Andrew J. Moodie

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Center for Water and the Environment
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Research Interests

My research integrates numerical modeling, field survey, and theory to understand sedimentary surface processes and stratigraphy. I am particularly interested in understanding the complex time and space scale interactions of fluvial-deltaic processes. My research is motivated by the need for a forward-looking framework for the sustainable management of highly anthropic landscapes.

Education

Doctor of Philosophy, Earth Science from Rice University — May 16, 2020

- *Assessing deltaic landscape management strategies based on studies from the Yellow River delta, China*
- Numerical modeling of delta growth through lobe development and avulsion
- Field measurement of the development of density stratification in the Yellow River, China
- Socio-economic costs of deltaic diversions and river engineering

Bachelor of Science, with High Honors in Geology, Lehigh University — May 2014

- Economics minor
- Senior Honors Thesis: Exhumation, dynamic topography, and drainage divides of active and ancient orogenic settings: the Gibraltar Arc and Appalachians

Appointments

Earth Sciences Postdoctoral Fellow; National Science Foundation — 2020–2022

- Civil, Architectural and Environmental Engineering, University of Texas
- Geological Sciences, Stanford University

Refereed Publications

[14] *Moodie, Andrew J.* and Jeffrey A. Nittrouer (in preparation). "Delta sustainability increases with urbanization." In: *Science*.

[13] Carlson, Brandee N., Jeffrey A. Nittrouer, Travis E. Swanson, *Andrew J. Moodie*, Tian Y. Dong, Hongbo Ma, Gail C. Kineke, Minglong Pan, and Houjie Wang (in preparation). "The effects of engineered diversions and natural avulsions on abandoned lobe development and shoreline stability." In: *Geophyscial Research Letters*.

[12] *Moodie, Andrew J.*, Brandee Carlson, Brady Z. Foreman, Jeffrey Kwang, Kensuke Naito, and Jeffrey Nittrouer (in review). "SedEdu: a suite of sediment-related educational modules." In: *Journal of Open Source Education*. DOI: 10.21105.jose.00069. [link].

[11] *Moodie, Andrew J.*, Jeffrey A. Nittrouer, Hongbo Ma, Brandee N. Carlson, Yuanjian Wang, and Michael P. Lamb (in revision). "Suspended-sediment induced stratification inferred from concentration and velocity profile measurements in the flooding lower Yellow River, China." In: *Water Resources Research*. [link].

[10] Dong, Tian Y., Jeffrey A. Nittrouer, Brandon J. McElroy, Elena Il'icheva, Maksim Pavlov, Hongbo Ma, and *Andrew J. Moodie* (in review). "Predicting water and sediment partitioning in a delta channel network under varying discharge conditions." In: *Water Resources Research*.

[9] Carlson, B. N., J. A. Nittrouer, A. J. Moodie, G. C. Kineke, L. L. Kumpf, H. Ma, D. R. Parsons, and H. Wang (2020). "Infilling Abandoned Deltaic Distributary Channels Through Landward Sediment Transport." In: *Journal of Geophysical Research: Earth Surface* 125.2. DOI: 10.1029/2019JF005254.

[8] de Leeuw, Jan, Michael P. Lamb, Gary Parker, *Andrew J. Moodie*, Daniel Haught, Jeremy G. Venditti, and Jeffrey A. Nittrouer (2020). "Entrainment and suspension of sand and gravel." In: *Earth Surface Dynamics*. DOI: https://doi.org/10.5194/esurf-8-485-2020. [link].

[7] Lamb, Michael P., Jan de Leeuw, Woodward Fischer, *Andrew J. Moodie*, Jeremy G. Venditti, Jeffrey A. Nittrouer, Daniel Haught, and Gary Parker (2020). "Mud in rivers transported as flocculated and suspended bed-material." In: *Nature Geoscience*. DOI: 10.1038/s41561-020-0602-5.

[6] Ma, Hongbo, Jeffrey A. Nittrouer, Baosheng Wu, Michael P. Lamb, Yuanfeng Zhang, David Mohrig, Xudong Fu, Kensuke Naito, Yuanjian Wang, *Andrew J. Moodie*, Guangqian Wang, Chunhong Hu, and Gary Parker (2020). "Universal relation with regime transition for sediment transport in fine-grained rivers." In: *Proceedings of the National Academy of Sciences*. DOI: 10.1073/pnas.1911225116.

[5] Chadwick, Austin J., Michael P. Lamb, *Andrew J. Moodie*, Gary Parker, and Jeff A. Nittrouer (2019). "Origin of a Preferential Avulsion Node on Lowland River Deltas." In: *Geophysical Research Letters* 46.8, pp. 4267–4277. DOI: 10.1029/2019GL082491.

[4] *Moodie, Andrew J.*, Jeffrey A. Nittrouer, Hongbo Ma, Brandee N. Carlson, Austin J. Chadwick, Michael P. Lamb, and Gary Parker (2019). "Modeling deltaic lobe-building and channel avulsions for the Yellow River delta, China." In: *Journal of Geophysical Research: Earth Surface*. DOI: 10.1029/2019JF005220.

[3] An, Chenge, *Andrew J. Moodie*, Hongbo Ma, Xudong Fu, Yuanfeng Zhang, Kensuke Naito, and Gary Parker (2018). "Morphodynamic model of lower Yellow River: flux or entrainment form for sediment mass conservation?" In: *Earth Surface Dynamics* 6.4, pp. 989–1010. DOI: 10.5194/esurf-6-989-2018.

[2] Ma, Hongbo, Jeffrey A. Nittrouer, Kensuke Naito, Xudong Fu, Yuanfeng Zhang, *Andrew J. Moodie*, Yuanjian Wang, Baosheng Wu, and Gary Parker (2017). "The exceptional sediment load of fine-grain dispersal systems: Example of the Yellow River, China." In: *Science Advances* 3, p. 7. DOI: 10.1126/sciadv.1603114.

[1] *Moodie, Andrew J.*, Frank J. Pazzaglia, and Claudio Berti (2017). "Exogenic forcing and autogenic processes on continental divide location and mobility." In: *Basin Research*. DOI: 10.1111/bre.12256.

Grants and Fellowships

National Science Foundation, EAR Postdoctoral Fellowship	$ 187,000	2020–2022
Geological Society of America, Research Grant	$ 1,400	2018
National Science Foundation, Graduate Fellowship	$ 102,000	2016–2019

Invited Presentations

Clinic	Active learning with SedEdu; CSDMS 2019 [link, link]	2019
Oral	ExxonMobil process sedimentology group	2019
Oral	Soft Rocks seminar; UT at Austin	2019
Oral	Science workshop; Yellow River Institute of Hydro. Research	2018
Oral	Fu research group; Tsinghua University	2017
Oral	Mohrig research group; UT at Austin	2017
Oral	ExxonMobil and Rice University deltas symposium	2016

Teaching Experience

Machine Learning in Geosciences; seminar [link]	Rice University	2018
Earth System Modeling (Guest Lecturer)	Rice University	2018
Geological History and Methods (field trip)	Rice University	2019
Geological History and Methods (field trip)	Rice University	2018
Geological History and Methods (field trip)	Rice University	2017
Geological History and Methods	Rice University	2016
Geological History and Methods (field trip)	Rice University	2015
Intro. to Environmental Science	Lehigh University	2014
Environmental Geology	Lehigh University	2012–2014

Additional Work Experience

Computational Science Intern	ExxonMobil; Houston, TX	Fall 2019
Graduate Advisor, HART SafeClear	Rice University; Houston, TX	2015–2016
Senior Intern and Field Tech.	Peak Environmental; Woodbridge, NJ	2013
Intern and Field Tech.	Peak Environmental; Woodbridge, NJ	2012

Awards and Honors

Gibbon Award in Geology for Best Thesis	Rice University	2020
Second Place, poster session; StratGAN	Houston Geol. Society	2019
First Place, poster session; delta modeling	Houston Geol. Society	2018
Chair's Award (Departmental Service)	Rice University	2017
Alison Henning Teaching Award in Earth Science	Rice University	2016
Vic Johnson Field Camp Scholarship	Lehigh University	2013

Department and Community Involvement

Peer-reviewer for Water Resources Research	AGU Journals	2020
Peer-reviewer for Geophysical Research Letters	AGU Journals	2019–2020
Session convener for GSA Annual Meeting [link]		2019
AGU EPSP Twitter takeover, Fall Meeting		2018
Summer Undergrad Lunch Seminar Series speaker	Rice University	2018
Journal Club, Organizer	Rice University	2018
GIESS Symposium, Founder and Chair [link]	Rice University	2017–2019
Undergraduate Research Symposium, Judge	Rice University	2016
GeoUnion, Treasurer	Rice University	2015

Short Courses

Graduate Pedagogy Institute	Cntr. Teaching Excellence	2018
Summer Institute for Earth-Surface Dynamics	NCED2	2018
Integrated Basin Analysis	ExxonMobil	2014

Field Experience

High concentration flow in the YR	Yellow River, China; two weeks	2018
Density currents in Xiaolangdi Reservoir	Henan Province, China; two weeks	2018
Infilling of abandoned channels	Yellow River, China; three weeks	2017
PETM in the stratigraphic record	Piceance Basin, CO; three days	2017
Density stratification in the YR	Yellow River, China; six weeks	2016
Namurian deltaic cyclothems	County Clare, Ireland; nine days	2016
Initiation of aeolian dune fields	White Sands, NM; five days	2015
General river survey	Yellow River, China; six weeks	2015

Practical and Analytical Expertise

Geological:	Sediment transport, autogenic channel processes, reduced-complexity modeling, quantitative stratigraphy, dynamic topography, basin evolution
Computational:	linear algebra, fluid mechanics, [bayesian] statistics, machine learning, high performance parallel computing
Technologies:	Matlab, Python, QGIS/ArcGIS, Generic Mapping Tools, Git, LaTeX, Tensorflow, Keras, sklearn, OnShape (CAD), R, bash, Unix, MS Suite, image and vector design

Professional Associations

American Geophysical Union, Earth and Planetary Surface Processes
Geological Society of America
American Association of Petroleum Geologists
Houston Geological Society
DEEPS Journal Club; Rice University
Citizen's Climate Lobby
NSF Graduate Research Fellowship Program Fellows
GeoUnion; Rice University
Rice AAPG chapter; Rice University
Society of Environmental Scientists; Lehigh University

Non-refereed Publications

[3] *Moodie, Andrew J.* (2020). *Yellow River Kenli-Lijin Station Survey.* DOI: 10.5281/zenodo.3457639.

[2] *Moodie, Andrew J.* (2016). "Evaluating the long-term sustainability of deltas." In: *Outcroppings: Rice Earth Science Newsletter* 1, pp. 30–33. [link].

[1] *Moodie, Andrew J.* (2014). "Dynamic topography and drainage divides in active and ancient orogenic settings, the Gibraltar Arc and Appalachians." Undergraduate Honors Thesis. Bethlehem, PA: Lehigh University.

Scientific Presentations with Abstracts

[26] Baykut, Tanyel, Joshua Johnson, André W. Droxler, Daniel Parsons, *Andrew J. Moodie*, and Jeffrey A. Nittrouer (2020). "Upper slope 3D morphologies along the Lighthouse Reef margin (Belize): punctuated global record of last deglacial sea level fluctuations?" In: Geological Society of America Abstracts with Programs. Vol. 52-6. Oral. DOI: 10.1130/abs/2020AM-357483. [link].

[25] Carlson, Brandee, Jeffrey A. Nittrouer, *Andrew J. Moodie*, Gail C. Kineke, Hongbo Ma, Travis Swanson, and Minglong Pan (2019). "The impacts of channel diversion characteristics on retreat rates of abandoned deltaic lobes, as informed by the Huanghe (Yellow River) delta of China." In: American Geophysical Union Fall Meeting. Oral. [link].

[24] Dong, Tian Y., Nittrouer Jeffrey A., Brandon J. McElroy, Elena Il'icheva, Maksim Pavlov, Hongbo Ma, and *Andrew J. Moodie* (2019). "Practical framework for predicting water and sediment partitioning in a delta under varying discharge conditions." In: American Geophysical Union Fall Meeting. Oral. [link].

[23] *Moodie, Andrew J.*, Jeffrey A. Nittrouer, Hongbo Ma, Brandee N. Carlson, Michael P. Lamb, and Gary Parker (2019). "Density stratification in open-channel flow due to high sediment concentration in the flooding Lower Yellow River." In: American Geophysical Union Fall Meeting. Oral. [link].

[22] Barefoot, Eric A., Jeffrey A. Nittrouer, Brady Foreman, Elizabeth A. Hajek, and *Andrew J. Moodie* (2018). "Paleohydraulic estimates from alluvial strata during the PETM: an example from the Piceance Basin, Colorado." In: American Geophysical Union Fall Meeting. Poster. [link].

[21] Carlson, Brandee, Jeffrey A. Nittrouer, *Andrew J. Moodie*, Michelle Mullane, Lisa Kumpf, and Gail C. Kineke (2018). "Seasonal sediment delivery to an abandoned deltaic distributary channel." In: American Geophysical Union Fall Meeting. Oral. [link].

[20] Ma, Hongbo, Jeffrey A. Nittrouer, Brandon J. McElroy, Yuanjian Wang, *Andrew J. Moodie*, Xingyu Chen, Xudong Fu, Baosheng Wu, and Gary Parker (2018). "Turbidity currents in Xiaolangdi reservoir, Yellow River, China: dynamics and geomorphic expression." In: American Geophysical Union Fall Meeting. Oral. [link].

[19] Ma, Hongbo, Jeffrey A. Nittrouer, Yuanfeng Zhang, Xudong Fu, Yuanjian Wang, *Andrew J. Moodie*, Yanjun Wang, Baosheng Wu, and Gary Parker (2018). "Change in downstream bedform type, bed material sediment transport regime and flood potential in response to sediment blockage by a dam: can bed degradation increase flooding risk?" In: American Geophysical Union Fall Meeting. Oral. [link].

[18] *Moodie, Andrew J.* and Brady Foreman (2018). "SedEdu: developing and testing a suite of computer-based interactive educational activities for introductory sedimentology and stratigraphy courses." In: American Geophysical Union Fall Meeting. Poster. [link].

[17] *Moodie, Andrew J.*, Jeffrey A. Nittrouer, Hongbo Ma, Brandee N. Carlson, Michael P. Lamb, and Yuanjian Wang (2018). "Suspended-sediment induced stratification inferred from concentration and velocity profile measurements in the flooding lower Yellow River, China." In: American Geophysical Union Fall Meeting. Poster. [link].

[16] An, Chenge, Gary Parker, Hongbo Ma, Kensuke Naito, *Andrew J. Moodie*, and Xudong Fu (2017). "Morphodynamic Modeling of the Lower Yellow River, China: Flux (Equilibrium) Form or Entrainment (Nonequilibrium) Form of Sediment Mass Conservation?" In: American Geophysical Union Fall Meeting. Poster. [link].

[15] Barefoot, Eric A., Jeffrey A. Nittrouer, Brady Z. Foreman, *Andrew J. Moodie*, and Gerald R. Dickens (2017). "Towards a mechanistic understanding of the linkages between PETM climate modulation and stratigraphy, as discerned from the Piceance Basin, CO, USA." In: American Geophysical Union Fall Meeting. Poster. [link].

[14] Carlson, Brandee N., Jeffrey A. Nittrouer, *Andrew J. Moodie*, and Hongbo Ma (2017). "Tie channels on deltas: A case study from the Huanghe (Yellow River) delta, China." In: American Geophysical Union Fall Meeting. Poster. [link].

[13] Kineke, Gail C., Brandee N. Carlson, Austin J. Chadwick, Liang Chen, Benjamin Hobbs, Lisa Kumpf, Michael P. Lamb, Hongbo Ma, *Andrew J. Moodie*, Michelle Mullane, Kensuke Naito, Jeffrey A. Nittrouer, and Gary

Parker (2017). "Morphodynamics and Sediment Transport on the Huanghe (Yellow River) Delta: Work in Progress." In: American Geophysical Union Fall Meeting. Oral. [link].

[12] Ma, Hongbo, Jeffrey A. Nittrouer, Baosheng Wu, Yuanfeng Zhang, David C. Mohrig, Michael P. Lamb, Yuanjian Wang, Xudong Fu, *Andrew J. Moodie*, Kensuke Naito, and Gary Parker (2017). "Phase transition behavior of sediment transport at the sandmud interface, across scales from flumes to the large rivers." In: American Geophysical Union Fall Meeting. Oral. [link].

[11] *Moodie, Andrew J.*, Jeffrey A. Nittrouer, Hongbo Ma, Michael P. Lamb, Brandee N. Carlson, Gail C. Kineke, and Gary Parker (2017). "Measuring Density Stratification and Understanding its Impact on Sediment Transport in Fine-grained Rivers, Based on Observations from the Lower Yellow River, China." In: American Geophysical Union Fall Meeting. Oral. [link].

[10] *Moodie, Andrew J.*, Frank J. Pazzaglia, and Claudio Berti (2017). "Exogenic forcing and autogenic processes on continental divide location and mobility." In: Geological Society of America Abstracts with Programs. Vol. 49-6. Oral. [link].

[9] Carlson, Brandee N., Jeffrey A. Nittrouer, Gail C. Kineke, *Andrew J. Moodie*, Hongbo Ma, and Lisa Kumpf (2016). "The coastline evolution of an abandoned deltaic lobe and the fate of its relict distributary channel: a case study from the Huanghe (Yellow River) delta, China." In: American Geophysical Union Fall Meeting. Poster. [link].

[8] Ma, Hongbo, Jeffrey A. Nittrouer, Kensuke Naito, *Andrew J. Moodie*, and Gary Parker (2016). "The exceptional sediment load of a fine-grain meandering river and relation to bedform geometry: an appealing example from the lower Yellow River, China." In: Geological Society of America Abstracts with Programs. Vol. 48-7. Oral. [link].

[7] *Moodie, Andrew J.*, Jeffrey A. Nittrouer, Hongbo Ma, Brandee N Carlson, and Gary Parker (2016). "A quasi-2d delta-growth model accounting for multiple avulsion events, validated by robust data from the Yellow River delta, China." In: American Geophysical Union Fall Meeting. Poster. [link].

[6] Carlson, Brandee N., Jeffrey A. Nittrouer, Hongbo Ma, and *Andrew J. Moodie* (2015). "Channel infilling processes on the Huanghe (Yellow River) deltaic coastal plain, China." In: Geological Society of America Abstracts with Programs. Vol. 47-7. Oral. [link].

[5] Ma, Hongbo, Jeffrey A. Nittrouer, *Andrew J. Moodie*, Brandee N. Carlson, and Gary Parker (2015). "Role of river bends for the formation and evolution of channel bedforms: Combined field studies and numerical modeling from the tidally influenced zones of the Yellow River, China and Mississippi River, USA." In: American Geophysical Union Fall Meeting. Poster. [link].

[4] *Moodie, Andrew J.*, Hongbo Ma, Jeffrey A. Nittrouer, Brandee Carlson, and Gail C. Kineke (2015). "Spatiotemporal channel-bed evolution patterns observed for the Huanghe (Yellow River), China: Implications for evaluating system response and complexity to external perturbations." In: Geological Society of America Abstracts with Programs. Vol. 47-7. Poster. [link].

[3] Berti, Claudio, David J. Anastasio, Frank J. Pazzaglia, Gilles Y. Brocard, *Andrew J. Moodie*, Josep M. Pares, Paseo S. d. A. Cenieh, and Juan I. Soto (2014). "Drainage network reorganization and divide migration in response to active tectonics in the Betic Range, Spain." In: Geological Society of America Abstracts with Programs. Vol. 46-6. Oral. [link].

[2] *Moodie, Andrew J.* and Frank J. Pazzaglia (2014). "Exhumation, dynamic topography, and drainage divides in active and ancient orogenic settings: the Gibraltar Arc and Appalachians." In: Geological Society of America Abstracts with Programs. Vol. 46-2. Oral. [link].

Additional Scientific Presentations

Poster	Rice Night; Houston Geological Society	2019
Poster	Industry-Rice Earth Science Symposium	2019
Poster	Summer Institute for Earth Surface Dynamics; UMN	2018
Poster	Rice Night; Houston Geological Society	2018
Poster	Industry-Rice Earth Science Symposium	2018
Poster	Int'l Workshop for Socioeconomic Sustainability of Large River Deltas	2017
Poster	AAPG Rice Industry Geoscience Series	2016
Poster	Industry-Rice Earth Science Symposium	2016
Poster	International Workshop of the Yellow River Delta	2015
Poster	Industry-Rice Earth Science Symposium	2015
Poster	Lehigh College of Arts and Sciences Symposium	2014
Oral	Lehigh EES Undergraduate Research Symposium	2014

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