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Assessing SWAT model performance to simulate daily stream flow and sediment transport from a tropical catchment of Tonle Sap Lake Basin in Cambodia

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Abstract

The main objective of this study is to assess the SWAT performance for simulating daily water discharge and sediment transport from a catchment of Tonle Sap Lake Basin. The model was calibrated from June 2010 to November 2013 for flow and from June 2011 to November 2013 for sediment. The result showed that the flow simulation was better than that of sediment transport. The model calibration was better during the first hydrological year but lower during the successive years. The model underestimated and overestimated daily water discharge during strong hydrological fluctuations particularly flood events. The statistical performance for flow was satisfactory, with a daily E_{NS} value of 0.50 and an R^2 value of 0.53. The sediment calibration was poor. Thus, simulating sediment transport from the catchment where sediment does not follow the discharge trend during flood periods will result in erroneous sediment load estimation. It can be concluded that SWAT may not be able to accurately simulate daily stream flow with strong hydrological variability and daily sediment transport in a catchment where sediment dynamics does now follow the stream flow trend.

Keywords: daily stream flow, sediment transport, SWAT model, Tonle Sap Lake Basin,

1. Introduction

Assessment of hydrology and sediment load transport at catchment scale is of critical importance for sound integrated catchment management within the context of human induced and environmental change. Quantifying and understanding the dynamics of suspended sediment transfer from land surface to watercourses is essential in controlling soil erosion and in implement appropriate mitigation practices to reduce sediment siltation in reservoir and associated pollutant loads, and hence improve surface water quality downstream (Heathwaite et al., 2005). Since the technological development takes place in the last decade, distributed catchment models are increasingly being applied to implement alternative management strategies in the area of water resource allocation and flood control (Setegn, 2009). Many hydrological and soil erosion models are designed to describe hydrology, erosion and sedimentation processes. Hydrological models describe the physical processes controlling the transformation of precipitation to runoff, while soil erosion modelling is based on understanding the physical laws of processes that occur in the natural landscape (Setegn, 2009). Distributed hydrological models, mainly simulating processes such as runoff and the transport of sediment and pollutants in a catchment, are crucial for providing systematic and consistent information on water availability, water quality and anthropogenic activities in the hydrological regime (Yang et al., 2007). A physically-based distributed model is mainly considered, since it can realistically represent the spatial variability of catchment characteristics (Mishra et al., 2007). As such, a number of water quality models at catchment scale have been developed, such as AGNPS (Young et al., 1989), CREAMS (Knisel, 1980), EUROSEM (Morgan et al., 1998), ANSWERS (Beasley et al., 1980), HSPF (Donigian et al., 1995), KIREROS (Smith, 1981), WEPP (Nearing et al., 1989), AnnAGPS (Binger and Theurer, 2003), SWAT (Arnold et al., 1998) and SHETRAN (Ewen et al., 2000).

Among these models, SWAT (Soil and Water Assessment Tool) can be a considerable option to assess hydrology and sediment transport in the tropical environment of Cambodia. To date, a number of SWAT applications to study hydrology and sediment transport in small and large catchments have been undertaken in different regions, e.g. Miyun reservoir catchment in China (Xu et al., 2009), Lake Pyhäjärvi, Yläneenjoki catchment in Finland (Bärlund et al., 2007; Koskiaho et al., 2007), Tana Lake Basin in Ethiopia (Setegn et al., 2009), two mountainous catchments in Central Iran (Rostamian et al., 2008), Kapgari catchment in India (Behera and Panda, 2006), and many studies in American catchments such as Cottonwood catchment in Minnesota (Hanratty and Stefan, 1998), Upper North Bosque River in Texas (Di Luzio et al., 2002) and Sandusky catchment in Ohio (Grunwald and Qi, 2006).

Sediment load transport to Tonle Sap Lake generally originates from the the Mekong River and its tributaries. Sediment input to Tonle Sap Lake is one of the key factors, together with the flood pulse, in the high productivity of the lake (MRC & WUP-FIN, 2003). The storage of large volumes of sediment in the Tonle Sap Lake basin is a natural phenomenon. However, the rapid rates of development and resource exploitation in the lake basin have led many observers to claim that the rate at which material is yielded to the lake and eventually stored in the basin is accelerating, and that the basin itself is in danger of filling with sediment (Kummu et al., 2008). Due to the scarcity of long-term observed water and sediment data from its tributaries, it is a big challenge to estimate accurate sediment load from the tributaries into the lake. Therefore, the modelling approach can be an ideal option to be taken into consideration for quantifying the sediment load from the tributaries of the Tonle Sap Lake basin. The main objective of this study is to assess the SWAT performance for simulating daily stream flow and sediment transport from a catchment of Tonle Sap Lake Basin.

2. Materials and method

2.1 Study area

Chreybak catchment is one of the medium tributaries of the Tonle Sap Lake Basin located in Kampong Chhnang Province, 90 km from the capital of Phnom Penh, Cambodia. The river is approximately 80 km in length, draining water into the Tonle Sap River through its floodplain (Figure 1). The main geology of the catchment is dominated by ancient alluvial at the upstream and recent alluvial at the downstream. The catchment elevation ranges from 5 to 1568 meters. There are 4 major soil types as shown in the Figure 2 and 5 different landuse types with dominant forest at the upstream and rice cover along the main river through the downstream (Figure 2) within the whole catchment. The catchment soil characteristic is mainly dominated by sandy loam.

This catchment is influenced by the tropical monsoon with two distinct seasons: the rainy season from May to October and the dry season from November to April. During the rainy season, the south-west monsoon from the Indian Ocean brings about 80 percent of the annual rainfall. The annual rainfall varies between 1400 mm at the downstream and 2000 mm at the upstream catchment. Peak rainfall in the catchment can be found in September–October. Water is originated from the Cardamom mountain range. Basically, there is too much water during the rainy season while very little during the dry season. The hydrology of the catchment is governed by two contrasted patterns with water discharge starting to increase in early July and peaking in September/October. Low flows occurred from November to May.

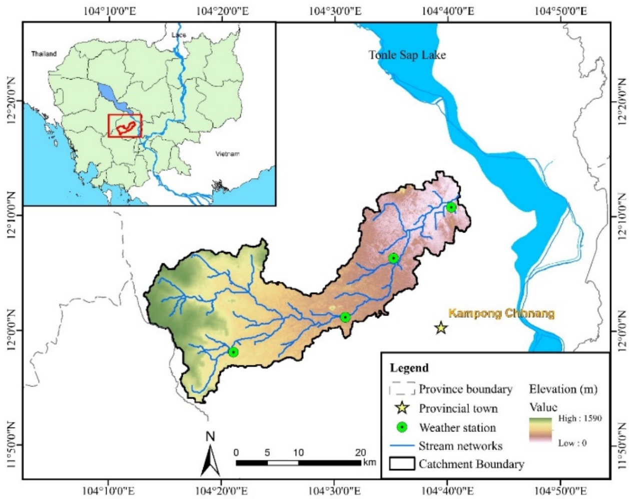

Figure 1. Geographic location of chrey bak catchment

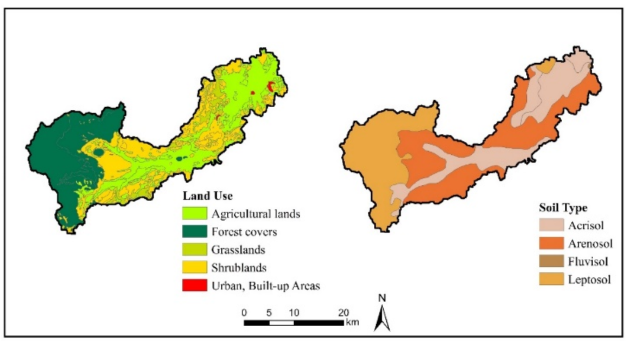

Figure 2. Landuse and Soil type in chrey bak catchment

2.2 Water level and sediment monitoring

Water level was set up at the catchment outlet in 2010 while the turbidity station was later installed in the early May 2011, where water level station was located (Figure 3). The turbidity sensor (Greenspan TS3000) has been set up in the river through a pipe to capture the variability of the continuous turbidity at 20 minute time step.

Water sampling has been also manually conducted next to the sensor pipe in order to maintain the coherence of the sediment and turbidity patterns. The water samples have been collected with high frequency as many as possible (2 to 3 samples/day during the high flooding period) and 2 times/week during low flow. The collected water samples were brought to the laboratory for the analysis of SSC. These water samples were analysed in the laboratory to determine SSC using a nitrocellulose filter (GF 0.45 µm) and drying at 50 °C for 48 h. Volumes of water ranging from 150 to 500 ml were filtered according particle concentration. Figure 4 showed the temporal variability of SSC during different hydrological years.

Figure 3. Water sampling conducted near the gauging station at the catchment outlet

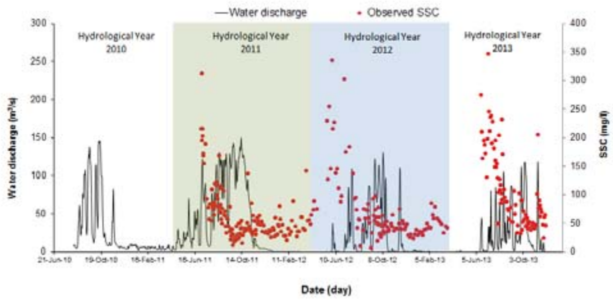

Figure 4. Daily water discharge and suspended sediment concentration observed at the Chreybak catchment outlet

2.3 Modelling approach

2.3.1 The SWAT model

The Soil and Water Assessment Tool (SWAT 2009) was selected for this study primarily because of its many previous applications to assess hydrology and sediment transport in small and large catchments in different regions. The model is a free assessable source and user friendly environment with GIS platform.

SWAT is physically-based, distributed, agro-hydrological model that operates on a daily time step and is designed to predict the impact of management on water, sediment and agricultural chemical yields in ungauged catchments (Arnold et al., 1998). SWAT can consider both upland and stream processes that occur in a catchment. Major component models include weather, hydrology, soil temperature, plant growth, nutrients, pesticides and land management. The model is capable of continuous simulation in large complex catchments with varying soils and management conditions over long time periods. SWAT uses readily available inputs, has the capability of routing runoff and chemicals through stream and reservoirs, and allows the addition of flows and the inclusion of measured data from point sources. SWAT can analyse small or large catchments by discretising into sub-basins, which are then further subdivided into hydrological response units (HRUs) with homogeneous land use, soil type and slope. The SWAT system embedded within geographical information system (GIS) can integrate various spatial environmental data, including soil, land cover, climate and topographical features.

2.3.2 Hydrological modelling component in SWAT

SWAT uses a modification of the SCS curve number method (USDA Soil Conservation Service, 1972) to compute surface runoff volume for each HRU. Peak runoff rate is estimated using a modification of the Rational Method (Chow et al., 1988). Daily rainfall data are used for calculations. Flow is routed through the channel using a variable storage coefficient method (Williams, 1969) or the Muskingum routing method (Cunge, 1969). In this work, SCS curve number and Muskingum routing methods, along with daily climate data, were used for surface runoff and streamflow computations. SWAT simulates the hydrological cycle based on the soil and water balance equation as follows:

$$SW_t = SW_0 + \sum_{i=1}^{t} (R_{day} - Q_{surf} - E_a - W_{seep} - Q_{qw})_i$$

Where SW_t is the final soil water content (mm), SW_0 is the initial soil water content on day i (mm), t is the time (days), R_{day} is the amount of precipitation on day i (mm), Q_{surf} is the amount of surface runoff on day i (mm), E_a is the amount of evapotranspiration on day i (mm), W_{seep} is the amount of water entering the vadose zone from the soil profile on day i (mm), and Q_{gw} is the amount of return flow to the stream on day i (mm).

Groundwater flow contribution to total streamflow is simulated by creating shallow aquifer storage (Arnold & Allen, 1996). Percolation from the bottom of the root zone is considered as recharge to the shallow aquifer. Three methods for estimating potential evapotranspiration are used in SWAT: Priestley and Taylor (1972), Penman (Monteith, 1965) and Hargreaves and Samani (1985). In this study, the Penman method was used to estimate potential evapotranspiration.

2.3.3 Suspended sediment modelling component in SWAT

The sediment from sheet erosion for each HRU is calculated using the Modified Universal Soil Loss Equation (MUSLE) (Williams, 1975).

$$Sed = 11.8 \times (Q_{surf} \times q_{peak} \times A_{hru})^{0.56} \times K_{USLE} \times C_{USLE} \times P_{USLE} \times LS_{USLE} \times CFRG$$

where Sed is the sediment yield (t) on a given day, Q_{surf} is the surface runoff volume (mm ha^{-1}), q_{peak} is the peak runoff rate (m^3 s^{-1}), A_{hru} is the area of the HRUs (ha), K_{USLE} is the soil erodibility factor, C_{USLE} is the cover and management factor, P_{USLE} is the support practice factor, LS_{USLE} is the USLE topographical factor and CFRG is the coarse fragment factor. Details of the USLE factors can be found in Neitsch et al. (2005).

The sediment concentration is obtained from the sediment yield, which corresponds to flow volume within the channel on a given day. The transport of sediment in the channel is controlled by simultaneous operation of two processes: deposition and degradation. Whether channel deposition or channel degradation occurs depends on the sediment loads from the upland areas and the transport capacity of the channel network. If the sediment load in a channel segment is larger than its sediment transport capacity, channel deposition will be the dominant process. Otherwise, channel degradation occurs over the channel segment. SWAT calculates the maximum amount of sediment that can be transported from the channel segment as a function of the peak channel velocity:

$$conc_{sed,ch,mx} = SPCON \times \upsilon^{SPEXP}$$

where $conc_{sed,ch,mx}$ (ton m^{-3}) is the maximum concentration of sediment that can be transported by streamflow (i.e. transport capacity), SPCON is a coefficient defined by the user, SPEXP is an exponent parameter for calculating sediment reentrained in channel sediment routing that is defined by the user (1< spexp <2) and υ (m s^{-1}) is the peak channel velocity. The peak channel velocity in a reach segment at each time step is calculated from:

$$\upsilon = \frac{PRF}{n} \times R_{ch}^{2/3} \times S_{ch}^{1/2}$$

where PRF is the peak rate adjustment factor with a default value of unity, n is manning's roughness coefficient, R_{ch} is the hydraulic radius(m), and S_{ch} is the channel invert slope (m m^{-1}).

The maximum concentration in the reach is compared with the concentration of sediment in the reach at the beginning of the time step, $conc_{sed,ch,i}$

- If $conc_{sed,ch,i} > conc_{sed,ch,mx}$, deposition is the dominant process in the reach segment. The net amount of sediment deposited is calculated by:

$$Sed_{dep} = (conc_{sed,ch,i} - conc_{sed,ch,mx}) \times V_{ch}$$

Where sed_{dep} is the amount of sediment deposited in the reach segment (metric tons), $conc_{sed,ch,i}$ is the initial sediment that can be transported by water (kg L^{-1} or ton m^{-3}) and V_{ch} is the volume of water in the reach segment (m^3).

- If $conc_{sed,ch,i} < conc_{sed,ch,mx}$, degradation is the dominant process in the reach segment. The net amount of sediment reentrained is calculated by:

$$Sed_{deg} = (conc_{sed,ch,mx} - conc_{sed,ch,,i}) \times V_{ch} \times K_{ch} \times C_{ch}$$

where sed_{deg} is the amount of sediment reentrained in the reach segment (metric tons), $conc_{sed,ch,mx}$ is the maximum concentration of sediment that can be transported by water (kg l^{-1} or ton m^{-3}), V_{ch} is the volume of water in the reach segment (m^3), K_{ch} (CH_EROD) is the channel erodibility factor (cm h^{-1} Pa^{-1}), and C_{ch} (CH_COV) is the channel cover factor.

The final amount of sediment in the reach is calculated by:

$$Sed_{ch} = sed_{ch,i} - sed_{dep} + sed_{deg}$$

where sed_{ch} is the amount of suspended sediment in the reach (metric tons), $sed_{ch,i}$ is the amount of the suspended sediment in the reach at the beginning of the time period (metric tons) and sed_{dep} is the amount of sediment reentrained in the reach segment (metric tons).

The total amount of sediment that is transported out of the reach segment is computed as:

$$sed_{out} = sed_{ch} \times \frac{V_{out}}{V_{ch}}$$

where sed_{out} is the total amount of sediment transported out of the reach (metric tons), sed_{ch} is the amount of suspended sediment in the reach (metric tons), V_{out} is the volume of water leaving the reach segment (m^3) at each time step and V_{ch} is the volume of water in the reach segment (m^3).

2.3.4 SWAT data input

The Arc SWAT interface for SWAT version 2009 was used to compile the SWAT input files. The SWAT model requires input on topography, soils, landuse and meteorological data.

- Digital elevation map (DEM) from the Mekong River Commission (MRC)
- Soil map data from the Mekong River Commission (MRC) and soil properties from Oeurng et al. (2012) for the SWAT soil database.
- Landuse data obtained from Japanese International Cooperation Agency (JICA) and reclassified for SWAT input.
- Meteorological data included 4 rainfall stations which have a complete measurement of daily minimum and maximum air temperature, wind speed, solar radiation and relative humidity. Penman method was used to simulate the potential evapotranspiration (PET) in the model.
- The catchment was discretised into 40 sub-basins with multiple landuse and soil classification. Figure 5 shows the 40 sub-basins in the Chreybak catchment

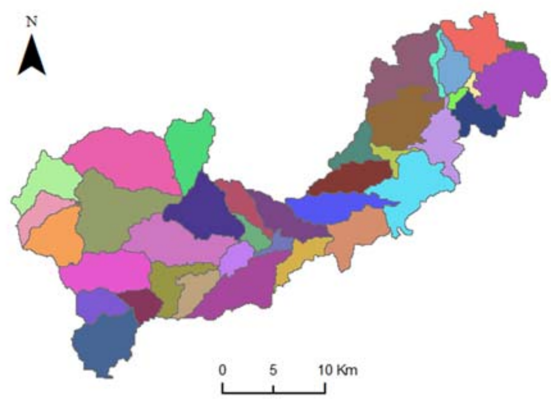

Figure 5. Map showing 40 sub-basins in Chreybak catchment

2.3.5 Model evaluation

The performance of the model in simulating discharge and sediment was evaluated graphically and by Nash-Sutcliffe efficiency (E_{NS}) and coefficient of determination (R^2):

$$E_{NS} = 1 - \frac{\sum_{i=1}^{n}(O_i - S_i)^2}{\sum_{i=1}^{n}(O_i - \overline{O})^2}$$

$$R^2 = \left\{ \frac{\sum_{i=1}^{n}(O_i - \overline{O})(S_i - \overline{S})}{\left[\sum_{i=1}^{n}(O_i - \overline{O})^2\right]^{0.5}\left[\sum_{i=1}^{n}(S_i - \overline{S})^2\right]^{0.5}} \right\}$$

Where O_i and S_i are the observed and simulated values, n is the total number of paired values, $\overline{O}$ is the mean observed value and $\overline{S}$ is the mean simulated value.

E_{NS} ranges from negative infinity to 1, with 1 denoting perfect agreement between simulated and observed values. Generally E_{NS} is very good when E_{NS} is greater than 0.75, satisfactory when E_{NS} is between 0.36 and 0.75, and unsatisfactory when E_{NS} is lower than 0.36 (Nash and Sutcliffe, 1970; Krause et al., 2005). However, a shortcoming of the Nash-Sutcliffe statistic is that it does not perform well in periods of low flow, as the denominator of the equation tends to zero and E_{NS} approaches negative infinity with only minor simulation errors in the model. This statistic works well when the coefficient of variation for the data set is large (Pandey et al., 2008). The coefficient of determination (R^2) is the proportion of variation explained by fitting a regression line and is viewed as a measure of the strength of a linear relationship between observed and simulated data. R^2 ranges between 0 and 1. If the value is equal to one, the model prediction is considered to be 'perfect'.

2.3.6 Calibration process

The period January to June 2010 served as a warm-up period for the model (allowing state variables to assume realistic initial values for the calibration period). The calibration was carried out at daily time steps using flow data for the hydrological years from 2010 to 2013 and suspended sediment data for June 2011- November 2013. The capability of a hydrological model to adequately simulate streamflow and sediment process typically depends on the accurate calibration of parameters (Xu et al., 2009). Parameters can either be estimated manually or automatically. In this study, the calibration was done manually based on physical catchment understanding and sensitive parameters from published literature (e.g. Bärlund et al., 2007; Xu et al., 2009) and calibration techniques from the SWAT user manual. After calibration of flow, calibration of sediment was carried out. The SCS curve number (CN2) is a function of soil permeability, landuse and antecedent soil water conditions. This parameter is important for surface runoff. The baseflow recession coefficient (ALPHA_BF) is a direct index of groundwater flow response to changes in recharge. This parameter is necessary for baseflow calibration. The sensitive parameters for predictions of sediment are a linear parameter for calculating the maximum amount of sediment that can be entrained during channel sediment routing (SPCON), an exponential parameter for calculating the channel sediment routing (SPEXP), and a peak rate adjustment factor (PRF), which is sensitive to peak sediment. There is no channel protection; however, the channel banks are covered by riparian vegetation along the Chreybak River.

Table 1. List of sensitive parameters used to calibrate flow and sediment at Chreybak river outlet

Parameters used to calibrate flow

	Parameter	Definition	Min.Value	Max.Value	Calibrated value
basins.bsn	ESCO	Soil evaporation compensation factor	0	1	0.1
	EPCO	Plant water uptake compensation factor	0	1	1
	ICRK	Crack flow (1=model crack flow in soil			active
	SURLAG	Surface runoff lag time	0	10	4
*.GW	GW_DELAY	Groundwater Delay	0	500	4
	GW_REVAP	Groundwater Revap	0.02	0.2	0.1
	RCHRG_DP	Deep aquifer percolation factor	0	1	0.1
	ALPHA_BF	Baseflow alpha factor	0	1	0.6
*.soil	SOL_AWC	Available water capacity of the soil layer	0	1	0.2
*.sub	CH_N1	Manning's "n" value for tributary channels	0.01	0.5	0.025
	CH_W1	Average width of tributary channel (m)			20
	CH_S1	Average slope tributary of channel (m/m)			0.0125
*.rte	CH_N2	Manning's "n" value for main channel	0.01	0.5	0.04
*hru	OV_N	Maining's "N" for overland flow	0.01	0.5	0.2
*.mgt	CN2	SCS Curve number	35	98	80 (cultivated) 65 (urban) 70 (forest)

Parameters used to calibrate sediment

File	Parameter	Definition	Min.Value	Max.Value	Calibrated value
*.bsn	PRF	Peak rate adjustment factor for sediment routing	0	2	1
*.rte	CH_COV	Channel cover factor	-0.05	0.6	0.1
*.rte	CH_EROD	Channel erodibility factor	0	1	0.1 to 1
*.bsn	SPCON	Linear parameters for calculating the channel sediment routing	0.0001	0.01	0.01
*.bsn	SPEXP	Exponent parameter for calculating the channel sediment routing	1	1.5	1.5

3 Results and discussion

3.1. Simulation of daily stream flow

The model has been calibrated from June 2010 to November 2013. Water discharge and sediment calibration was based on daily simulations. Table 1 presents the calibrated parameters for discharge, suspended sediment and the range of SWAT parameter values. Figure 6 graphically illustrated observed and simulated daily water discharge at Chreybak catchment outlet from June 2010 to November 2013. Simulated daily water discharge followed a similar trend to observed flow particularly during the first hydrological year. However, simulated peak flow was overestimated during some flood periods particularly in August 2012. The simulated flow trend is close with the observed value in the first hydrological year; hence, the cumulative water flow is identical (Figure 7). However, it was overestimated for the hydrological year 2012 and underestimated for hydrological year 2012. This showed some uncertainties of model calibration.

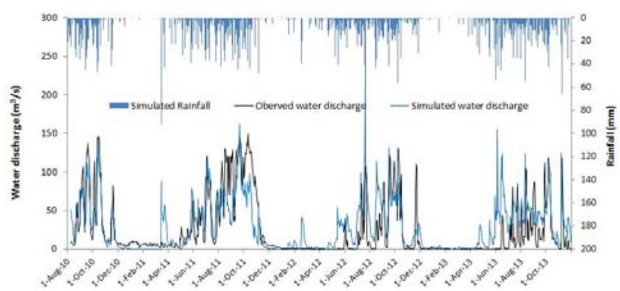

Figure 6. Observed and simulated daily stream flow at Chreybak catchment outlet

The runoff response from SWAT totally depends on rainfall event; for example, it can be observed that the observed flow in the river during the dry season was not correlated with the simulated peak flow during March 2011 and March 2012 (Figure 6), attributed to some rainfall events occurred during these periods. All most no runoff occurred in the river because most of rainwater was mainly infiltrated during the dry season. Therefore, SWAT tends to be not able to simulate flow by taking antecedent conditions into account. Additionally, there is a lack of input data for simulation of groundwater recharge and groundwater–river interaction. It should be noted that the hydrological regime of the catchment fluctuates significantly during the wet season, possibly resulting in difficulty in performing daily stream flow calibration. The water diversion and water use by the upstream hydraulic structures along the Chreybak River also contributes to the uncertainty in discharge calibration. The statistical performance was satisfactory, with a daily E_{NS} value of 0.50 and an R^2 value of 0.53 (Figure 8).

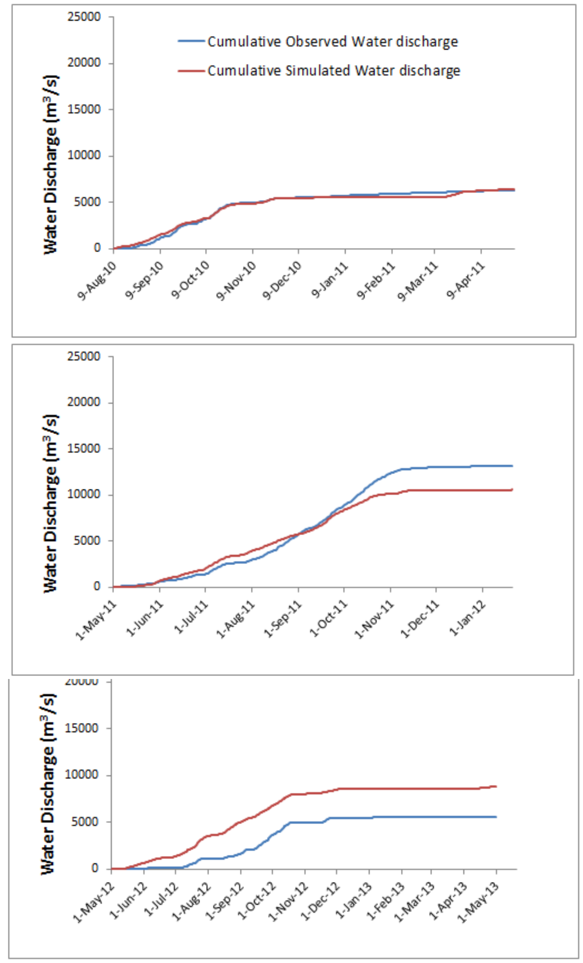

Figure 7. Cumulative observed and simulated stream flow during hydrological year 2010, 2011, 2012 at Chreybak catchment outlet

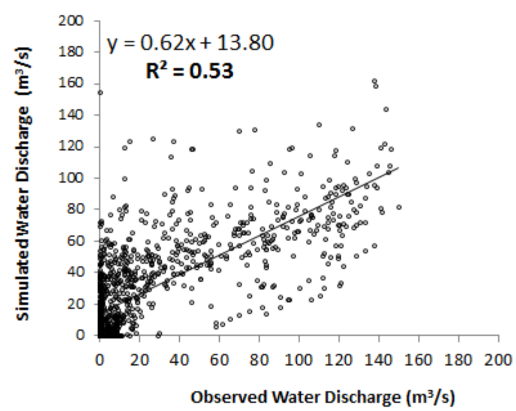

Figure 8. Regression relationship between observed and simulated stream flow at Chreybak River

3.2. Suspended sediment simulation

The observed values of suspended sediment were compared with simulated sediment values for the period June 2011– November 2013. Figure 9 graphically showed observed and simulated daily suspended sediment concentration (SSC) at Chreybak catchment outlet from June 2011– November 2013during the suspended sediment sampling period at Chreyak catchment outlet. Simulated SSC does not follow the trend of observed SSC. This is mainly attributed to the model capability. The SSC simulated in SWAT computationally does not follow then observed SSC but correlated with water discharge trend (Figure 9). The sediment concentration simulated by SWAT depends particularly on water discharge which can be seen in the section 2.3.3 on the suspended sediment modelling component in SWAT.

SWAT might not be able to simulate high sediment transport flood events and that even-based models such as AGNPS and ANSWERS should be used instead of continuous simulation models such as SWAT (Xu et al., 2009). Benaman and Shoemaker (2005) analysed high flow sediment event data to evaluate the performance of the SWAT model in the 1178 km^2 Cannonsville catchment and concluded that SWAT tended to underestimate the loads for high loading events (greater than 2000 metric tons). The largest error in prediction of sediment, however, was associated with large peak flows. Furthermore, SWAT allows all soil eroded by runoff to reach the river directly, without considering sediment deposition remaining on surface catchment areas (Oeurng et al, 2011). The weakness of the model to simulate sediment was also due to the improper peak runoff simulation.

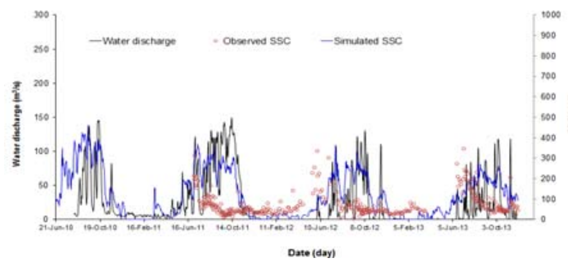

Figure 9. Observed and simulated daily suspended sediment concentration (SSC) at Chreybak catchment outlet (June 2011 to November 2013).

Based on the field data observation, the sediment dynamics in the Chreybak River is not correlated with water discharge (Figure 4). The peak observed SSC took place typically at the beginning of the rainy season while SSC was rather low despite the flood events occurred at the later event as shown in Figure 4. The sediment at the beginning of the rainy season mainly came from the sediment deposit from previous season possibly through bank erosion. Even though during a big flood in October 2011, the water discharge reached 149 m^3/s, SSC was only 56 mg/l. However, at the beginning of the rainy season, SSC reached 314 mg/l while the water discharge was about 96 m^3/s (Figure 4). It was observed that this pattern was very similar for other hydrological years. The behaviour of sediment dynamics from Chreybak river is different from other rivers where sediment mainly follows the discharge trend during flooding periods (Oeurng et al, 2009). In this case, it can be concluded that SWAT has weakness to simulate the daily sediment transport within this context.

4 Conclusion

SWAT model was applied to the Chreybak River catchment in order to simulate daily stream flow and suspended sediment concentration. Parameterisation of the model to achieve good simulations of daily flow and sediment transport under strong hydrological variability proved to be a laborious task in this catchment. The simulation of daily discharge was better than that of sediment transport. The model underestimated and overestimated daily discharge during strong hydrological fluctuations particularly flood events. During the dry season, flow simulated by SWAT totally depends on rainfall with lack of integrating antecedent conditions.

Sediment transport component in SWAT basically correlate with flow behaviour. Simulating sediment transport from the catchment where sediment does not follow the discharge trend during flood periods will result in erroneous sediment load estimation. Therefore, SWAT may not be ideal to simulate daily water discharge and daily sediment transport at daily time scale with strong hydrological variability in a catchment where trend of sediment dynamics does not correlate with water discharge trend as the Chreybak catchment.

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Conflicts of Interest: The authors declare no conflict of interest.

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