Great Salt Lake Basin Hydrologic Observatory Prospectus

Submitted to CUAHSI for consideration as a CUAHSI Hydrologic Observatory

Utah State University and University of Utah
In collaboration with Weber State University, University of Nevada
Boise State University, Idaho State University, University of Idaho,
Brigham Young University, and the University of Iowa

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Abstract

The availability of clean water to sustain life and human societies is perhaps the most recurrent constraint in human history and it will remain so for the foreseeable future. In the U.S. nowhere is this more evident than in the arid west, where rapid population growth and limited water resources converge to reach near-crisis level during periods of drought. Located in one of the fastest-growing areas in the U.S., the Great Salt Lake Basin provides the opportunity to observe climate and human-induced land-surface changes affecting water availability, water quality, and water use. These attributes reflect the changing relationship between people and water across the globe and make the Great Salt Lake Basin a microcosm of contemporary water resource issues and an excellent site to pursue interdisciplinary and integrated hydrologic science.

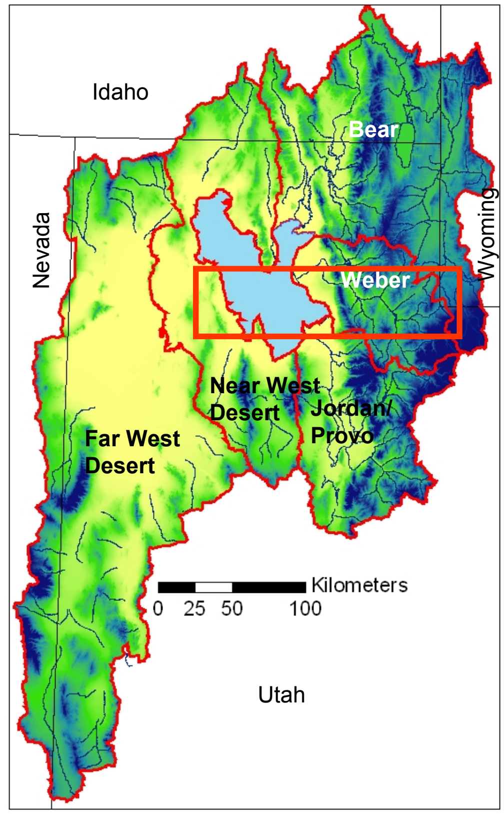
The Great Salt Lake Basin serves as a model for much of the western U.S. in that the hydrologic system is driven by snowmelt in the mountains that supplies water to the relatively arid valleys. The region is dominated by nonlinear interactions between snow deposition and loss in the mountains, streamflow, and groundwater recharge at high and mid-elevations, and evaporation from the desert floor. Important societal concerns center on: **How do climate variability and human-induced landscape changes affect hydrologic processes, water quality and availability, and aquatic ecosystems over a range of scales? What are the resource, social and economic consequences of these changes?** These questions cut across the following themes: (1) *Water Quantity and Quality Management*, (2) *Hydrogeomorphic Influences on Aquatic Ecosystems*, (3) *Soil, Vegetation, Atmosphere Interactions*, and (4) *Social and Economic Dynamics*. These fundamental issues provide the thematic focus of the proposed Great Salt Lake Basin Hydrologic Observatory.

Few hydrologic models are able to represent the complexity of western mountain systems, making an observatory in this region critical for advancing these models. The Great Salt Lake Basin terminates in a closed basin lake. Thus it is uniquely suited to be a hydrologic observatory because it presents the opportunity to close the water, solute, and sediment balances in a way that is rarely possible in a watershed of a size sufficient for the study of

atmospheric interactions. The steep topographic, climatic, and land-use gradients in the Great Salt Lake Basin provide a compactness that is unparalleled in the U.S., and that is more proximal to logistical support than any other comparable location in the U.S. For example, a 30 km transect can span from regional base-level to alpine catchment while remaining within 50 km of major research universities, an international airport, and major government agencies.

Overall the Great Salt Lake Basin is a unique location ideally suited, both physically and in terms of infrastructure, to addressing fundamental hydrologic science questions in western mountain basin systems in an open community-driven hydrologic observatory.

Spatial Extent of Hydrologic Observatory



The proposed Great Salt Lake Basin Hydrologic Observatory spans the entire area draining to the Great Salt Lake. This area has been selected to take advantage of the opportunity for a surface water and sediment balance given by a closed basin. The Great Salt Lake Basin, as mapped, encompasses 89,000 km^2, including much of Utah, parts of southeastern Idaho, southwestern Wyoming and eastern Nevada. The basin includes the rapidly growing Salt Lake City metropolitan area, where the population is expected to increase nearly 50% in the next 20 years. The Utah Water Resources Department predicts a shortfall of 800,000 acre-ft per year by 2050 for consumptive use in the basin, which will need to be addressed by conservation and new water development.

The effective area of the Great Salt Lake Basin is approximately 55,000 km^2 since the Far West Desert Basin is separated from the Great Salt Lake by a low topographic divide and only yields small groundwater flux to the Great Salt Lake. The vast majority of water to the Great Salt Lake is provided by surface flow (and groundwater to a much lesser extent) from the three sub-basins to the east of the Great Salt Lake (Bear River, Weber River, and Jordan/Provo River), which have their source catchments located in the Wasatch and Uinta Mountains. The significance of the West Desert Basin is its position as the gateway in the prevailing westerly meteorological systems that drive the hydrology of the eastern Great Salt Lake Basins.

The Great Salt Lake Basin Hydrologic Observatory represents a significant advance in scale relative to scales over which hydrologic processes have previously been comprehensively measured. Furthermore, the scales over which atmospheric processes operate in the western U.S. require consideration of an area of this size.

Scientific Rationale for Design

The Great Salt Lake Basin is uniquely suited to be a hydrologic observatory because the Great Salt Lake acts as a collector and integrator of hydrologic signals from the surrounding basin providing the opportunity to investigate fundamental hydrologic processes at scales that have been previously unexplored. Analysis of the geologic record in accumulated lake sediments offers the ability to determine historic trends in lake inflow, volume and water quality.

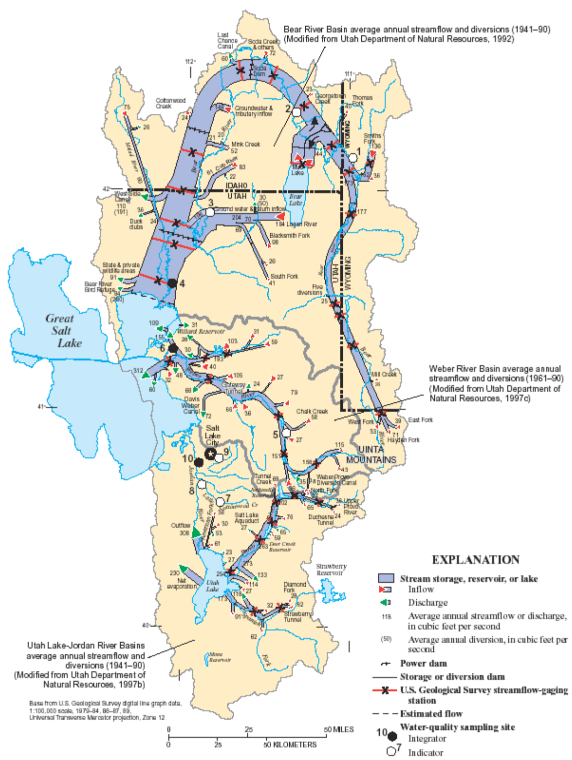
The Great Salt Lake Basin is tractable as a Hydrologic Observatory not only because it is closed, but also because the extremes in topography, climate, geology, ecology, and land use are captured in much smaller representative areas, allowing the overall system to be represented by a nested sampling design.

Due to the interest in water development of the early settlers, the basin has a rich hydrologic measurement infrastructure (precipitation, snowpack, streamflow, groundwater). Furthermore paleohydrologic research in the closed basin lakes (Bear Lake and Great Salt Lake) extends our knowledge of hydrologic processes well beyond the historical record.

Site Characteristics

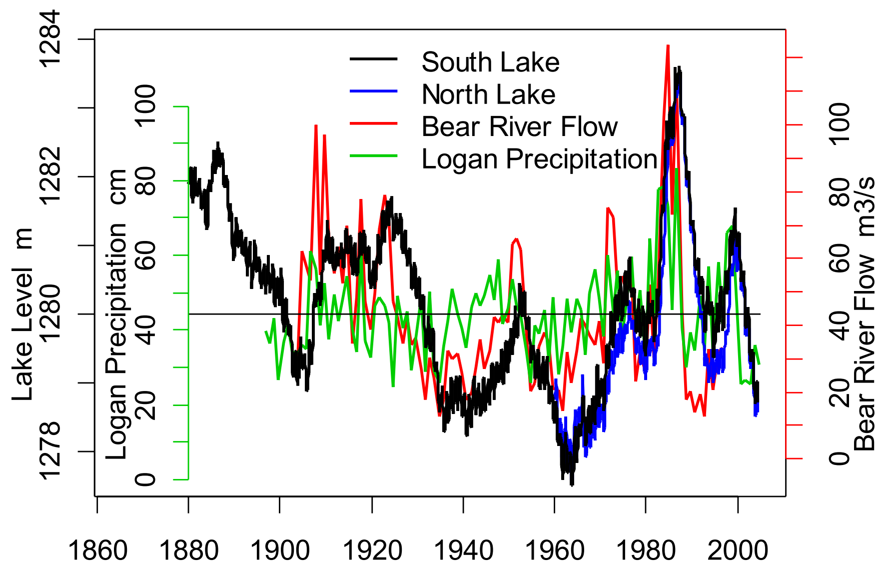
The Great Salt Lake Basin has a wide diversity of hydrologic and physiographic characteristics that make it ideal for long-term research for a broad spectrum of hydrologic scientists concerned with numerous issues. The basin spans four distinct geologic provinces: the Wasatch Plateau, the Uinta Mountains, the Rocky Mountain thrust belt, and the Basin and Range province. Each has its unique set of bedrock and surficial geologic character that impact the hydrology of the region. Nearly every bedrock type is exposed across the region, and geomorphologic regimes range from high alpine glaciated terrains, mountain valley streams, braided and meandering streams with broad flood plains, alluvial fan complexes, recent lacustrine deposits, freshwater and saline alkaline lakes, sand dune deposits, a variety of mass wasting deposits, and basins that have a range of unconsolidated deposits. Paleoclimate records for each of these regimes have been, or can be determined, providing constraints on the amount of water and temperatures in the recharge regions over the past 100-15,000 years.

Superposed on this hydrologic diversity is a variety of hydrologic uses and demands, from wilderness watersheds to sport fishery management, grazing, logging, mining and oil and gas exploitation, endangered species stabilization, and water consumption for urban and exurban population growth. The Great Salt Lake Basin spans four states, and three of these states are parties to an interstate compact governing the allocation of water from the Bear River. The political and social considerations involved in managing water in the western U.S. are therefore well represented in the Great Salt Lake Basin.



The three major rivers which drain into the Great Salt Lake: the Bear, the Weber, and the Provo/Jordan originate in the western end of the Uinta Mountains, along the eastern edge of the basin at altitudes above 3000m. The many tributaries join and flow through broad valleys and narrow canyons, and emerge from the western side of the Wasatch Range. The Bear and Weber Rivers discharge directly into the Great Salt Lake. The Provo River discharges into Utah Lake, a freshwater lake at the south end of the Great Salt Lake valley. The Jordan River drains from Utah Lake north into the Great Salt Lake. The Bear River is diverted into Bear Lake for storage. A pumping station returns water from Bear Lake to the Bear River where it is used downstream for irrigation and hydropower. A substantial part of the Great Salt Lake basin drainage area is the desert to the west. There are no perennial streams in this area which is separated from the lake by a low topographic divide. This area does not contribute flow to the lake except from springs in extremely wet years (Lall and Mann, 1995). The figure above depicts the estimated annual discharge for the major streams on the east side of the Great Salt Lake basin. The disposal of precipitation that falls in the Wasatch Mountains is approximately 30-40% runoff, 40-60% evapotranspiration and sublimation, and 5-20% regional groundwater recharge (Manning, 2002).

Historic data on the level of the Great Salt Lake has been collected since 1843. The lake level reached a historic high of about 1283.5 m (4212 ft) in 1873 and again in 1986 and 1987, and a historic low of 1277.5 m (4191 ft) in 1963. During the "Dust Bowl" period of drought encountered across the mid-west and western U.S. in the 1930s, the lake was at a level of around 1278.5 m (4195 ft) for a prolonged period. The lake is currently at this 1278.5 m level, a manifestation of the current regional drought. The 1983-86 rise of the lake to 1283.6 m caused flooding and damage to transportation and public utilities infrastructure, including Interstate 80, the Salt Lake International Airport, wastewater treatment facilities, wetlands, bird habitat and tourism. Dilution of the lake salts damaged the minerals and brine shrimp industries. Flood damages during the 1983-86 period were estimated to be $350 million per year. To reduce lake levels and increase evaporative losses, the state created a breach in the railroad causeway that separates the more saline northern arm of the lake from the larger, less saline southern arm, and constructed a $60 million facility to pump water from the lake and circulate it into the West Desert Storage Pond. These expensive measures lowered the elevation of the lake, but also left more than 0.5 billion tons of salt in the desert west of the lake, and affected lake salinity dynamics in unknown ways. The rapid retreat of the lake in 1987 led to severe criticism of the decision to pump.



Fluctuations in the Great Salt Lake volume represent the integrated effects of precipitation, snow pack sublimation, and subsurface transport over the watershed. Hence, there is sometimes not a strong correspondence between precipitation and streamflow (figure above), reflective of the difficulty in quantifying basinwide precipitation inputs. Note also that major changes in lake volume lag behind changes in precipitation and streamflow indicating influence of subsurface transport and possibly other processes influencing lake volume fluctuation.

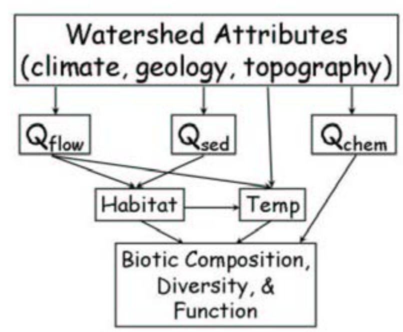
Science Questions

The fundamental hydrologic science questions given below highlight the unique characteristics of the proposed Great Salt Lake Basin Hydrologic Observatory.

1. Forcing, Feedbacks, and Coupling. How does the aggregate water balance of a watershed reflect the integrated effect of nonlinear interactions among runoff, vegetation dynamics, mountain block groundwater dynamics, urbanization and water use dynamics? Prior work in the Great Salt Lake Basin (Shun and Duffy, 1999) has suggested that low frequency components in runoff and Great Salt Lake volume time series are related to modulation of the climate forcing through mountain block groundwater dynamics. What are the relative

roles played by long and short term climate variability and land use change due to population and economic growth in the region in driving the system dynamics? The Great Salt Lake serves as a natural integrator for the observation of these dynamics in the forms of lake volume fluctuations and sediment and solute accumulations.

2. Prediction, Limits to Prediction and Sustainability of Water Resources. How can we better predict natural and human-induced changes in the hydrologic cycle so as to plan for and adapt to changes and uncertainties in water resources in a water-stressed semi-arid snowmelt driven system? The Great Salt Lake basin region exhibits extreme inter-annual climate variability, with large temporal variations of precipitation. For example, during the period from 1966 – 2003 the yearly precipitation in Logan, UT averaged 480 mm, but varied from 254 to 912 mm. This variability provides a good setting for the study of climate-hydrology interactions.
3. Hydrologic Extremes. As climate varies over short and long terms, what is the outlook in terms of flooding, both episodic flooding events and inundation due to rises in the lake level? What is the outlook in terms of drought with respect to sustainability of water resources, economic impact of lost lake industries, and reduced air quality due to dust generation?
4. Linking hydrologic and biogeochemical cycles. How does climate variability affect soil microclimate (temperature and moisture regime) and soil organic carbon dynamics (SOC distribution, quality, decomposition, leaching) across different vegetation types? How does the sparse distribution of vegetation in much of the western U.S. and the variability of canopy structure and type (e.g. forests, sage, willows, etc.) influence the distribution of precipitation, evaporation/sublimation, and transpiration? How will changing land use from predominantly agricultural to increasingly urban impact nutrient sources, loads, and cycling processes in the rivers of the Great Salt Lake Basin? How might coupled biogeochemical cycles of C, N and P change with a transition from agricultural to urban land uses? The opportunity to study the above questions is provided by the diversity and gradients in terrestrial ecosystems in the Great Salt Lake Basin.
5. Hydrologic influence on ecosystem functions. How is the structure of an aquatic ecosystem related to climate, topography and geology? The figure right gives a conceptual model depicting causal relationships between watershed attributes, water quantity and quality and aquatic biota. How will these systems respond to change, both in climate and land use? The opportunity to study these questions is provided by the diversity of terrestrial and aquatic ecosystems in the Great Salt Lake Basin, some of which are relics from previous climates, and for which continued existence is in question.



6. What are the pathways by which recharge to groundwater occurs? What is the role of faults and bedrock structure in hydrologic systems? What are the groundwater budgets for the basins, and what are the contributions of bedrock-dominated groundwater flow to this budget? How does the quantity and quality of recharge change with landuse?
7. What is the spatial distribution of groundwater residence times? Does integration of this distribution lead to a meaningful recharge rate? Can the spatial distribution and recharge rate of groundwater be linked to lake volume fluctuation? How much groundwater flux contributes to baseflow in mid- and high-elevation streams?
8. To what extent do the Great Salt Lake and surrounding salt playas affect the temporal and spatial variability of precipitation throughout the basin relative to the role played by larger-scale atmospheric moisture fluxes into the basin? Specifically, how do latent and sensible

heat fluxes from the lake contribute to downstream precipitation as a function of the lake's spatial extent?

The above hydrologic science questions serve as the foundation for study of hydrologic processes related to water resources, water quality, biogeochemistry (including the carbon balance), riparian ecology and ecosystem state, as well as stream flow and ground water modeling, forecasting, resource management and flood control. These questions are only a sampling of possible questions that may be addressed in the Great Salt Lake Basin Hydrologic Observatory. These questions include all five of the science topics identified by CUAHSI (Linking Hydrologic and Biogeochemical Cycles, Hydrologic Extremes, Sustainability of Water Resources, Transport of Chemical and Biological Contaminants, and Hydrologic Influence on Ecosystem Functions) as well as all three of the CUAHSI-identified cross cutting themes (Scaling, Forcing, Feedbacks, and Coupling, and Predictions and Limits-to-Prediction). The input of the national hydrologic community is sought in expanding and refining these questions in order to develop a robust set of drivers for the Great Salt Lake Basin Hydrologic Observatory proposal.

Existing Data Infrastructure

Numerous federal and state agencies conduct hydrologic monitoring and hydrologic investigations in the Great Salt Lake Basin, among them are the USGS, USDA, EPA, State Engineer's Offices, and State Divisions of Water Resources and Water Quality. Of note are the recently completed NAWQA reports (http://ut.water.usgs.gov/nawqa/, Baskin et al., 2002), designation of the Bear River Watershed as an EPA Target Watershed (http://www.epa.gov/twg/), hydroecological investigations in Red Butte Canyon (http://redbuttecanyon.net/), extraction of 100,000 year-long climate history from Great Salt Lake sediment (http://climchange.cr.usgs.gov/info/lacs/), and paired watershed vegetation manipulation studies at the Deseret Ranch in the upper Weber River Basin (http://cc.usu.edu/~gooseff/usu_watershed_research.html).

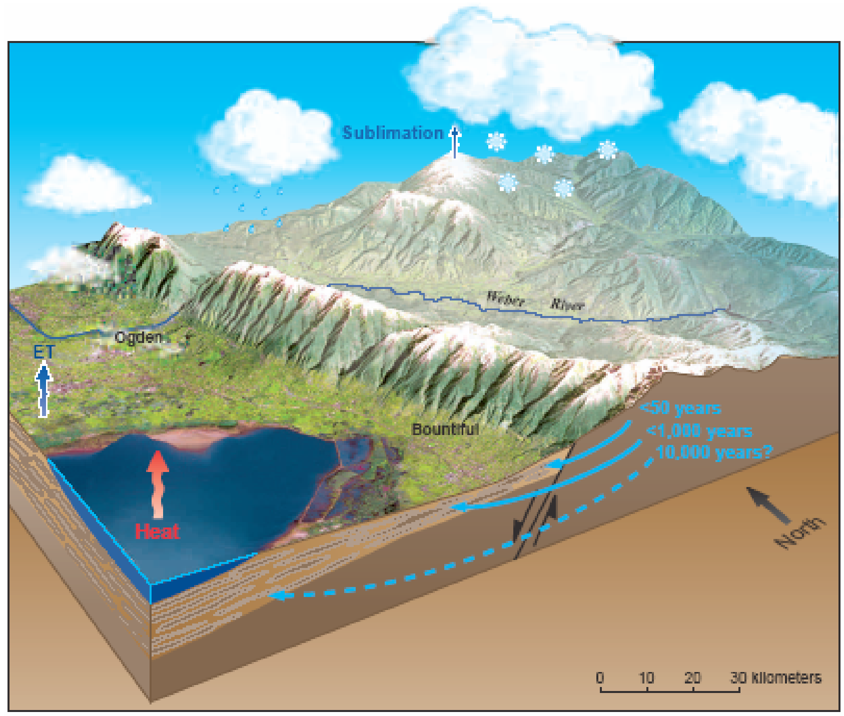
Much of the existing data infrastructure and data available has been assembled or linked from the Great Salt Lake Basin Hydrologic Observatory website (http://greatsaltlake.utah.edu) that also includes capability for simple analysis and plotting of the data using map and database server technology. The existing data infrastructure includes: 340 USGS streamflow gage sites, of which 48 report current real time data; 44 SNOTEL sites; 48 Active NOAA/NWS Cooperative Observer Network Climate Stations reporting temperature and precipitation; and numerous groundwater wells sampled by the USGS as part of NAWQA, and for other reasons.

Proposed Core Data Infrastructure

The overall Great Salt Lake Basin will be represented by selected focus areas in the contributing watersheds that are complemented by discrete measurements across the entire basin. For example, stream gages on the major rivers provide integration of surface water flux over their contributing watersheds. Networks for meteorological and snow pack monitoring, as well as groundwater monitoring also presently exist within the basin (see existing data infrastructure section) providing a rich infrastructure context within which the observatory will be developed. Smaller areas will be observed with greater detail and focus. Selecting both the scale and location of these focus regions is a critical step in the observatory design.

Characteristic of the eastern Great Salt Lake Basins is steep topography that leads to large climatic gradients, yielding hydrologic systems that are dominated by non-linear interactions between snow deposition and snow melt in the mountains, stream flow and groundwater recharge in the mid-elevations, and evaporative losses from the desert floor at lower elevations. The essential hydrologic processes occurring in the Great Salt Lake Basins occur within the topographic, climatic, biological, and land-use gradients between the mountain catchments and basin bottoms. Hence, examination of hydrologic processes within mountain-to-basin transects is imperative in western hydrologic observatories.

The figure below illustrates in a simple manner our conceptualization of several key hydrologic processes in the Great Salt Lake Basin that will serve as a basis for delineating the basin into stores for the quantification of storages, flow paths and fluxes. Stores include the atmosphere, snow pack, streams, lakes and reservoirs, soil moisture, and groundwater. Core data will focus on observing these quantities at multiple nested scales. The base figure presented is a satellite image draped on a digital elevation model in order to highlight the short distances over which large ranges in elevation, climate, vegetation, and land use occurs. The compact nature of these mountain basin systems allows the development of densely instrumented areas to observe strong contrasts and process gradients.



Atmospheric fluxes will be quantified using an array of moisture and wind profilers that will be assimilated into mesoscale meteorological models. Remote sensing measurements will be used to observe energy balances, snow and evaporation, soil moisture and vegetation. Precipitation will be measured using radar, as well as shielded precipitation gages and snow pillows (SNOTEL). Meteorological flux stations (temperature, wind, humidity, eddy covariance) will monitor land to atmosphere exchange. In-situ soil moisture will be sampled using TDR and dielectric probes. Deep (greater than 300 m) multilevel sampling wells will be used to measure ground water levels, fluxes, and for sampling of age dating and environmental tracers. The deep wells will provide an unprecedented evaluation of flow and transport processes (including the interaction between groundwater and the thermal field) through a combined fractured rock and granular aquifer system. Stream gauging stations will include measurements of discharge, as well as water quality and tracers of interest.

Below are example components of core data infrastructure. This sampling of proposed infrastructure is provided in order to elicit input from the national hydrologic community regarding interest in proposing, taking part in, or even leading a particular component of the observatory. It is our belief that the optimal hydrologic observatory will have sufficient strength in local expertise to ensure success, but that domination by local investigators should be avoided. We are committed to expanding the observatory design team to achieve a balance that will ensure a full partnership among the local and national hydrologic research communities.

Mountain to basin transect

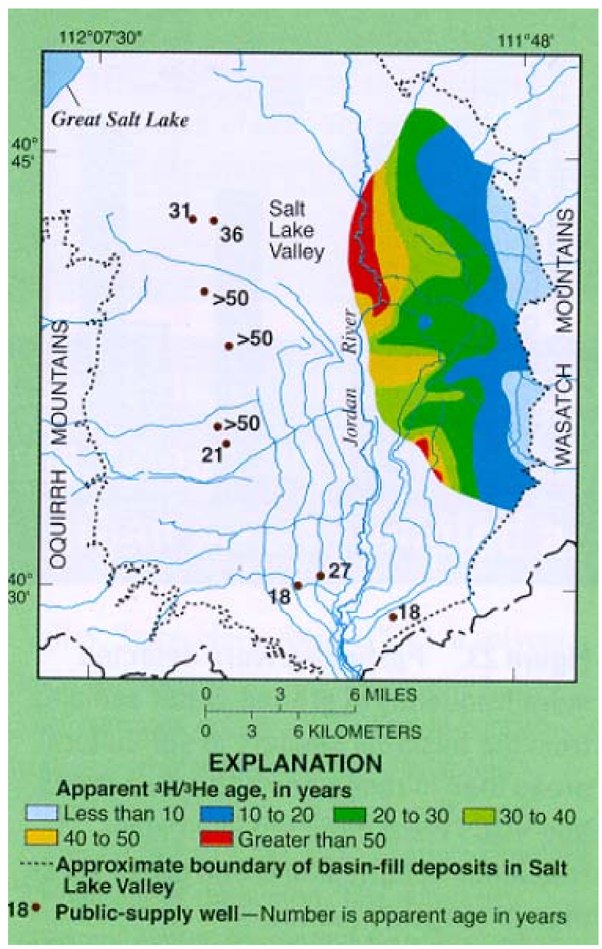
We propose at least one highly instrumented mountain-to-basin transect to investigate hydrologic processes extending from the mountain ridge top to the Great Salt Lake. The transect will range in elevation from about 1200 m to 3200 m, with a corresponding range in precipitation from about 15 cm/yr (West Desert) to 150 cm/yr (Wasatch Crest), range in evapotranspiration regimes from semi-arid to alpine, range in groundwater residence times from 10 to 10,000 years, and ranges in biome type from semi-arid shrubland to alpine forest, all within a 30 km distance depending on location.

One possible location of a transect is an east-west swath directed across the length of the Wasatch Front between North Ogden and Bountiful, where the axis of the Wasatch Mountains runs parallel and most promixal to the Great Salt Lake shoreline. This location is shown both in the concept-location diagram above, and forms the center of the red rectangle in the watershed map (leading figure). This particular location allows dense hydrologic monitoring within a 30 km distance while spanning a large spectrum of elevation, climate, vegetation, and land uses, all within 30 km of cities and universities that can provide necessary infrastructure support.

This transect location has access, instrument and communication advantages with respect to sampling, including direct line-of-sight to the Promontory Point WSR-88D radar and existing meteorological equipment and communication infrastructure at the Francis Peak FAA radar installation located at the ridge crest. Atmospheric measurements in the mountain-to-basin transect will extend meteorologically upwind of the Great Salt Lake (West Desert Basin) to allow observation of changes in air mass characteristics across the lake and mountain front. Between the Great Salt Lake and the portion of the Weber Basin directly east of the Wasatch ridge crest, atmospheric monitoring stations, spaced at 1-2 km will be coupled to snow pack monitoring stations and multilevel sampling wells. Less dense atmospheric, snowpack, and hydrologic infrastructure will be deployed within the eastern most portion of the Great Salt Lake Basin to the high Uinta Mountains. The overall transect dimension (including less dense monitoring west and east of the transect center) is shown by the red rectangle in the watershed map (leading figure).

The transect will build upon recently obtained groundwater age data in the Salt Lake basin east of the Wasatch Mountains depicted in the figure right (Thiros and Manning, 2004). The change in age as a function of distance (age gradient) provides a direct measure of groundwater velocities and recharge rates (Manning, 2002). Noble gas thermometry has shown that the majority of groundwater in the basin is sourced in the mountain block. As such, the age data constitute a type of geochemical tomography in that they reflect (provide an "image" of) processes occurring in the adjacent (but not directly sampled) mountain block.

The transect will cross land use gradients in the Ogden-Weber canyons, and is situated in a location to capture long term changes in land use, water quality, water availability. The transect provides a compactness that presents not only logistical advantages, but also advantages in terms of increased interaction among researchers from different disciplines.



Lake sediment coring, tributary and lake sampling program

Lake sediment coring has been performed in the Great Salt Lake, Bear Lake, as well as smaller lakes within the Great Salt Lake Basin for broad ranging purposes including reconstruction of climate history (http://climchange.cr.usgs.gov/info/lacs) and examination of historical trends in trace-element, organic contaminant, and nutrient concentrations to determine anthropogenic sources of contaminants (Waddell and Giddings, 2004 http://water.usgs.gov/pubs/wri/wri034283/).

Lake sediment cores provide a record of long term climate and hydrologic processes, as well as long term water quality trends; since they avoid the issues associated with short record lengths, inconsistent analytical methods, and below-detection aqueous concentrations. Existing and ongoing core characterization work provides a basis for continued examination of these closed basin lakes as integrators and recorders of signals that might otherwise be difficult to discern based on discreet measurements made in individual tributary watersheds.

We propose to formalize a collaborative program involving core characterization activities, hydrologic monitoring activities, and biogeochemical investigations in order to relate climate, sediment accumulation, ecologic indicator, and contaminant records to corresponding processes in the contributing watersheds. Proposed infrastructure includes a program to core distal deltas of the three main tributaries and to monitor sediment and water quality parameters in contributing tributaries as well as the Great Salt Lake itself. Cores will allow comparison of prehistory to history, and contrasting of tributary watersheds in terms of pollen, other ecological markers, sediment flux, and contaminant flux.

Complementary monitoring of fluxes of dissolved and suspended constituents in tributaries to the Great Salt Lake and the lake itself is required in order relate their present flux to their historic accumulation within the lakes. These comparisons will also provide a basis for evaluation of biogeochemical processes controlling the fate of dissolved and suspended constituents within the watershed, and the consequences of these processes to ecological systems. Many specific issues can be examined within this context. For example, methyl Hg (biotoxic form of Hg) is quite elevated in the Great Salt Lake, especially in a deep brine layer that covers 50% of the south basin of the lake (David L. Naftz, USGS, personal communication). These elevated concentrations raise ecological concerns for the wetlands surrounding the GSL, which are of hemispheric significance to migratory waterfowl. Since Hg-methylation is mediated by sulfate reducing bacteria, it is likely that the rate of methyl-Hg production is controlled by lake level fluctuations via exposure and re-oxidation of sulfides. As another example, contaminant introduction to the Great Salt Lake may also result from ostensibly beneficial processes, for example, the Jordan Valley Water Conservancy District is presently considering treating impaired groundwater in the Salt Lake Valley, an action that could postpone importation of Bear River water and associated ecological consequences to that watershed. However, treatment of impaired water by reverse osmosis (RO) yields elevated Se and other heavy metals in the RO concentrate. The consequences of release of the RO concentrate to the wetlands surrounding the lake are as yet uncharacterized (see www.deq.utah.gov/issues/nrd/index.htm).

This proposed infrastructure will allow us to answer: 1) To what extent do lake sediment records of sediment transport and contaminant transport indicate differences in processes occurring within respective contributing watersheds over prehistoric versus historic pre-development versus modern times? Can climatic and anthropogenic influences be clearly distinguished? Are differences apparent in the lake sediment record for watersheds of differing development histories? 2) Can the observed differences in lake sediment records be linked to known biogeochemical processes occurring in those watersheds? Are there critical locations at which these processes take place? 3) For known contaminant loadings to the contributing tributaries, are there contaminants for which there is no representation in the lake sediments despite expectations based on known processes? What are the processes that eliminate these contaminants from the system prior to deposition in the lake? Where in the hydrologic system are the eliminating processes located?

Past and Ongoing Studies in the Great Salt Lake Basin

A large number of past and ongoing studies related to hydrology exist for the Great Salt Lake Basin. These studies are highlighted in the Great Salt Lake Basin Hydrologic Observatory web page (http://greatsaltlake.utah.edu) and include: USGS NAWQA (http://ut.water.usgs.gov/); lake sediment coring activities (http://climchange.cr.usgs.gov/info/lacs/); MesoWest atmospheric monitoring (www.met.utah.edu/mesowest/); Bear Lake Watershed studies (http://www.usu.edu/water/watershed/); Red Butte Canyon ecohydrologic studies (http://redbuttecanyon.net/); Deseret Ranch paired basin vegetation manipulation studies (http://cc.usu.edu/~gooseff/usu_watershed_research.html); Southwest Jordan Valley Groundwater Cleanup study (http://www.deq.utah.gov/issues/nrd/index.htm); Little Bear River socioeconomic study (http://water.usu.edu/wis/bear_river/research/socioeconomics.htm); Davis County Exp. Watershed (http://rna.nris.state.mt.us/rna_detail.asp?sitecode=S.USUTHP*127).

The Reynolds Creek experimental watershed is within a few hours drive from Salt Lake City (see http://www.nwrc.ars.usda.gov/reynoldscreek.html). This highly instrumented experimental watershed (external to the Great Salt Lake Basin) has a 45 year history of research that can be used for hydrologic process studies in a physiographic setting similar to that of the Great Salt Lake Basin. We propose a close partnership with the Reynolds Creek Experimental Watershed for the pilot development of observation systems at smaller scale prior to deployment across the larger Great Salt Lake Basin.

Hydrologic Observatory Operation

The Great Salt Lake Basin Hydrologic Observatory will be operated as an open community facility. The proposing investigators are strongly committed to rapid dissemination of data from the hydrologic observatory to the community via the CUAHSI hydrologic information system and synthesis center. A policy will be established whereby any data collected with any funding or logistical support from the observatory is made available immediately following quality control evaluation.

In this prospectus, space and resource limitations prevent the development of detailed core data design. Participation has to date been largely limited to regional universities and agencies. We invite the national community interested in the Great Salt Lake Basin Hydrologic Observatory to join this team and contribute to the development of detailed plans and a proposal for the upcoming NSF Hydrologic Observatory solicitation.

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