITO'	-23.733	-64.467
INA (Argentina)	'0471'	'RUTA PROVINCIAL Nº 157'	-27.336	-65.317
INA (Argentina)	'2297'	'LOS MOLINOS'	-45.991	-69.500
INA (Argentina)	'3339'	'SANTA FE - LA GUARDIA'	-31.630	-60.678
INA (Argentina)	'3340'	'FLORENCIA'	-28.029	-59.225
INA (Argentina)	'0637'	'SAN TELMO'	-22.571	-64.240
ONS (Brazil)	-	'A. VERMELHA'	-19.863	-50.346
ONS (Brazil)	-	'A.A. LAYDNER'	-23.210	-49.230
ONS (Brazil)	-	'A.S. LIMA'	-22.153	-48.753
ONS (Brazil)	-	'AIMORÉS'	-19.498	-41.024
ONS (Brazil)	-	'B. COQUEIROS'	-18.722	-51.003
ONS (Brazil)	-	'B. ESPERANCA'	-6.754	-43.563
ONS (Brazil)	-	'BAGUARI'	-19.022	-42.125
ONS (Brazil)	-	'BARRA BONITA'	-22.519	-48.534
ONS (Brazil)	-	'BARRA GRANDE'	-27.780	-51.192

Data Provider	Code	Name	Latitude	Longitude
ONS (Brazil)	-	'CACHOEIRA DOURADA'	-18.504	-49.490
ONS (Brazil)	-	'CACU'	-18.532	-51.149
ONS (Brazil)	-	'CAMPOS NOVOS'	-27.604	-51.327
ONS (Brazil)	-	'CANA BRAVA'	-13.402	-48.143
ONS (Brazil)	-	'CANOAS I'	-22.941	-50.517
ONS (Brazil)	-	'CANOAS II'	-22.938	-50.251
ONS (Brazil)	-	'CAPIM BRANCO I'	-18.789	-48.149
ONS (Brazil)	-	'CAPIM BRANCO II'	-18.659	-48.437
ONS (Brazil)	-	'CAPIVARA '	-22.655	-51.357
ONS (Brazil)	-	'CHAVANTES'	-23.128	-49.733
ONS (Brazil)	-	'COARACY NUNES'	0.903	-51.259
ONS (Brazil)	-	'COMP PAF'	-9.396	-38.202
ONS (Brazil)	-	'CORUMBÁ I'	-17.988	-48.532
ONS (Brazil)	-	'CORUMBÁ III'	-16.788	-47.935
ONS (Brazil)	-	'CURUÁ-UNA'	-2.812	-54.299
ONS (Brazil)	-	'D. FRANCISCA'	-29.449	-53.285
ONS (Brazil)	-	'DARDANELOS'	-10.159	-59.453
ONS (Brazil)	-	'EMBORCAÇÃO'	-18.452	-47.985
ONS (Brazil)	-	'ESTREITO'	-20.151	-47.280
ONS (Brazil)	-	'ESTREITO TOCANTINS'	-6.589	-47.466
ONS (Brazil)	-	'FOZ CHAPECÓ'	-27.139	-53.044
ONS (Brazil)	-	'FOZ DO AREIA'	-26.010	-51.666
ONS (Brazil)	-	'FOZ DO RIO CLARO'	-19.117	-50.646
ONS (Brazil)	-	'FUNIL (Paraiba do Sul)'	-22.529	-44.568
ONS (Brazil)	-	'FUNIL (Grande)'	-21.143	-45.036
ONS (Brazil)	-	'FURNAS'	-20.669	-46.318
ONS (Brazil)	-	'GARIBALDI'	-27.626	-50.985
ONS (Brazil)	-	'IBITINGA'	-21.759	-48.991
ONS (Brazil)	-	'IGARAPAVA'	-19.989	-47.756
ONS (Brazil)	-	'ILHA DOS POMBOS'	-21.852	-42.608
ONS (Brazil)	-	'IRAPÉ'	-16.738	-42.575
ONS (Brazil)	-	'ITÁ'	-27.277	-52.382
ONS (Brazil)	-	'ITAIPU '	-25.408	-54.587
ONS (Brazil)	-	'ITAPARICA'	-9.144	-38.312
ONS (Brazil)	-	'ITAPEBI'	-15.966	-39.593
ONS (Brazil)	-	'ITAÚBA'	-29.261	-53.236
ONS (Brazil)	-	'ITUMBIARA'	-18.407	-49.099
ONS (Brazil)	-	'JAGUARA'	-20.023	-47.434
ONS (Brazil)	-	'JUPIÁ '	-20.776	-51.627
ONS (Brazil)	-	'LAJEADO'	-9.757	-48.372
ONS (Brazil)	-	'M. DE MORAES'	-20.286	-47.064
ONS (Brazil)	-	'MACHADINHO'	-27.527	-51.790
ONS (Brazil)	-	'MARIMBONDO'	-20.303	-49.198

Data Provider	Code	Name	Latitude	Longitude
ONS (Brazil)	-	'MASCARENHAS'	-19.500	-40.918
ONS (Brazil)	-	'MAUA'	-24.062	-50.706
ONS (Brazil)	-	'MIRANDA'	-18.910	-48.041
ONS (Brazil)	-	'MONTE CLARO'	-29.031	-51.521
ONS (Brazil)	-	'MOXOTO'	-9.358	-38.208
ONS (Brazil)	-	'NOVA AVANHANDAVA '	-21.119	-50.201
ONS (Brazil)	-	'NOVA PONTE'	-19.133	-47.697
ONS (Brazil)	-	'OURINHOS'	-23.068	-49.838
ONS (Brazil)	-	'P. AFONSO'	-9.416	-38.208
ONS (Brazil)	-	'P. CAVALO'	-12.584	-38.998
ONS (Brazil)	-	'P. COLOMBIA'	-20.124	-48.572
ONS (Brazil)	-	'P. PRIMAVERA'	-22.476	-52.959
ONS (Brazil)	-	'PASSO SÃO JOÃO'	-28.142	-55.052
ONS (Brazil)	-	'PEIXE ANGICAL'	-12.235	-48.386
ONS (Brazil)	-	'PIRAJÚ'	-23.154	-49.380
ONS (Brazil)	-	'PROMISSÃO'	-21.296	-49.783
ONS (Brazil)	-	'RETIRO BAIXO'	-18.878	-44.781
ONS (Brazil)	-	'ROSANA'	-22.600	-52.869
ONS (Brazil)	-	'SALTO'	-18.808	-51.171
ONS (Brazil)	-	'SALTO CAXIAS'	-25.543	-53.498
ONS (Brazil)	-	'SALTO OSÓRIO'	-25.538	-53.009
ONS (Brazil)	-	'SAMUEL'	-8.751	-63.454
ONS (Brazil)	-	'SANTO ANTÔNIO'	-8.797	-63.952
ONS (Brazil)	-	'SÃO SALVADOR'	-12.808	-48.238
ONS (Brazil)	-	'SÃO SIMÃO'	-19.018	-50.499
ONS (Brazil)	-	'SEGREDO'	-25.790	-52.112
ONS (Brazil)	-	'SERRA DA MESA'	-13.834	-48.305
ONS (Brazil)	-	'SERRA FACÃO'	-18.046	-47.675
ONS (Brazil)	-	'SLT. SANTIAGO'	-25.629	-52.615
ONS (Brazil)	-	'SLT. VERDINHO'	-19.143	-50.754
ONS (Brazil)	-	'SOBRADINHO'	-9.430	-40.827
ONS (Brazil)	-	'STA CECILIA'	-22.481	-43.839
ONS (Brazil)	-	'STA CLARA'	-17.896	-40.202
ONS (Brazil)	-	'STO ANT JARI'	-0.641	-52.507
ONS (Brazil)	-	'TAQUARUÇU'	-22.544	-52.000
ONS (Brazil)	-	'TELES PIRES'	-9.349	-56.779
ONS (Brazil)	-	'TRÊS IRMÃOS'	-20.669	-51.300
ONS (Brazil)	-	'TRÊS MARIAS'	-18.215	-45.259
ONS (Brazil)	-	'TUCURUÍ'	-3.832	-49.643
ONS (Brazil)	-	'VOLTA GRANDE'	-20.033	-48.222
ONS (Brazil)	-	'XINGÓ'	-9.620	-37.793
ORE-HyBam	'10064000'	'BORJA'	-4.470	-77.548
ORE-HyBam	'10080900'	'FRANCISCO DE ORELLANA'	-0.473	-76.983

Data Provider	Code	Name	Latitude	Longitude
ORE-HyBam	'10099800'	'NAZARETH'	-4.121	-70.036
ORE-HyBam	'10100000'	'TABATINGA'	-4.250	-69.933
ORE-HyBam	'13870000'	'LABREA'	-7.252	-64.800
ORE-HyBam	'14100000'	'MANACAPURU'	-3.308	-60.609
ORE-HyBam	'14710000'	'CARACARAI'	1.821	-61.124
ORE-HyBam	'14840000'	'MOURA'	-1.456	-61.633
ORE-HyBam	'15275100'	'RURRENABAQUE'	-14.445	-67.534
ORE-HyBam	'15400000'	'PORTO VELHO'	-8.737	-63.920
ORE-HyBam	'15860000'	'BORBA'	-4.897	-60.025
ORE-HyBam	'17050001'	'OBIDOS'	-1.947	-55.511
ORE-HyBam	'17730000'	'ITAITUBA'	-4.283	-55.983
ORE-HyBam	'30030000'	'LANGA TABIKI'	4.986	-54.437
ORE-HyBam	'30055000'	'SAUT MARIPA'	3.802	-51.885
ORE-HyBam	'40800000'	'CIUDAD BOLIVAR'	8.143	-63.607
SENAMHI/Peru	'10043000'	'PICOTA'	-6.955	-76.369
SENAMHI/Peru	'10043600'	'CHAZUTA'	-6.578	-76.129
SENAMHI/Peru	'10046000'	'PUCALLPA'	-8.382	-74.522
SENAMHI/Peru	'10070500'	'SAN REGIS'	-4.507	-73.920
SENAMHI/Peru	'10074800'	'REQUENA'	-5.010	-73.820
SENAMHI/Peru	'10075000'	'TAMSHIYACU'	-4.003	-73.161
SENAMHI/Peru	'10082800'	'NUEVO ROCAFUERTE'	-0.916	-75.396
SENAMHI/Peru	'10086800'	'BELLAVISTA'	-3.487	-73.084
SENAMHI/Bolivia	'15230200'	'PUERTO VILLAROEL'	-16.836	-64.799
SENAMHI/Bolivia	'15233000'	'CAMIACO'	-15.334	-64.866
SENAMHI/Bolivia	'15242000'	'PUERTO SILES'	-12.804	-65.003
SENAMHI/Bolivia	'15250010'	'GUAYARAMERIN'	-10.812	-65.343
SENAMHI/Bolivia	'15289800'	'MIRAFLORES'	-11.108	-66.411
SENAMHI/Bolivia	'15290000'	'PENAS AMARILLAS'	-11.550	-66.667
SENAMHI/Bolivia	'15292000'	'RIBERALTA'	-11.000	-66.078
SENAMHI/Bolivia	'15295500'	'CACHUELA ESPERANZA'	-10.538	-65.572
SENAMHI/Bolivia	'15312000'	'EL SENA'	-11.470	-67.237

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