2016 | Issue No. 35

UCLA ENGINEER

Smart Manufacturing

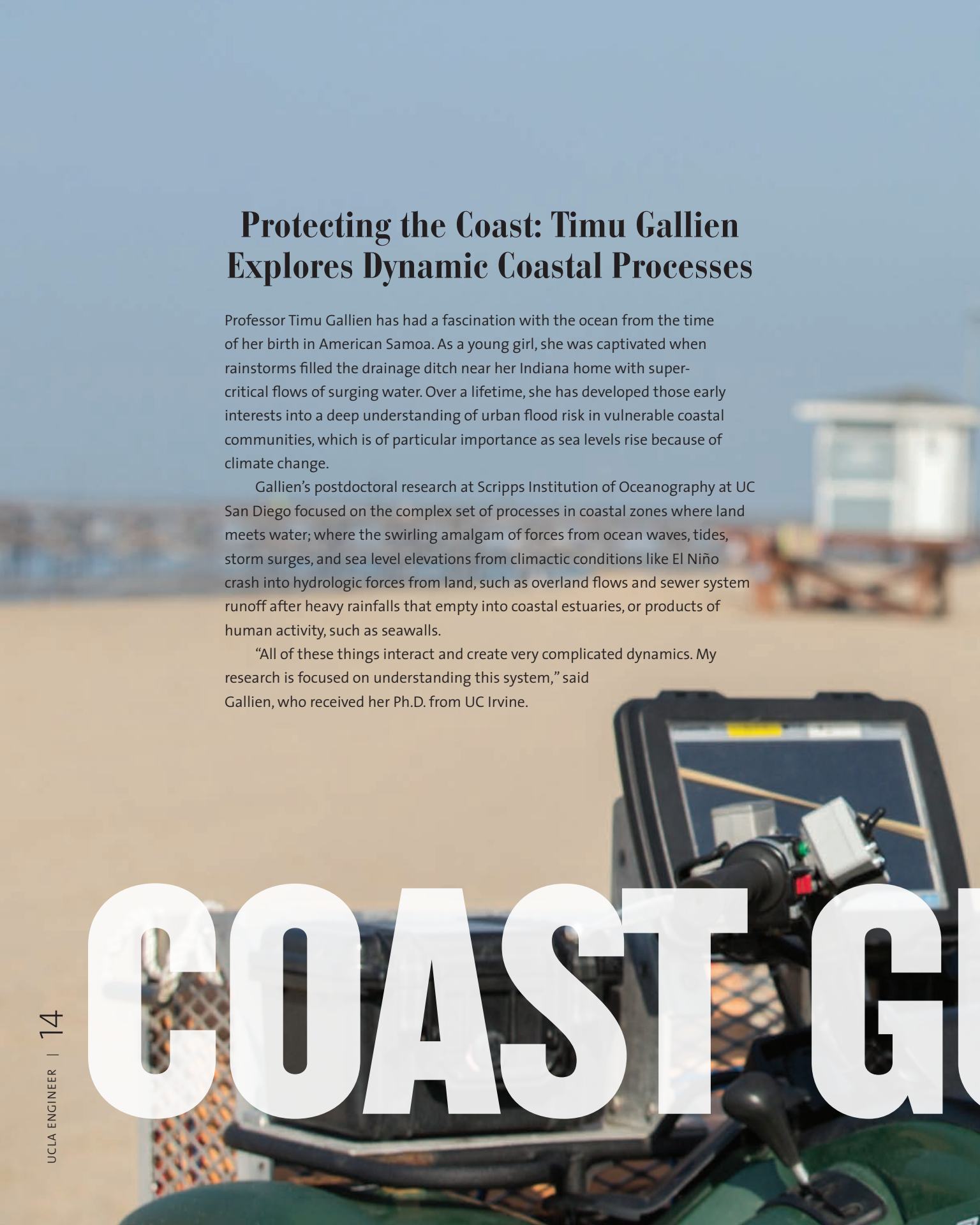
UCLA ENGINEERING
Henry Samueli School of Engineering and Applied Science
Birthplace of the Internet

Protecting the Coast: Timu Gallien Explores Dynamic Coastal Processes

Professor Timu Gallien has had a fascination with the ocean from the time of her birth in American Samoa. As a young girl, she was captivated when rainstorms filled the drainage ditch near her Indiana home with super-critical flows of surging water. Over a lifetime, she has developed those early interests into a deep understanding of urban flood risk in vulnerable coastal communities, which is of particular importance as sea levels rise because of climate change.

Gallien's postdoctoral research at Scripps Institution of Oceanography at UC San Diego focused on the complex set of processes in coastal zones where land meets water; where the swirling amalgam of forces from ocean waves, tides, storm surges, and sea level elevations from climactic conditions like El Niño crash into hydrologic forces from land, such as overland flows and sewer system runoff after heavy rainfalls that empty into coastal estuaries, or products of human activity, such as seawalls.

"All of these things interact and create very complicated dynamics. My research is focused on understanding this system," said Gallien, who received her Ph.D. from UC Irvine.



UARDIAN

Professor Timu Gallien surveys the beach on an ATV.

Writer: Melody Pupols Photographer: Joanne Leung

Gallien, who recently joined UCLA as an assistant professor of civil and environmental engineering, plans to study how the state of the beach itself affects backshore vulnerabilities like flooding and the risk of infrastructure damage. Currently, even the highest-quality mathematical models assume a static beach that does not evolve over time. However, the beach changes daily with tides and waves and more broadly with the seasons, from a narrow, rocky beach in winter to a wide, sandy beach in summer, and everything in between. Beaches in Southern California are also highly managed to keep people dry and safe and to prevent erosion, with physical management projects such as using bulldozers to erect beach berms or, in the case of Seal Beach, to build a large sand dike each winter to protect the backshore.

Her research aims to answer many pressing coastal management questions.

"These techniques are applied ad hoc, and anecdotally they must work because taxpayers and municipalities would not spend hundreds of thousands of dollars a year doing these things if there wasn't some benefit," she said. "Yet there is no understanding in the scientific literature of how beaches perform when these management techniques are applied. So that is something I'm interested in addressing."

Her research aims to answer many pressing coastal management questions: Should we be building these? When should we be building these? What level of protection do they provide the backshore? And are there optimal ways to build with the least amount of disturbance to the beach for animal habitats and breeding grounds?

Answering those questions requires fieldwork. On a recent summer morning, Gallien and two field engineers from Scripps used an unmanned aerial vehicle (UAV) and an ATV to survey a Los Angeles–area beach. They were collecting highly accurate subaerial beach topography with a resolution of

approximately 1 centimeter. It is part of a longitudinal study and something she hopes to expand to other California coastal communities.

"I'm very lucky to be at UCLA. It's a dream come true for somebody that does what I do," Gallien said. "Southern California is among the most vulnerable locations in the United States to sea level rise, so there is no shortage of things to work on here."

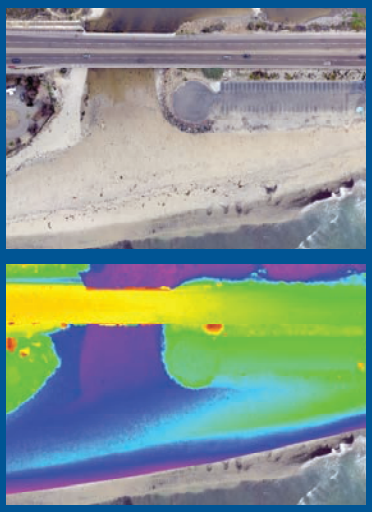
Of vital importance, Gallien also plans to continue her mentorship, teaching, and community outreach activities. She is most passionate to continue mentoring first-generation students who often face very challenging family demands amidst their academic pursuits. Her guidance has helped past mentees overcome these challenges to continue into graduate programs and science, technology, engineering, and mathematics (STEM) careers. She has a special interest in educating citizens and children in beach science. Gallien has taught 6th and 8th grade students through the Birch Aquarium Beach Science program and spearheaded the Mobile Beach Erosion Monitoring (MoBERM) program during her postdoctoral studies, which will now expand to engage Los Angeles residents.

Gallien plans to offer interested UCLA undergraduates the chance to participate in field research and data analysis—opportunities she hopes will inspire continued education in graduate engineering programs.

Usually one of the only women in her upper division undergraduate engineering classes, Gallien also has a strong desire to act as a role model to inspire future generations of women in STEM.

"You often can't dream about becoming something unless you see somebody whom you can connect with that you feel is a role model," she said. "It's critical for me to work with the students who are struggling to find their voice because they haven't found that connection yet. I've been extremely impressed with the quality of students at UCLA. It's an exciting time, and I'm really excited to be a Bruin." ■

High-Res Bird's Eye View: Gallien uses an unmanned aerial vehicle to track changes on the beach.

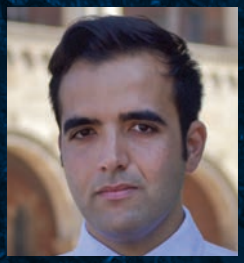


▲ *Top*: Orthoimage from a UAV of San Elijo Lagoon in San Diego County. *Bottom*: San Elijo Lagoon topography data from original orthoimage. Low elevations in pink increasing to high elevations in brown.

Images courtesy Timu Gallien

◀ Gallien uses an unmanned aerial vehicle to survey a Southern California beach.

NEW FACULTY FOR 2016-17



Sam Emaminejad, *Assistant Professor of Electrical Engineering*

Emaminejad's research focus is to develop an ecosystem of integrated portable, wearable, and in vivo physiological and environmental monitoring platforms to enable personalized and precision medicine. Emaminejad received his Ph.D. from Stanford University. He most recently held a joint postdoctoral scholar post with UC Berkeley and Stanford School of Medicine.

Timu Gallien, *Assistant Professor of Civil and Environmental Engineering*

Gallien's research examines evolving coastal hazards from climate change and urbanization, using numerical modeling and high resolution field observations. Her research interests include urban coastal flood prediction, beach morphology, near-shore processes, remote sensing, and beach groundwater. Gallien received her Ph.D. from UC Irvine. Before joining UCLA, she was a Chancellor's Postdoctoral Scholar at Scripps Institution of Oceanography, UC San Diego.

Eran Halperin, *Professor of Computer Science*

Halperin's research interests are in computational methods to analyze genetic data, in particular to improve the understanding of disease genetics. Halperin, who will hold a faculty appointment in the David Geffen School of Medicine, joins UCLA from Tel Aviv University, where he received his Ph.D. He is also a senior research scientist at the International Computer Science Institute, which is affiliated with UC Berkeley.

Ximin He, *Assistant Professor of Materials Science and Engineering*

He's research interests are in bio-inspired materials and systems, biomedical and environmental applications, energy applications, and 3-D printing technologies. Her honors include the National Science Foundation CAREER Award. He was a Gates Cambridge Trust Scholar at Cambridge University, where she received her Ph.D., and was a postdoctoral fellow at Harvard University. He joins UCLA from a tenure-track position at Arizona State University.

Lihua Jin, *Assistant Professor of Mechanical and Aerospace Engineering*

Jin's research interests include the mechanics of soft materials, continuum mechanics and their applications in technologies, nanomechanics, and multiscale modeling. Jin was most recently a postdoctoral scholar at Stanford University, where she worked on modeling mechanical and electrical properties of stretchable carbon nanotube electrodes. She received her Ph.D. in engineering sciences from Harvard University.

Jonathan Kao, *Assistant Professor of Electrical Engineering*

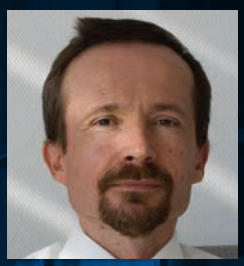
Kao's research interests lie at the intersection of neuroengineering, neuroscience, and information systems engineering, in particular how to improve algorithms for neural prosthetics. Kao joins UCLA from Stanford University. His honors include a National Science Foundation Graduate Research Fellowship and Stanford Engineering's Terman Award for Scholastic Achievement.

Sanjay Mohanty, *Assistant Professor of Civil and Environmental Engineering*

Mohanty studies physical, geochemical, and biological processes that affect contaminant removal in the subsurface soil. His goal is to use this knowledge to develop strategies to protect and manage land and water resources. Mohanty received his Ph.D. from the University of Colorado, Boulder. He has held postdoctoral scholar posts at Stanford University and more recently at the University of Pennsylvania.

Tony Nowatzki, *Assistant Professor of Computer Science*

Nowatzki's research interests include hardware/software codesign and architectural modeling and applications of mathematical optimization. Nowatzki has received a Google fellowship in computer architecture and a distinguished paper award at the Programming Language Design and Implementation conference. He received his Ph.D. from the University of Wisconsin and will join UCLA in January.



Philippe Sautet, *Professor of Chemical and Biomolecular Engineering*

Sautet's research interests are in computational catalysis, and he has done pioneering work in the theory of heterogeneous catalysis. He joins UCLA from École Normale Supérieure de Lyon, France, where he was an exceptional class director of research at the National Center for Scientific Research (CNRS). His numerous honors include the Pierre Sue Grand Prize and election to the French Academy of Sciences. He received his doctorate from Paris-Orsay University. He has supervised 24 Ph.D. students including seven now in academia, and 14 postdoctoral researchers.

Yizhou Sun, *Assistant Professor of Computer Science*

Sun's research interests are in mining information and social networks, and more generally data mining, machine learning, and network science. Her focus is on modeling novel problems and proposing scalable algorithms for real-world applications, such as academic databases, social media, and healthcare. Her honors include the NSF CAREER Award, Yahoo's Academic Career Enhancement Award, and the ACM SIGKDD Dissertation Award. Sun received her Ph.D. from the University of Illinois at Urbana-Champaign. She joins UCLA from the faculty of Northeastern University.

George Varghese, *Professor of Computer Science*

Varghese's research interests are in network verification and network algorithmics, where he has made pioneering contributions. He was most recently a principal researcher at Microsoft Research. Varghese has previously been on the faculty of UC San Diego and Washington University in St. Louis. His honors include the IEEE Kobayashi Award for Computers and Communications and the SIGCOMM Lifetime Award. He is a Fellow of the ACM. Several of the algorithms he helped develop appear in commercial systems. He received his Ph.D. from MIT.