Geos 499 Capstone Abstracts - 2018

Altenberger, S.

Glacial lake outburst floods (GLOFs) have the potential to cause massive damage to infrastructure and communities with little to no warning. This project attempts to develop a risk classification scheme for outburst flood events using easily-accessible and affordable remote sensing methods that communities in glaciatated regions can use to strategically focus further research and funding. Several glaciers in the state of Alaska were studied using existing remote orthoimagery and digital elevation models. Potential flood conditions were modeled using this information and attributed to possible impacts on observed downstream anthropogenic features, such as populations and utilites. While this process severely lacks accuracy for temporal GLOF prediciton, it did provide a stable initial assessment for potential flood hazards that can be used to direct targeted studies.

Barrett, M.

Polymetallic manganese nodules are both geologically and economically important. Geologically, because they can provide further insight into hydrothermal influences on marine deposits across the world and economically, because of their high content of both valuable metals and minerals, along with rare earth elements that are necessary for modern technology. The aim of this study is to better understand how black smoker chimneys are responsible for enrichment of metals, minerals and elements in manganese nodule deposits via hydrothermal leaching and ocean current circulation. By analyzing past bathymetry map, chemical and structural nodule data, it is expected that the ultimate source of enrichment will be derived from Enriched Mid Ocean Ridge basalts with upper continental crust influence, more specifically associated with the East Pacific Rise. The ocean water is also expected to be a major contributing factor in the development process due to its influence on chemical reactions.

Bortel, H.

Washington State is not known as a productive petroleum producer. This study examines the potential for petroleum production in Washington state compared to that of Alaska. Stratigraphic data from the Hoh Rock Assemblage and Ozette Terrane as well as the Astoria, McIntosh, and Humptulips Formations such as lithology and length was collected for the production of detailed stratigraphic columns. Data show that the McIntosh and Humptulips formations have the potential for source rocks. In addition, data show that the Astoria and McIntosh Formation have the potential for reservoir rocks. Analysis of the data show that there is the potential for petroleum production in Washington but not to the scale of Alaska.

Boyd, C.

Contaminants from heavy pesticide use easily infiltrate groundwater in agricultural areas within the United States, posing risks to nearby biotic communities. One such contaminant, atrazine, commonly used on US agricultural land as a pesticide/herbicide is particularly hazardous due to its ability to act as an endocrine disruptor in amphibious populations and cause infertility in women. Rapidity of infiltration is significantly influenced by bedrock geology. Karst systems, characterized by carbonate bedrock, cave systems, and sinkholes, allow for rapid travel of contaminants into and through local groundwater systems. This study seeks to examine contaminant presence in karst-dominated groundwater systems in Dubuque County, IA when compared to glacially sedimented systems in Piatt County, IL. Groundwater samples in Dubuque County yielded concentrations of atrazine whereas atrazine was unrecoverable in Piatt County water samples. The more quantifiable contaminant presences in the IA study sites highlights the facilitating effect of karst on groundwater contaminant infiltration.

Christensen, J.

Atmospheric rivers (AR's) are flowing columns of condensed water vapor that can produce extreme levels of precipitation along areas of penetrating landfall, and accurate meteorological predictions can be used to mitigate potential flood risks resulting from these AR events. This study utilizes three decades of daily and statistical streamflow data gathered for ten unique Puget Sound watersheds to determine the flooding risks associated with three notable atmospheric river events that penetrated western Washington in 2005, 2006, and 2009. It is assumed all three AR events produced equal precipitation across the individual watersheds, hypothesizing that each watershed would respond similarly between each AR event. Data supports this claim, with the 2005 AR producing the least anomalous discharge response throughout all ten watersheds. The 2009 AR event produced seven of the greatest anomalous discharge responses, and the 2006 AR produced the latter three greatest discharge responses. Further research on the specific meteorological conditions and geographical setting of each landfalling AR event is essential in identifying the reason in variations between the three AR events.

Denham, S.

This research investigates potential slope failures, ensuing landslide dams, and extent of corresponding impoundment lakes on the Carbon River. With the use of USGS Scoops 3D slope stability software, ArcGIS software, and modified techniques from Drain (2016), modeling the blockage of a river by a landslide dam was accomplished. A landslide scenario was generated by modifying the 2011 digital terrain model (DTM) from High-resolution Light Detection and Ranging (LiDAR) to assess potential impoundment lake and river diversion path scenarios. This methodology was validated when the findings from the Scoops 3D software correlated a lowest stability rating (factor of safety) with an area were slope failure occurred in 2017. This methodology can be widely used to evaluate the slope stability in any area where a landslide risk is suspected.

Dier, N.

This study was done to identify unstable slopes and areas at risk of landslide hazards in Hoquiam, WA, following a 2015 landslide that occurred there. A weighted multi criteria data analysis (MCDA) approach was used, based on previous work by Abella and Van Westen (2007). ArcGIS software was used to complete this study. The result of this study is a model showing the relative stability of slopes in the area. When this model is compared to satellite imagery taken after January 2015, the locations where landslides occurred matched closely with locations identified as being more unstable. This study shows that the GIS mapping method used can accurately and rapidly portray hillslope stability over a wide region to facilitate more focused field study.

Hunt, P.

Reservoir dams disrupt river channels by impounding both water and sediment behind them. Following the removal of the Glines canyon and Elwha dams, 100 years of sediment was released from impoundment and discharge returned to normal patterns. With this release of sediment and lack of control over the discharge of water through the system, how does the river respond to these changes after having controlled discharge and being sediment starved? Using Google Earth images to digitize the rivers land features after the dam removal, I hoped to find a clear pattern of channel response to increased sediment load or higher discharge. Data collected does not support either of these possibilities, as individual features along the length of the study area have had different responses. Further studies could uncover whether the response of the river is slower than anticipated, or that the flow dynamics during the tenure of the dam has the greatest effect on the channel.

Johnsen, J.

The greater Pacific Northwest is rife with landslide hazard. Determining frequency rates of landslides is critical to public safety. Surface roughness is a proxy for deposit age. Surface roughness is defined as the standard deviation of slope (SDS). With time, surface morphology will smooth through the process of diffusion. Using the baseline dataset (collected through photogrammetry techniques in the August following the storm season that caused the studied slide), the change in SDS from August to November was calculated to be ~0.8° (August average SDS was 7.08° across the lower section of slide mass while November SDS was 6.3°). This change in SDS evidences that changes in surface roughness occur over short intervals and that natural/ climatic inputs are critical to the evolution of surface morphology in landslide denuded zones. Further work must be done to constrain the effects of the denizen geology within landslide zones.

Sondall, V.

Methane hydrates have been observed in ocean floor sediments at many locations around the world (Ruppel and Kessler, 2017). Without drilling and direct observation, the theoretical zone in which hydrates exist can be estimated based on the known pressure-temperature conditions required for methane to become solid. Data from sites within the Cascadia Margin, Blake Ridge, and Mid-Norwegian Margin were used to estimate the methane hydrate stability zone (MHSZ) locally. BSR data correlates closely with calculated theoretical base of MHSZ for Cascadia Margin (0.197 kmbsf) and Blake Ridge (0.606 kmbsf). Blake Ridge and Mid-Norwegian Margin sites could be subject to a 3°C increase in bottom water temperature over the next 100 yrs (Kretschmer et al., 2015) resulting in a decrease in the depth of the MHSZ.

Sullivan-Johnson, R.

The objective of this study was to assess the correlation between published historical landslide frequency and severity and climate change in order to examine the feasibility of landslide predictability relative to projected El Nino and La Nina events. Using published historical data from several federal and state agencies, a direct correlation between ENSO events and landslides was established. Evidence supports an increased likelihood of occurrence for landslides as the result of El Niño and La Niña events, and more specifically, during the La Niña phase of the ENSO cycle

Walter, E.

This study investigates the first flush response in swan creek via ground water springs in the lower reach of Swan Creek between August 2017 and March 2018. First flush has been recorded in the creek although not specifically studied during previous studies between 2008 and 2014. The concentration levels of nitrate and phosphate were significantly higher in 2017-2018 than in earlier years. While a first flush response was expected it was not observed except for spring 2. On the contrary, a dilution of ions was actually recorded during the heaviest rain event. In addition to nitrate and phosphate, chloride and sulfate was measured to show that certain springs showed specific chemical signatures. The increase in phosphorus and nitrate combined with the absence of first flush suggests a change in the structure of the basin. Further studies will be necessary to investigate the drastic increase in nutrient concentration.