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8:30 AM – 10:00 AM

SESSION 39: Surface water/Groundwater Ecosystem Interactions

The Priestley-Taylor Coefficient Estimated for *Vochysia Divergens* Monospecific Forests in Pantanal, Brazil - Marcelo de Carvalho Alves, Federal University of Mato Grosso, Cuiabá, MT, Brazil (co-authors: Luciana Sanches, José Holanda Campelo Filho, José de Souza Nogueira)

The Priestley-Taylor coefficient α was calculated based on two methods used for the estimation of evapotranspiration, the Bowen ratio and Penman-Monteith method. This study was conducted in the northeastern Pantanal located approximately 160 km south of Cuiabá city, Mato Grosso state, Brazil (16°39'50"S; 56°47'50"W). The climate is characterized by a pronounced dry and a wet season. Flooding follows the rainy season, however because of the flat landscape; the flood pattern inside the Pantanal is strongly influenced by local precipitation. In this area occur a forest formation of special importance, the *Vochysia divergens*, Vochysiaceae ("Cambará"), which vigorously spreads into pastures and can form monospecific stands with average tree heights between 28 – 30 m and a dense leafy crown. Continuous micrometeorological flux tower measurements at a height of 32 m tall were made from January through December of 2007. The Bowen ratio varied little over the year, with values ranging from -0.365 (July) to -0.163 (December). Average Bowen ratio was -0.217 in the wet season and -0.346 in the dry season. The evapotranspiration ranged from 2.26 mm day⁻¹ (dry season) to 4.50 mm day⁻¹ (wet season) if determined by the Bowen ratio. The annual integrated evapotranspiration was about 1590 mm, or ~6% higher than of the observed rainfall. The seasonal integrated evapotranspiration was ~19% higher than the observed rainfall in the wet season and ~15% lower than the rainfall in the dry season. The average estimated α ranged from 1.05±0.25 to 1.565±0.27 and from 1.05±0.14 to 1.65±0.19 for values of evapotranspiration estimated by Penman-Monteith and Bowen methods, respectively, with annual averages of 1.26±0.31 and 1.46±0.28. According to Priestley and Taylor α varies between 1.08 for bare soil evaporation and 1.32 evapotranspiration in dense vegetation and an average of 1.26 under humid climates. With the empirically determined dimensionless correction of α , estimates of evapotranspiration can be improved for *Vochysia divergens* forests in Pantanal floodplain.

Modeling Hydrologic Interactions between Karstic Aquifer and Lakes in Florida using HSPF - Zhulu Lin, North Dakota State University, Fargo, ND (co-authors: David Clapp, Tom Jobes)

Orange Creek Basin (OCB) in central Florida is characterized by limestone topography with complex surface water – groundwater interactions and by the presence of broad shallow lakes and sinkholes. Three large shallow lakes in OCB are Newnans, Lochloosa and Orange Lakes. A large sinkhole developed in the bottom of Orange Lake during an extended drought period in early 1950's. Lake water discharges into the underlying Floridan aquifer through the sinkhole. The upstream lakes (Newnans and Lochloosa) interact with the underlying Hawthorne aquifer through lake-bottom seepage. The net result of surface water –groundwater interactions in Newnans Lake is that Newnans Lake recharges underlying groundwater while that in Lochloosa Lake is that Lochloosa Lake receives discharge from groundwater system. As water quality of the water bodies in OCB deteriorating, the development of the Total Maximum Daily Loads (TMDLs) for nutrients (N and P) in the three lakes was imminent and was scheduled to be completed by 2008. However, the complex karst hydrology in this region poses a great challenge to the hydrological modeling that is essential to the subsequent TMDL development. We used the Special Action module of HSPF (Hydrological Simulation Program – HSPF) coupled with the parallel PEST (Parameter ESTimation) model calibration software to effectively estimate the hydrological interactions between groundwater systems and surface waters in OCB. The Nash-Sutcliffe coefficients of stream stage calibration for four tributaries were among 0.61-0.77 while those of the lake stage calibration for the

three lakes were greater than 0.92. The flow rate of the large sinkhole in Orange Lake recharging groundwater was estimated to be 39.0 cubic feet per second.

Interaction of the Soil Water Content and Vegetation Dynamics of a Tropical Semi-Deciduous Forest of the Southern Amazon Basin, Brazil - Marcelo de Carvalho, Federal University of Mato Grosso, Cuiabá, MT, Brazil (co-authors: Luciana Sanches Alves, Osvaldo Borges Pinto Júnior, José de Souza Nogueira)

This study analyzes the interaction between soil water content (SWC) and litterfall (litter production), litterpool (forest floor litter mass) and leaf area index (LAI) of semi-deciduous tropical forest located in the rainforest-savanna ecotone of the southern Amazon basin for 2001-03. SWC was measured by three time domain reflectometry sensors at a depth 5, 30 and 70 cm. Monthly were measured leaf, stem, and reproductive (flower + fruit) litterfall and the forest floor litter mass. Leaf area index were estimated indirectly according Lambert-Beer Law and altered equation according Monsi & Saeki (Monsi & Saeki, 1953) with continuous measurements of photosynthetically active incident radiation (PAR). Average monthly of SWC ranged from 0.050 m³m⁻³ (dry and dry-wet-transition season) to 0.149 m³m⁻³ (wet and wet-dry-transition season). The average monthly of leaf litter production varied between 10 and 135 g dry mass m⁻² mon⁻¹ over the study period, and in general leaf litter production was significantly higher during the dry season (c.a 70%). Forest floor litter mass ranged between 5-8 Mg ha⁻¹. Leaf area index varied between 4-5 m² m⁻² in the wet season and 2-3 m² m⁻² in the dry season. Average monthly of soil water content were not significantly correlated with litter production and forest floor litter mass. Soil water content was positively correlated with leaf area index during the wet seasons and negatively correlated with this variable during the dry season. In the dry season, occur the rainfall reduction and consequently the decline of SWC; so same tree species lost leaf to save supplemental water, declining the leaf area index more than the decline of soil water content. Overall, our results suggest that SWC variability influence directly in leaf area index mainly during wet season. SWC indirectly can be altering the litter production dynamics and forest floor litter mass; will likely have important consequences for the vegetation dynamics of Amazonian semi-deciduous forest.

Characterization of Groundwater-Surface water Interactions using GMS and differential gauging approaches - Said Ghabayen, Utah Water Research Laboratory, Utah State University, Logan, UT (co-authors: Noah Schmadel, Bethany T. Neilson)

Stream losses to and gains from groundwater play an important role in processes that affect watershed hydrologic response and water quality. These exchanges are an important mechanism to quantify in order to understand solute and contaminant transport. In this study, we applied two separate approaches to estimate the groundwater – surface water exchanges in different sections of Curtis Creek, UT. The approaches, which include groundwater modeling system (GMS) and differential gauging with dilution gauging techniques, were used to determine the extent of groundwater – surface water exchange at a reach and sub-reach scale. To characterize sub-reach scale interactions, the study reach was divided into sections that were expected to be primarily gaining or losing based on water table gradients from groundwater observations wells, stream water surface elevations, main channel vertical head gradients, and visible surface groundwater seep locations. The groundwater flow model was calibrated using water table measurements from the observation wells. Saturated hydraulic conductivity values were measured at many locations and the spatial representation of these values were adjusted in the calibration. The differential gauging results show that the net changes in stream discharge observed in 13 sub-reaches range from 5 to 20% of upstream discharge. Since these measured changes confound the effects of gross gains and losses, GMS estimates that provide a better spatial representation of these processes will be provided and compared.