increase during the spring could severely affect the biodiversity in many surface waters. For example, a 15% increase in the concentration of DOC during the spring flood would augment the decline in pH to an extent that could severely affect the biodiversity of many surface waters in northern Sweden.

B32A-04 1120h

Is a Universal Model of Organic Acidity Possible: Comparison of the Acid/base Properties of DOC in the Boreal, Temperate and Tropical Zones

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The acid/base properties of dissolved organic carbon (DOC) are an important feature of soil and surface waters. Large differences in the acid/base properties of DOC observed in different studies might be solely due to spatial and temporal differences. Different analytical techniques, however, may explain some of the observed differences. We used a combination of ion-exchange techniques, titration and surface water chemistry data to evaluate DOC character from two substantially different areas - the relatively pristine boreal zone of Sweden and the heavily acidified temperate zone of the Czech Republic. On average we found a significantly higher site density (amount of carboxylic groups per milligram of DOC) for the Swedish sites (10.2 microequivalent/mg DOC) compared to the Czech sites (8.8 microequivalent/mg DOC) measured in 1990s. This suggests a slightly higher buffering capacity for Swedish DOC. A tri-protic model of a type commonly incorporated in biogeochemical models was used for estimating the DOC dissociation properties. For Swedish sites the following constants were calibrated: pKa1=3.04, pKa2=4.51, pKa3=6.46, while the constants for Czech sites were pKa1=2.5, pKa2=4.42, pKa3=6.7. Despite differences in site density values, both models predict very similar dissociation and thus pH buffering by DOC in the environmentally important range of pH 3.5-5.0. Interestingly, very recent results showed an increased site density in some of the Czech sites to values of 10.4 microequivalent/mg DOC, almost identical to that valid for the boreal zone. Recent data from a tropical region of Kamerun indicate values of 10.9 microequivalent/mg DOC. These two observation suggest that the temporary heavy antropogenic acidification in the Czech sites had a measurable influence on acid/base properties of surface water DOC.

B32A-05 1135h

Trace Metals and Nutrients at the Soil-Root Interface of Forest Soils

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The activity of roots creates a microenvironment, known as the rhizosphere, where soil properties, processes and feedback mechanisms differ substantially from those observed in the soil matrix. Due to its proximity to the site of elemental uptake by plants, the rhizosphere is viewed as a biogeochemical hotspot characterized by massive fluxes of matter and energy. In this context, the acquisition of new knowledge on the rhizosphere is crucial to increase our capacity to understand, manage and model soil-plants systems. Of particular interest to scientists is the response of the rhizosphere to perturbations of natural (e.g. climatic fluctuations) or anthropogenic (e.g. soil contamination) origin. Moreover, results from rhizosphere research help define new approaches designed either to restrict the entrance of potentially toxic elements in crops and, hence, in the food chain or, contrarily, to increase the uptake of trace elements by plants in contaminated environments to be bioremediated. Our recent studies in forested environments have clearly established that the rhizosphere (Abies, Acer, Betula, Picea, Pinus or Populus roots) is more acidic than the soil matrix and that it is enriched in organic substances (dissolved and solid), nutrient cations (Ca, Mg) and trace metals. Indeed, the rhizosphere systematically acts as a sink for Cd, Cu, Ni, Pb and Zn, notably under bioavailable (water-soluble and salt-extractable) forms. Yet, the relative activity of free metal ions is lower in the rhizosphere, as shown for Cu++, probably as a consequence of the higher DOC content. The corrosive environment forming in the rhizosphere, as controlled by the release of H+ ions and of organic acids, also impacts on mineral assemblages through an increase in the weathering of primary minerals (amphiboles, plagioclases) and the formation of secondary solid phases such as Fe and Al oxides. Some of the research avenues currently investigated by our research group include the quantification of functional links between organic carbon, microbial activity and metal speciation, the development of methodological and analytical approaches operating at the spatial scale of the rhizosphere and, the assessment of preferential hydrological fluxes along root networks.

B32A-06 1150h

Plant Species Anaerobiosis and DOC Dynamics in a Peat-Forming Wetland, New York State

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We quantified spatial and temporal patterns of dissolved organic carbon (DOC) concentrations in the shallow peat soil of a freshwater wetland (located in central New York State) and correlated the patterns with anaerobiosis in roots of the dominant plant species. Sampling was stratified in zones dominated by: lakebank sedge (Carex lacustris), common cattail (Typha latifolia), purple loosestrife (Lythrum salicaria) or soft rush (Juncus effusus). Concentrations of DOC peaked in late summer and were much greater in wet years (14.3 mg C/L) than during summer drought (5.3 mg C/L). DOC concentrations did not vary significantly as a function of plant species and were greater in subsurface peat (13.3 mg C/L at 20 cm depth) than in surface peat (8.6 mg C/L at 5 cm depth). Anaerobiosis was pronounced in cattail in the spring and autumn, in purple loosestrife in mid summer, but showed little seasonal pattern in rush and in sedge. Although recent ecological research has shown that plant species can control belowground processes, we found little evidence for plant species control of DOC dynamics in this wetland.

B33A CC: 220 C-E Wednesday 1330h

Estuarine Ecosystems and Links to Uplands Posters

Presiding: **D M Peteet,** NASA Goddard Institute for Space Studies**; P Louchouarn,** Lamont-Doherty Earth Observatory

B33A-01 1330h POSTER

The Existence and Release of Bio-effective Silicon in the Estuary Sediments

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Silicon is an essential element for the living body. A moderate amount of silicon in seawater has a stimulative function to oceanic primary productivity. The excessive silicon may lead diatom to propagate rapidly. The red tide that the diatom is in the majority have relation to the bio-effective silicon released from sediment. To reveal the existence and release of the bio-effective silicon with various species in the estuary sediments is of great significance for understanding the mechanism of inducing red tide and controlling red tide harm. The existent species and release behaviors of bio-effective silicon in sediment columns collected from the Peal River estuary in China where the red tides occur frequently are studied. The results show that the concentrations of various species silicon below 15cm depth of sediment column decline obviously. It is suggested that the bio-effective silicon in surface sediment can be released duo to the variations of aquatic dynamics condition and physicochemical features of seawater. The results of simulated tests indicate that the release of exchangeable silicon in sediment bears mainly a relation to aquatic dynamical action. The release of silicon combined with carbonate is controlled by pH. The reduction reactions occurring in the redox interface of sediment can promote the release of silicon combined with iron manganese oxide or with organic matter and sulfide. The salinity exerts an influence on release of bio-effective silicon in sediments. The release degree of silicon is different in various salinity ranges, which may have relation to the ionic exchange action and complex action.

B33A-02 1330h POSTER

Long-term Variability of Landfast Ice along the Beaufort Coast

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Landfast ice thickness computed from a model and fast ice extent derived from ice charts show a large interannual variability along the Beaufort coast between 1976 and 2003. The largest change occurs in spring maximum ice extent, which shows a considerable reduction between the periods 1974-1988 and 1989-2003. This reduction is accompanied by a gradually shortened ice growth season; the maximum fast ice extent appears to contribute the most to the long-term trend. Compared with the Alaska coast, the Mackenzie shelf shows a larger decrease in fast ice cover at the peak of growth season in spring. The interannual variability of surface air temperature in winter and spring, as well as the mean atmospheric circulation patterns represented by the PDO and the AO are thought to be responsible for the observed long-term changes in fast ice cover. Since landfast ice can store a considerable amount of freshwater along the arctic coasts, the decrease in maximum fast ice cover, as well as its shortened growth season and reduced freshwater storage, could have a significant hydrological, biological, and biogeochemical consequences in the coastal regions.

B33A-03 1330h POSTER

Spatial and Temporal Variability of Sedimentary Environments in the Hudson River Estuary

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Sitting at the interface between marine and terrestrial systems, estuaries are sensitive to natural climatic, sea-level and tectonic changes as well as to anthropogenic impacts. Research on estuarine systems has led to improved understanding of estuarine processes, but relation of those processes to the long-term evolution of estuaries is still uncertain. A geophysical survey funded by the New York State Department of Environmental Conservation resolves details of spatial and temporal variability of sedimentary processes in the Hudson River Estuary. Here we present interpreted sedimentary environments and evidence of past environments for a 30-km stretch of the Lower Hudson River Estuary, between Piermont and Haverstraw Bay. Integration of high-resolution seismic surveys, side-scan sonar imagery and multibeam bathymetry with sediment samples allows differentiation of three distinct sedimentary environments in the estuary: depositional, erosional and dynamic. Modern deposition occurs mainly in Haverstraw Bay on shallow marginal flats bounding the river channel as well

as the channel floor. South of Haverstraw Bay, deposition is limited to a local region in a sharp channel bend, and to areas of anthropogenic disturbance. Erosion in the Lower Estuary dominates the broad, shallow western marginal flats in Tappan Zee and Piermont. Manmade and natural obstructions to river flow, such as a relic oyster bed that outcrops on the river bottom in Haverstraw Bay, create local erosional areas. Dynamic environments, incorporating both erosion and deposition, occur where sediment is actively moving through the estuary. Flow-perpendicular sediment waves dominate the channel floor and walls of the Lower Estuary. Dynamic sediment drifts and scouring are associated with man-made constructions, such as the Tappan Zee Bridge and a pipeline crossing the river south of Piermont Pier. Information from sub-bottom seismics and sediment coring provide evidence that sedimentary environments have changed through time. A delta deposit approx. 3-km wide, 7-km long with an average thickness of 3.5-m, sourced from the Sparkill Creek, dominates the marginal flats south of the Tappan Zee Bridge. Radiocarbon dates indicate that the delta was actively depositing between 3370 and 2520 cal yr B.P., but the modern delta surface is eroded with no evidence of recent deposition. Relic oyster beds are imaged in this stretch of the estuary, buried by sediment and outcropping on the river bottom. Existing shell dates suggest that oysters grew during distinct periods in the past but disappeared 500-800 cal yr B.P. Although modern salinities could support oysters, environmental factors such as cooler temperatures during the Little Ice Age and increased storminess may have prevented populations from thriving as they did in the past. These data provide a detailed view of estuarine processes and variability within the Hudson River system and continue to improve our understanding of long-term estuary evolution.

B33A-04 1330h POSTER

Late Holocene Environment in the Lower Hudson Valley, New York: Medieval Warming, Little Ice Age, and European Impact

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Two sediment cores from Piermont Marsh, located in the southern Hudson River Valley, provide a well-dated bi-decadal record of vegetation, climate, land use, and fire frequency. The classic Medieval Warm Period is evident through striking increases in charcoal and *Pinus* dominance from A.D.800-1350, paralleling records southward along the Atlantic seaboard. Higher inputs of inorganic sediment during this interval suggest increased watershed erosion during drought conditions. Increases in *Picea* and *Tsuga* with corresponding decreases in *Liquidambar*, coupled with increasing organic percentages due to cooler, moister conditions indicate the presence of the Little Ice Age. European impact is manifested by increased weedy plant cover (i.e., *Ambrosia, Plantago*, and *Rumex*), decline in arboreal pollen due to land clearance, and increase in inorganic particles to the watershed. Radionuclide dating using Cs-137 and Pb-210 from the southern end of the marsh shows that little disturbance of sediments has occurred, adding validity to the high resolution results and supporting the sedimentation rates obtained using radiocarbon dating. Comparison with other marsh records in the Hudson River estuary shows general agreement in chronology with interesting differences in species changes and sedimentation rates.

B33B CC: 220 C-E Wednesday 1330h

BOREAS +10 Posters

Presiding: **M Litvak,** University of Texas at Austin**; A McGuire,** University of Alaska, Fairbanks

B33B-01 1330h POSTER

Carbon Turnover in Organic Soils of Central Saskatchewan: Insights From a Core-Based Decomposition Study

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Field-based decomposition studies that examine several site types tend to use one of two approaches: Either the decay of one (or more) standard litters is examined in all sites, or litters native to each site type are incubated in the environment they came from. The first of these approaches examines effects of environment on decay, whereas the latter determines rates of mass loss characteristic of each site type. Both methods are usually restricted to a limited number of litters, and neither allows for a direct estimate of ecosystem-level parameters (e.g. heterotrophic respiration). In order to examine changes in total organic matter turnover along forest - peatland gradients in central Saskatchewan, we measured mass loss of native peat samples from six different depths (surface to 50 cm) over one year. Samples were obtained by sectioning short peat cores, and cores and samples were returned to their original position after determining the initial weight of each sample. A standard litter (birch popsicle sticks) was included at each depth, and water tables and soil temperature were monitored over the growing season. After one year, average mass loss in surface peat samples was similar to published values from litter bag studies, ranging from 12 to 21 percent in the environments examined. Native peat mass loss showed few systematic differences between sites or along the forest - peatland gradient, with over 60 percent of the total variability explained by depth alone. Mass loss of standard litter samples was highly variable, with high values in areas at the transition between upland and peatland that may have experienced recent disturbance. In combination, these results suggest strong litter-based control over natural rates of organic matter turnover. Estimates of heterotrophic respiration calculated from the mass loss data are higher than values obtained by eddy covariance or static chamber techniques, probably reflecting loss of material during the handling of samples or increased mass loss from manipulated profiles. Nevertheless, the core-based method is a useful tool in examining carbon dynamics of organic soils, since it provides a good relative index of organic matter turnover, and allows for separate examination of environmental and litter-based effects.

B33B-02 1330h POSTER

Simulating Carbon Dynamics at Landscape Level:A Case Study for Lake Abitibi Model Forest in Ontario, Canada

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This study assessed the temporal and spatial variability of carbon storage at landscape level, and estimated the carbon budget at a regional scale in the boreal ecosystems of Lake Abitibi Model Forest (LAMF, Ontario, Canada). We simulated the stand-level forest growth and carbon dynamics using TRIPLEX1.0, a process-based forest growth and carbon dynamics model, and GIS (Geographical Information System). The simulated carbon storage (net primary productivity (NPP), forest biomass and soil carbon) was compared with field data and the results of remote sensing analysis. The model simulation of biomass carbon was highly correlated with field measurements (r^2 ranged from 0.73 to 0.89). The simulated NPP ranged from 3.26 to 3.34 tC $ha^{-1}yr^{-1}$ at regional scale, and was sensitive to the changes in annual temperature and precipitation. The estimation of the net carbon balance suggests that the forest ecosystems in LAMF were a carbon sink in the 1990s. The results of this study can be used by local forest managers to develop ecological and carbon-based indicators and to monitor the sustainability of the boreal forest ecosystem under the changing environment. **Key words:** ecosystem simulation, carbon modeling, TRIPLEX model, boreal forest, GIS application.

B33B-03 1330h POSTER

Solid-Phase Characterization of Sediments From 100 Boreal Forest Lakes

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We report some first results of the Lake Sediment Structure and Evolution (LSSE) project (www.science.uottawa.ca/LSSE) in which sediments [collected by the Geological Survey of Canada, under its Metals in the Environment (MITE) program] from 100 boreal forest lakes have been analysed by several complementary solid phase measurement methods including: room temperature and cryogenic Fe-57 Mossbauer spectroscopy, powder X-ray diffraction, light element analysis (C, H, N, S) gas chromatography, X-ray fluorescence spectroscopy, mineral magnetometry, and nuclear magnetic resonance. This allows one to develop a baseline for the depth wise and lake to lake distributions in quantitative solid phase compositions of recent boreal forest lake sediments, including the organic matter, inorganic crystalline (i.e., mineral, usually detrital) and inorganic amorphous or nanophase (usually diagenetic) compartments. In particular, this is the first such broad Mössbauer study, covering lakes with diverse characteristics (pH 4-9, sediment organic matter contents 5-80%) and from diverse settings (dominant vegetation type, catchment area rock type, various distances from a metal smelter point source, etc.). In general, the dominant authigenic Fe phases (nanogoethite, ferrihydrite) and total solid-Fe ferric/ferrous abundancies are not distributed according to monotonic diagenetic redox depth profiles.

URL: http://www.science.uottawa.ca/LSSE

B33B-04 1330h POSTER

Factors Controlling Carbon Storage in Black Spruce Boreal Forests: A Comparison Between Canada and Alaska

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Many factors affect carbon (C) storage within the boreal forest, including soil drainage, stand age, and fire behavior. We examined the influence of these factors across the boreal region of North America by studying black spruce (*Picea mariana* (Mill.) BSP) stands that vary in soil drainage and stand age in both Alaska and Canada. Our first study region was located near the Northern Study Area of BOREAS, in Manitoba, Canada. Stands ranging from four to approximately 150 years old were examined in both moderately well- and poorly-drained ecosystems. Our second study area, which consisted of well- to moderately well-drained ecosystems, was located in central Alaska. These stands ranged from one to >100 years. While the Alaskan sites were slightly warmer than the Canadian ones (mean annual temperatures of 2.6 versus 0.8 degrees Celsius, respectively), mean annual precipitation