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Physical erosion and chemical weathering are first-order controls on sediment loads and solute chemistry, two important components of surface water quality. Recent developments in cosmogenic radionuclide geochemistry permit rates of physical erosion and chemical weathering to be measured over 10,000-year timescales. We have used cosmogenic ^{10}Be to measure long-term rates of physical erosion and chemical weathering at dozens of sites, spanning a 20-fold range in precipitation, a 30 $^{\circ}$C range in temperature, and a 30-fold range in denudation rates. Across this network of sites, rates of physical erosion and chemical weathering are tightly coupled with one another: sites with higher rates of physical erosion also have higher rates of chemical weathering, all else equal. Chemical weathering intensity varies systematically with climate; the ratio of chemical weathering to physical erosion increases linearly with precipitation, and increases as an Arrhenius function of temperature. These measurements provide a long-term perspective for interpreting present-day sediment and solute fluxes in streams. In the mountains of central Idaho, long-term erosion rates are nearly 20 times higher than sediment yields measured over the past several decades, indicating that sediment delivery is extremely episodic. But in the northern California Coast Range, long-term erosion rates are within a factor of two of modern-day sediment yield measurements, suggesting that sediment delivery over decadal timescales is in equilibrium with long-term rates of sediment production in that rapidly-eroding landscape. At Silver Creek, Idaho, cosmogenic estimates of chemical weathering rates are roughly four times higher than 11-year weathering fluxes calculated from catchment input-output mass balances. But at Rio Icacos, Puerto Rico, cosmogenic measurements of long-term chemical weathering rates are consistent with stream solute fluxes, indicating that present-day solute fluxes are in equilibrium with long-term rates of solute generation in that intensive weathering regime.

H42K-07 1740h

Sediment Fingerprinting Using Carbon and Nitrogen Stable Isotopes in the Upper Palouse Watershed, Northwestern Idaho

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Unwarranted soil erosion creates detrimental problems for watershed users and for habitats and human infrastructure that experience increased suspended sediment in surface water. Identification and mitigation of erosion prone uplands relies on the realization that land uses (i.e. agriculture, forest, industrial, pasture, etc.) "produce sediment differently" at the watershed scale. Quantification of sediment production from various land uses is deemed feasible by using sediment-particle fingerprinting. This technique utilizes vegetative derived carbon (C) and nitrogen (N) stable isotopes and the carbon/nitrogen (C/N) atomic ratio of sediments to identify sediment producing land uses. Past research has established differences between C and N isotopic signatures and C/N ratios for soils under forest vs. agriculture (i.e. grasses and wheat) land cover. The current research rigorously examines these distinct signatures through isotopic analysis of field soils from the Palouse River Watershed of Northwestern Idaho preceded with statistical analyses to establish soil uniqueness. In addition, stream sediments are preliminarily analyzed to identify their origin with the goal of establishing a blueprint methodology for estimating sediment source and erosion rates within the watershed. Prior to field sampling of source soils, a statistical-experimental design was established with the intent to capture spatial and temporal variations and random errors of C and N isotopic signatures and C/N ratios within the forest and agriculture land uses. Factors including, elevation, slope topography, and season, were assessed by excavating over 300 samples during 4 seasons (i.e. May 2002, August 2002, November 2002, and March 2003) and at numerous locations throughout the watershed. Atomic analyses was performed at the University of Idaho Natural Resources Stable Isotope Laboratory using a Costech 4010 Elemental Combustion System connected with a continuous flow inlet system to the Finnigan MAT Delta Plus isotope ratio mass spectrometer. The statistical analysis of variance (ANOVA) with C and N isotopic signatures and C/N ratios as three independent response variables was administered to identify the agriculture and forested uniqueness, and discriminant analysis was used to create an organic fingerprint parameter which weights the contribution of C and N isotopic signatures and C/N ratios to the land cover separation. Results indicate uniqueness of the N isotope C/N ratio for the forest and agriculture sediment sources and little distinction possible for the C isotope signature. The organic fingerprint parameter was then calculated and coupled with in-stream sediment isotopic data using a simple end-member model. Preliminary results indicate that C and N isotopic signatures and C/N ratios will serve as a useful technique in quantifying erosive source rates and understanding upland erosion processes.

H42K-08 1755h

Erosion Measurements in Linear, Oscillatory, and Combined Oscillatory and Linear Flow Regimes

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Many contaminated sediments and dredged material mixtures of cohesive and non-cohesive sediments occur in wave-dominated environments. *In situ* analysis is imperative in understanding the erosion and transport of these sediments. Recent research efforts have developed a flume with unidirectional flow that can measure *in situ* sediment erosion with depth (SEDflume). However, the flow regime for the SEDflume has limited applicability to wave-dominated environments. Therefore, a unique device, called the SEAWOLF flume, was developed and used by Sandia National Laboratories to simulate high-shear stress erosion processes experienced in coastal waters where wave forcing dominates the system. The SEAWOLF is capable of testing *in situ* or laboratory prepared cores. Erosion rates of cohesive and non-cohesive sediments prepared in the laboratory were determined in oscillatory and combined oscillatory and linear flow regimes. Results of these tests were compared to results from the unidirectional SEDflume. Although maximum shear stresses for oscillatory flows were as high as 7 Pa for the tests, the associated erosion rate for specific sediment over the entire wave cycle were comparable to much lower shear stresses found for constant, linear flows. For example, sediment exposed to a maximum of 7 Pa over a 15 s period resulted in erosion rates similar to results for a constant linear shear stress of 3.4 Pa. Analysis of results for all sediments tested led to a determination of values for an effective shear stress that relates wave-induced erosion to linear flow induced erosion.

H42L MCC: 3022 Thursday 1600h

Extreme Event Geomorphology III

(joint with T, C, NG)

Presiding: **D R Montgomery,** University of Washington**; J J Major,** U.S. Geological Survey

H42L-01 1600h

Increased sediment delivery from an active mountain belt caused by earthquake and typhoon disturbance

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Earthquakes in active mountain belts commonly trigger widespread landsliding. Coseismic landsliding is an important geomorphic component of continental tectonics, a fundamental control on the rate of sediment delivery to rivers and ocean basins, and a destructive natural hazard. Here we report measurements of sediment discharge for rivers in Taiwan following the 1999 M_w 7.6 Chi-Chi earthquake. Average sediment discharge to the ocean from rivers draining the epicentral area increased by 3–5 times following Chi-Chi earthquake, and by up to an order of magnitude in several mountain catchments. Detailed field mapping reveals that debris from widespread coseismic landsliding remains stored on hillslopes and in channels and is mobilized in subsequent storms. Our findings suggest that sediment discharges will remain elevated for several more years. Using measurements of coseismic deformation and post-seismic erosion, we assess the contribution of large earthquakes to the long-term development of topography.

URL: http://www.esc.cam.ac.uk/~simon00/

H42L-02 1615h

A modeling study on the effects of vegetation and disturbances on episodic sediment delivery

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In steep forested basins of the Western U.S. episodic catastrophic erosion events are often linked to extreme climate events together with vegetation disturbances by wildfires and anthropogenic activities such as timber harvest. These disturbances have been shown to dramatically accelerate erosion rates over rates in undisturbed forests at short time-scales. Over longer time scales, however, characterization of the frequency and magnitude of extreme events has been hampered by the lack of data and techniques to date past low frequency and large magnitude events. Here we investigate the controls of forest vegetation, natural (wildfires) and anthropogenic (harvest) disturbances on the frequency and magnitude of sediment delivery from a small watershed (3.9 km2) in the Idaho Batholith through numerical modeling. Our model simulates soil production, gully erosion, forest vegetation dynamics, shallow landsliding and debris flow generation over millennial time scales. In the model, vegetation provides root cohesion and surface resistance to channel initiation. Fire and harvest reduce the vegetation and fire leads to water repellent soils. Our simulation results compare well with published data for sediment yields of recently observed catastrophic events, and long term averages over 10,000 years in the Idaho Batholith. By experimenting with different vegetation scenarios we found that the magnitude of episodic stream sediment inputs mostly depends upon the frequency of disturbance. Large but infrequent episodic sediment inputs occur when when vegetation was not disturbed by wildfires or harvesting over thousands of years. When forest disturbance is modeled through the simulation of either wildfires or harvesting, episodic sediment inputs are more frequent and occur during accelerated erosion periods following disturbances. Because for this watershed the long-term rate-limiting factor in sediment delivery is modeled to be soil production, the magnitude of episodic sediment delivery is smaller under the presence of disturbances.

URL: http://www.engineering.usu.edu/cee/faculty/dtarb/

H42L-03 1630h

A Record of Extreme Sedimentation Events in Central Idaho: Fire, Climate, and Changing Sediment Yields Over the Holocene

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In the central Idaho mountains, most of the annual runoff in small streams occurs with snowmelt, suggesting that most sediment transport would occur during high seasonal discharges with recurrence interval of perhaps a few years. A spate of recent major debris-flow events in small basins, however, implies that infrequent severe storms where mass movement threshold conditions are crossed are also be major contributors to sediment yields. This landscape is characterized by deeply weathered Idaho batholith granitic rocks, and slopes mantled by thick, poorly cohesive grussy sediment. An important control on debris-flow generation is fire, which dramatically lowers threshold conditions for surface runoff generation and also lowers the cohesive strength of slope sediment after roots decay. A series of storms culminating in intense rain on melting snow in January 1997 caused numerous colluvial failures, debris flows, and sediment-charged floods in South Fork Payette River tributaries, with the majority in either burned forested or unburned rangeland basins. This event produced sediment yields up to 44,000 Mg km^{-2} in $\sim$0.5 km^2 basins, which equals several thousand years of background sediment yields (2.7-30 Mg km^{-2} yr^{-1}) measured over a few decades of trapping and gauging in Idaho batholith watersheds, where major debris-flow events are not included (Clayton and Megahan, 1986). Recurrence intervals of $\sim$ 400 years for such extreme events would account for 10,000-yr average Idaho batholith sediment yields of $\sim$ 116 Mg km^{-2} yr^{-1} (Kirchner et al., Geology 29, 2001). Shaub (2001) found that of $>$ 200 colluvial failures in the 1997 event in the South Fork Payette drainage, 75% occurred in burned areas. Over the last several decades, however, other large debris flows have been generated from unburned slopes by unusually intense summer convective storms and winter rain-on-snow events; we hypothesize that these events are more probable in warmer climates. Long-term effects on the main South Fork Payette channel are strongly dependent on sediment size transported as well as the total mass. Deposit characteristics from 10 alluvial fan sections in small basins show that of the total stratigraphic thickness, over 90% is probably or possibly related to fire. Of $\sim$ 54 depositional units within these fans, 5 fire-related debris-flow deposits account for $\sim$ 25% of the total stratigraphic thickness. Radiocarbon dating of these 5 large events show that all occurred between $\sim$ 750-1100 cal yr BP, corresponding to the "Medieval Warm Period", a time of increased fire-related sedimentation in Yellowstone and severe droughts in parts of the western USA. Most other large debris flows appear to occur during relatively warm episodes in Idaho. Event frequency reaches a maximum at other times corresponding to cooler climate (e.g., $\sim$ 300-500, 1100-1400, and 6600-7400 cal yr BP), but fan aggradation rates from these frequent small events are relatively low, and one well-preserved fan built over the earliest period provides a low average sediment yield comparable to modern background rates. These results suggest that infrequent large events account for the majority of sediment transport out of small mountain basins, and that sediment yields are strongly nonstationary over millennial timescales. Variations in climate and associated changes in fire regimes and storms exert a major control on the occurrence of extreme erosional events.

H42L-04 1645h

Episodic Mass Transfer During Extreme Floods from a 70,000 km^2 Andean River Basin to Amazonian Floodplains

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Continental-scale, sand-bedded rivers sequester a significant proportion of their sediment load in lowland basins, but the hydraulic and hydrologic conditions under which sediment efflux from mountainous sources and downstream floodplain storage occur are poorly understood. A new geochronological method makes it possible to identify discrete events and measure the accumulation from such processes with near-annual resolution, and thereby resolve the spatial and temporal distribution of individual accumulation events across large, dynamic fluvial dispersal systems. Our measurements along two rivers at a variety of distances from the channel reveal previously undocumented spatial and temporal patterns that reflect the hydraulics of sedimentation and the occurrence of flooding and sediment delivery forced by global atmospheric processes. Specifically, we quantify century-scale floodplain sedimentation rates across a pristine 720,000 km^2 basin covering the principal sediment and water sources for the Madeira River, the largest sediment source for the Amazon. Accumulation is dominated by crevasse splays emplaced hundreds to thousands of meters from the channel as lenticular, lobate deposits, with system-wide and local recurrence intervals of 8 years and multiple decades, respectively. Ocean temperature and stream flow records link these episodic events to cold-phase ENSO rapid-rise floods that also debouch extraordinary volumes of sediment from the Andes; we explore the timing and mechanics of these events, both in terms of the Andean denudation (from a 70,000 km^2 mountainous basin) and the downstream transfer and emplacement of sediment across lowland foreland basins. Transient processes control the formation of floodplains and sedimentary strata, and modulate the efflux, transport, floodplain storage, exchange, and downstream delivery of sediment and associated carbon, nutrients, and heavy metals to the Amazon River.

H42L-05 1700h

Quantifying Flow Resistance in Rivers and on Floodplains During Large Floods

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In an effort to improve predictions of peak discharge at ungaged sites by reducing the uncertainty in estimates of channel roughness, a series of processed-based methods have been developed over the past several years to quantify the flow resistance of common channel roughness elements using simple measurements of their geometric properties. These methods have been recently incorporated into a flow model and have been applied to predict the velocity, discharge, and boundary shear stress in a 150-m densely vegetated reach of the Rock Creek Branch of the Whitewater River, Kansas. This is done without calibration using measured stage together with detailed measurements of the channel geometry and the size, shape, and spacings of the small-scale topographic features and plant stems in the channel. Topographic features on the bed and banks of the channel are characterized by a sequence of Gaussian shaped elements, which have drag coefficients known from recent experiments. Woody vegetation is modeled as randomly distributed rigid vertical cylinders. The model explicitly calculates drag on the roughness elements and includes the effects of friction on lateral boundaries on the flow and boundary shear stress. Model predictions of discharge during a moderate flow event are in agreement with the measured discharge at a USGS gaging station at the entrance to the study reach. The model is then used to explore the effect of floodplain roughness on the flow and boundary shear stress during a hypothetical overbank event. The model shows that drag on the vegetation substantially reduces the flow velocity on the floodplain, which results in increased velocities and boundary shear stress in the main portion of the channel relative to the case with no vegetation present. When used in conjunction with information on the critical shear stress of the bed and bank material, the model can be used to determine whether or not a given event can alter the channel topography and to evaluate the geomorphic response of the channel to extreme flow events. During extreme events the topography and roughness of the channel can change with time and these changes must be calculated with bed and bank evolution models.

H42L-06 1715h

Sediment Pulse Migration And Stopping Along The Sendai River, Japan

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A pulse of sediment was tracked in the middle portion of the Sendai River, Tottori-prefecture: southwestern Japan. During Typhoon Number 10 in 1998, a large landslide behind a quarry along the river contributed approximately 50,000 cubic meters (equivalent to c.a. 8,000 dump trucks) of metamorphic rock to the channel. We investigated the lithologic composition of the riverbed gravel in four classes (16-32mm, 32-64mm, 64-128mm and 128-256mm) at 15 different sites along a 6.5 km reach of the river. Investigations were conducted during four periods over the successive two years (1999 and 2000); in spring- after snowmelt floods and in autumn following floods in the rainy and typhoon seasons and also during a period in the summer of 2003. The lithologic composition data revealed sediment pulse movement in all 4-size classes. In the pulse for both the 16-32mm and the 32-64mm particles, a 6.2 km migration was observed from 1998 until 2000. While the sediment pulse migration in the 64-128mm and the 128-256mm particles was 5.6 km and 4 km respectively for the same period. As particle size segregation proceeds flood-by-flood, propagation rates of sediments pulses has decreased rapidly and have subsequently ceased to move in spite of some effective annual floods. During the period 2000 - 2003, only marginal migrations of sediment pulses were detected. Therefore, the authors consider that the loss of grain size mixture effects on sediment transport could explain the dearease in the migration rate of sediment pulses as well as the cessation of sediment pulse propagation.
Keywords: sediment pulse, migration rate, lithologic composition, river-bed gravel, landslide

H42L-07 1730h

Bedload Transport During an Extreme Runoff Event in Arctic Alaska

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While spring snowmelt floods are common annually in the Arctic, rainfall generated floods are rare or at least seldom documented. Since 1999, we have documented two rainfall events in the Upper Kuparuk River where the total precipitation for each storm approached 100 mm. These two floods (July 1999 and August 2002) produced flows that exceeded the maximum snowmelt runoff by a factor of three to four. It is these large events that shape the drainage network. Passive and active tracer rocks, scour chains and pre- and post-storm surveyed cross-sections were used to quantify bedload transport. The August 2002 event mobilized the entire bed. All of the tracer rocks moved and those that were recovered after the flood traveled an average of 72.8 m, with those in pools traveling farther than those in riffles. Lateral bank erosion exceeded 10 m in many areas; the bed degraded and aggraded more than 1 m. It is estimated that 870 cubic meters of bed material passed through the study area.

H42L-08 1745h

Late Quaternary Volcanogenic Megafloods in the Taupo Volcanic Zone, New Zealand

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The Taupo Volcanic Zone in the central North Island of New Zealand is an area of intense Quaternary silicic volcanism, characterized by frequent caldera-forming explosive eruptions from multiple short-lived, nested, and/or overlapping volcanic centres. Although many people are familiar with the geologically recent devastating volcanic eruptions from the two currently active rhyolitic volcanoes, Taupo and Okataina, there is much less awareness of the equally damaging sedimentary aftermaths of these events as landscapes readjust to burial by thick layers of pyroclastic debris. Lake Taupo, the largest lake in New Zealand, partially occupies a composite caldera and volcano-tectonic collapse structure formed during the 26.5 ka Oruanui eruption and last modified during the 1800a Taupo eruption. Post-eruption, Lake Taupo refilled to 500 metres above sea level (mASL), an increase of c. 140 m over

its modern level, and impounded an additional 80 cubic kilometers of water. The highstand lake initially overtopped the lowest area on the caldera rim to establish a semi-stable outlet controlled by a sill of older welded ignimbrite. Headward erosion through thick but unwelded Oruanui pyroclastic further east established a new, lower outlet at 405 mASL prior to 22.5 ka, releasing c. 60 cubic km of water in a flood that transported enormous boulders and which may have permanently changed the course of the largest river in the North Island. More recently, the 1800a Taupo eruption also blocked the outlet to the lake, resulting in a 34 m rise in lake level. Catastrophic failure of the ignimbrite dam following overtopping generated a flood whose discharge peaked at 17 000 - 30 000 cubic metres per second, releasing 5 years of normal outflow in 3 weeks. The geomorphic expression of this flood is found in boulder deposits, erosion surfaces, and overbank aggradation deposits and buried forests that can be traced for over 200 km downstream. Further north, Lake Rotorua is also fringed by extensive terrace and shoreline deposits that, coupled with downstream evidence, suggest multiple break-out flood events, while Lake Tarawera has been the source of volcanogenic floods c. 700 years ago and as recently as 1904 A.D.. Outbreak floods from caldera and crater lakes are a recurrent feature of volcanism in New Zealand and constitute a significant new and far-reaching hazard.

H42M MCC: 3020 Thursday 1600h

Assessing the Impacts of Vegetation on the Water Balance III *(joint with B)*

Presiding: **B R Scanlon,** University of Texas at Austin**; M A Walvoord,** U.S. Geological Survey

H42M-01 1600h

Assessing the Importance of Incorporating Spatial and Temporal Variability of Soil and Plant Parameters into Local Water Balance Models for Precision Agriculture: Investigations within a California Vineyard

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Due Due to the high cash crop nature of premium winegrapes, recent research has focused on developing a better understanding of the factors that influence winegrape spatial and temporal variability. Precision grapevine irrigation schemes require consideration of the factors that regulate vineyard water use such as (1) plant parameters, (2) climatic conditions, and (3) water availability in the soil as a function of soil texture. The inability to sample soil and plant parameters accurately, at a dense enough resolution, and over large enough areas has limited previous investigations focused on understanding the influences of soil water and vegetation on water balance at the local field scale. We have acquired several novel field data sets to describe the small scale (decimeters to a hundred meters) spatial variability of soil and plant parameters within a 4 acre field study site at the Robert Mondavi Winery in Napa County, California. At this site, we investigated the potential of ground penetrating radar data (GPR) for providing estimates of near surface water content. Calibration of grids of 900 MHz GPR groundwave data with conventional soil moisture measurements revealed that the GPR volumetric water content estimation approach was valid to within 1 percent accuracy, and that the data grids provided unparalleled density of soil water content over the field site as a function of season. High-resolution airborne multispectral remote sensing data was also collected at the study site, which was converted to normalized difference vegetation index (NDVI) and correlated to leaf area index (LAI) using plant-based measurements within a parallel study. Meteorological information was available from a weather station of the California Irrigation management Information System, located less than a mile from our study area. The measurements were used within a 2-D Vineyard Soil Irrigation Model (VSIM), which can incorporate the spatially variable, high-resolution soil and plant-based information. VSIM, which is based on the concept that equilibrium exists between climate, soils, and LAI, was used to simulate vine water stress, water use, and irrigation requirements during a single year for the site. Using the simple water-balance model with the dense characterization data, we will discuss: (1) the ability to predict vineyard soil water content at the small scales of soil heterogeneity that are observed in nature at the local-scale, (2) the relative importance of plant, climate, and soil information to predictions of the soil water balance at the site, (3) the influence of crop cover in the water balance predictions.

H42M-02 1615h

Evaluation of canopy transfer models for growing vegetation using in-canopy profile measurements

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Estimates of the roughness lengths and the in-canopy transfer of momentum and sensible and latent heat are needed for any determination of the fluxes from a vegetated area. We use in-canopy measurements of the wind and temperature profiles taken with needle anemometers in acorn crop to test models of the in-canopy transfer. Profile measurements were taken during the course of the day, and over a larger portion of the growing season, as the corn grows from approximately 80cm to above 2 m. The changes in canopy height and closure led to a varying relationship of roughness height and displacement height, and affected the choice of best model for the in-canopy sensible and latent heat transfer. The implications of our measurements and analysis for estimating fluxes from a larger-scale area are explored.

H42M-03 1630h

The impact of uncertainty in evapotranspiration on the water balance at a pasture site in Florida

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The difference between precipitation (P) and evapotranspiration (ET) provides the net atmospheric input of water to watersheds. Precipitation data commonly are available. However, ET data are scarce and coarse estimates of ET routinely are used in hydrologic analyses. Measured ET values over a 986-day period at a pasture site in Florida provided a unique opportunity to evaluate the sufficiency of coarse estimates of ET in hydrologic analyses. A simple, daily hydrologic model was used to evaluate the sensitivity of the flow system to error in ET. The day-to-day variation in measured vegetation coefficients (ratio of actual to potential ET) was replaced within the hydrologic model with a simple, annually-invariant pattern of monthly vegetation coefficients. This approach was proven to be effective in reproducing unbiased estimates of daily water table fluctuations and flow terms and was successful despite the substantial fluctuation in measured daily vegetation coefficient and significant year-to-year variation in measured vegetation coefficient for a given month. Coarser estimates of the vegetation coefficient (a constant, average value of 0.86 and values biased +/-10%) poorly reproduced the flow system. Errors in estimated flow terms increased by tens of percent and substantial biases were introduced to these estimates. Despite the unbiased estimates of ET produced by a constant, average vegetation coefficient, this approach produced biased partitioning of net atmospheric input into recharge (-13% error) and runoff (5% error). The modest +/-10% bias to vegetation coefficients (and therefore to ET) produced a +/-20% error in net atmospheric input through residual error amplification. This error was further amplified in the fraction of net atmospheric input becoming recharge (+35% / -63%) and again in the fraction of recharge that became subsurface flow (+48% / -86%), indicating that use of unbiased estimates of vegetation coefficient is critical to hydrologic simulation. The results suggest that annually-invariant, monthly vegetation coefficients are the appropriate level of coarseness for hydrologic analyses at the study site. Estimates of potential ET, derived either from a simple meteorological station or remote-sensing approaches, combined with these monthly vegetation coefficients are suitable for generation of historical or ongoing ET estimates in environmental settings similar to the study site. The particular vegetation coefficients and acceptable level of coarseness of these coefficients at other environmental settings can be defined by methods outlined in the present study.

H42M-04 1645h

Scaling Evapotranspiration Depletion Rates in Native and Non-native Vegetation Along the Middle Rio Grande Riparian Corridor

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This research uses ground-based measurements and remote sensing techniques to scale evapotranspiration (ET) estimates along the middle Rio Grande riparian corridor in central New Mexico. Previous estimates of riparian evapotranspiration (ET) along the corridor range from between 20 to 50 percent of the total water depletions. These depletions are believed to be increasing due to the invasion of non-native species. The University of New Mexico (UNM) Departments of Civil Engineering and Biology have been working to better define ET depletion values in native and non-native field plots within the riparian forest. Currently, half hourly ground based micrometeorological data are being collected using four instrumentation towers installed in native cottonwood and non-native saltcedar sites. The tower data form the basis for calculating ET at the four tower sites using the 3-D eddy covariance method. These ET values are arguably the most accurate estimates of ET available within the middle Rio Grande; however, they are limited to only four points along the 320-kilometer riverine corridor. In order to scale ET calculations to the entire corridor, we first scale ET to eight additional study sites using the relationship between Leaf Area Index and ET. This provides an adequate number of points for groundtruthing remote sensing imagery. Next we compare the Landsat 7 ETM+ imagery with the groundtruthing points and develop relational equations. These equations are applied to a vegetation classification map also derived from Landsat 7 imagery. The resulting maps allow us to quantify ET depletions for both saltcedar and cottonwood canopies.

H42M-05 1700h

The Role of Vegetation Dynamics on the Soil Water Balance in Water-Limited Ecosystems

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The structure and function of the vegetation regulates the exchange of mass, energy and momentum across the biosphere-atmosphere interface. Vegetation dynamics are usually neglected, other than seasonal phenology, in land surface models (LSMs). However, changes in vegetation densities, influencing the partitioning of incoming solar energy into sensible and latent heat fluxes, can result in long-term changes in both local and global climates (e.g., precipitation and temperature), which in turn will feedback to affect the vegetation growth. In semi-arid regions, this may result in persistent drought and desertification, with substantial impacts on the human populations of these regions through reduction in agricultural productivity and reduction in quantity and quality of water supply. With an objective of finding a simple vegetation model able to accurately simulate the leaf area index (LAI) dynamics, vegetation models of different level of complexity (e.g., including or not the modeling of the root biomass or the modeling of the dead biomass) are developed and compared. The vegetation dynamics models are coupled to a LSM, with the vegetation models providing the green biomass and the LAI evolution through time, and the LSM using this information in the computation of the land surface fluxes and updating the soil water content in the root-zone. We explore the models on a case study of a water limited grass field in California. Results show that a simple vegetation model that simulates the living aboveground green biomass (i.e., with