Hima Hassenruck-Gudipati – Research Statement *Draft*

1. General Research Interest:

I develop multi-method frameworks to describe earth surface processes that build, erode, and preserve landscapes. A focus of mine is advancing frameworks with processes that transcend different timescales (e.g. sediment transport, flood event, decadal-scale change-detection, sediment accretion burial). Broad questions that drive my research include: How will low relief landscapes evolve during the next 50-100 years as climate change effects become increasingly measurable? How can flow and sediment availability indicators be used to understand past, present, and future environmental conditions? What can flow tell us about the routing of solids, solutes? How do transfer zones such as floodplains, deltas, and groundwater amplify or dampen signals? How do topography and its permeability affect how landscapes are built and transfer flow, solutes, and solids?

2. Major Research Topics

Deposition, erosion, and bypass of sediment in low relief landscapes

A major theme of my research program is to study the transfer of flow and sediments through low relief landscapes using a combination of methods. Previous research projects have focused on how avulsion locations are set on deltas [Ganti et al 2016a, 2016b]. Using an experimental setup, we showed how variable discharge rivers building deltas have a characteristics length scale and preferential avulsion location due to the infilling of the river channel bed.

My ongoing work in this theme aims to identify the overbank flow patterns and sediment transport patterns on the floodplains on the Trinity River, Texas. Overbank flow and its associate deposition are still poorly constrained yet have important implications for the usability of inundation surfaces and the preservation of fluvial sedimentary records. Spanning over seven years, overlapping high-resolution topography of more than 150km of river reach enabled me to identify both trends in natural levee characteristics and its variability as well as quantify the amount and location of deposition on natural levees. Most of this work has been made possible by a NSF Graduate Research Fellowship grant. A GSA Robert. K. Fahnstock Award, awarded to the graduate research proposal with the best proposal in sediment transport, allowed me to investigate the characteristics of deposition previously quantified. Insights from fieldwork have confirmed the growth patterns of natural levees are similar to a delta, where channel transport sediment into a slower-moving body of water and land is built.

In the next 3-5 years, I would like to study how sediment availability changes due to permafrost thawing will affect northern rivers. I am currently working with Dr. Smith at Brown University on a proposal to build a framework using remotely sensed water surface elevation and suspended sediment measurements to detect changes in water surface elevation variability and meandering rates in northern rivers.

Preservation ad redistribution of landscapes in the rock record

A major question at the intersection of sedimentology and geomorphology is what environmental conditions and landscapes are preserved in the rock record. I previously studied the effects of climate change on fluvial processes during the Paleocene-Eocene Thermal Maximum [Chen et al. 2018] during my Thomas J. Watson Fellowship, a fellowship that allows for 50 awardees to independently study their topic of choice for a year.

I have also investigated the effects of antecedent topography (in the form of Aeolian deposits) on subsequent sediment deposition and helped quantify the amount of reworking and describe the associated environmental conditions [Kocurek et al. 2018].

One major opportunity is also quantifying the amount of reworking and abandonment of modern landscapes to understand past changes. I developed undergraduate research to use high-resolution topography to understand terrace formation on the Trinity River, Texas. The undergraduate student successfully presented the work at AGU [Ellis et al., 2017] and am now working up the framework into a paper. Additionally, I mentored a student, who studied the characteristics of sediment processes filling an oxbow lake that did not have an active tie channel brining in sediment from the river [Nix et al., 2018, in prep.].

In the next 3-5 years, I would like to study the preservation potential of mud in the rock record. Unlike grain sizes greater than silt, mud is very unlikely to be transported as bedload in most environments and be preserved because of aggradation and progradation of landforms. Therefore, the distribution and preservation of mud, which organic carbon preferentially adsorbs to, might reveal something about landform processes beyond aggradation and progradation. One hypothesis is that antecedent topographic lows are increasingly important for mud preservation.

Transfer and storage of water and solutes

Another research theme that I have been collaborating on is understanding the transfer and storage of both water and solutes in mountainous regions. I have been working with Dr. Hovius' lab at the GFZ Potsdam to understand how water isotopes can help quantify the water sources in both time and space in a region that is hard to access and has few in-situ measurements [Van der Veen et al. accepted]. I have also contributed to studies of ions dissolved in the rivers of Taiwan to understand how changing weathering rates affect the carbon cycle. I am keenly interested to continue building collaborations in this research theme to understand how rain intensity and surface runoff patterns affect reactive transport and water isotope distributions in mountainous regions.