UEC PROFILE: CLOUD MODELER AND OBSERVER

Published: 19 February 2019

STARTING WITH PHYSICS AND AN URGE TO MAKE A DIFFERENCE, A VETERAN ATMOSPHERIC SCIENTIS HER ANALYZING EYE TO THE SKY

This is the second article in a series of 2019 profiles on members of the ARM User Executive Committee (UEC).

During 25 years of work as an atmospheric scientist who specializes in clouds, Paquita Zuidema of the University of Miami has studied many things that to most of us seem exotically fascinating, including shortwave-absorbing aerosols (tiny particles in the air), shallow cumulus convection, and the evolution of marine cloud systems.

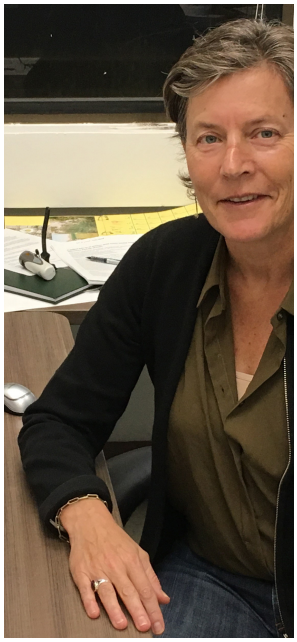
Some of that research was sponsored by the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) user facility and Atmospheric System Research (ASR) program. Other support for Zuidema's work over the years has come from NASA, the National Oceanic and Atmospheric Administration, and the National Science Foundation.

Among her 65 peer-reviewed publications is a 2018 study Zuidema led in *Geophysical Research Letters* on why and when the boundary layer of the remote southeast Atlantic Ocean is smoky.

Smoke from biomass burning in Africa advects, or moves horizontally, westward over the southern Atlantic for at least one-third of every year. It contains shortwave-absorbing aerosols that can mix with a vast stratocumulus deck.

The aerosols and clouds can interact in many ways, all of which change the radiative transfer —and therefore the way the clouds influence the Earth's heating and cooling.

"Some subtropical locations on the planet contain expansive low cloud decks," says Zuidema, a professor in Miami's Rosenstiel School of Marine and Atmospheric Science. They are generally proximate to deserts, span thousands of kilometers, and influence the atmosphere profoundly. One referenced in the paper adjoins the Namib Desert on the Skeleton Coast of southwestern Africa.



Paquita Zuidema, a professo Miami's Rosenstiel School of Atmospheric Science, brings observation and analysis to t Executive Committee. Photo Mapes, University of Miami.

The paper used observational data from ARM research that Zuidema directed as lead scientist for 17 months in 2016 an Layered Atlantic Smoke Interactions with Clouds (LASIC) field campaign set up ground instrumentation on Ascension Isl of the tropical south Atlantic.

Its mission was to characterize the smoke-related aerosols and their effect on stratocumulus clouds in the marine boun Ultimately, such process-level understanding can aid earth system change predictions.

Writing the paper "was exciting," says Zuidema. "Those were the first data from the campaign. It was good to get the L smoke-cloud system that up till then had primarily been characterized with satellite data."

A NEW COMMITTEE ROLE

Zuidema, a fan of getting out into the field for her research, walks across an airfield in São Tomé and Príncipe in October 2018 during the NASA Observations of Aerosols above Clouds and their Interactions (ORACLES) field campaign off the coast of west-central Africa. Photo is courtesy of Bernadette Luna, NASA.

In 2019, Zuidema is interacting with ARM in a different way. She is one of th members of its User Executive Committee (UEC), an advisory group that serv voice of the user community in its interactions with ARM management.

"I'm curious about their conversations," she says of the committee, "and abc approaching this relationship. It is very relevant for the larger community."

Zuidema sees the UEC as a way of reaching out to a broad community of sci definitely interested in ways to make that work well," she says.

That includes outreach to university students of atmospheric science, whose programs are not set up to expose them to working with field instruments.

Zuidema, an observationalist, is a particular fan of the summer classes in rac matters at ARM's Southern Great Plains atmospheric observatory in Oklahon not one of the instructors. The classes "already play a valuable role" in awak instrumentation, she says.

Zuidema joined the UEC in part because she has always enjoyed mentoring y and practitioners.

"Maybe it's because I don't have kids," she says with a laugh. "But I'm also v the idea that atmospheric science will benefit from the involvement of peop wide range of backgrounds and places in the world."

The kind of science she practices is "a global enterprise" that is advanced by variety of skills and inclinations, says Zuidema. "Being good at math helps, b having good social skills and good organizational skills."

GROWING UP AND OUTWARD

Informing all of these inclinations is Zuidema's own background.

Born in Holland, she grew up speaking Dutch. Her father, a native of the Netherlands, influenced her with his own professional inclination toward knowing a lot about the wider world.

R. Tom Zuidema, who died in 2016, was a cultural anthropologist who specialized in South America and was an expert in the social and political organization of Andean civilization, especially the Incas.

Zuidema was only 4 when her father moved the family to Peru for a university teaching post, and just 7 when another teaching job brought the family to the University of Illinois at Urbana-Champaign.

Starting as a girl in Peru, "I got used to the idea of adapting to different cultures and environments," says Zuidema of her international childhood. "That's been pretty helpful."

The family occasionally summered in Holland, and she attended eighth grade there.

Zuidema takes in the view from a research aircraft in 2018 Observations of Aerosols above Clouds and their Interactio campaign. Photo is courtesy of Sam LeBlanc, University of

From early on, Zuidema was very interested in science. "That was the one thing that didn't change," she says of her ecle

She earned a bachelor's degree in physics (University of Illinois at Urbana-Champaign, 1983), but Zuidema was in her la atmospheric sciences took hold of her.

"I just didn't think of it as an undergraduate," she says. It was a time when she began trying to marry her interest in sci passion for social causes.

FINDING CLOUDS

Ascension Island was the site for ground instrumentation during the Layered Atlantic Smoke Interactions with Clouds (LASIC) field campaign, which Zuidema led in 2016 and 2017.

Zuidema's path to atmospheric science was circuit
"I didn't see a place where I really fit in very well."

Still searching, Zuidema studied in a technology a
program—"optimized for technological issues," sh
Massachusetts Institute of Technology (M.S., civil
1987). Then at the University of Washington, she
master's degrees: in physics (1989) and atmosphe
(1993).

"The physics department was almost next door to
sciences department," says Zuidema. "I thought, '
place I can combine my interests in science and sc
way that works with my more introverted, analyti

She studied with Dennis Hartmann, an expert i
budget and climate dynamics. Right away, remem
realized it would be a good fit for me."

From there, she entered a doctoral program at the
Colorado, Boulder. Her husband, atmospheric scie
, now a specialist in tropical convection at the University of Miami, had just finished his PhD at Washington, "and it w
could both go," says Zuidema.

Earlier, during her master's studies in atmospheric sciences, she wrote a thesis on a satellite characterization project tha
shallow clouds—an interest in cloud type that later underpinned her PhD dissertation on three-dimensional radiative tr
advisor Frank Evans.

Such clouds remain the biggest source of uncertainty in projections of climate change, says Zuidema, and their processe
complex.

In 2004, ready to dig into that complexity anew and take on new challenges, she moved on to a faculty position at the U
Miami.

Zuidema, a nature photographer who prefers shooting clouds, took this picture on the South Florida coast, looking out over Biscayne Bay.

‘I FEEL REALLY LUCKY’

“What we know now has evolved” dramatically, says Zuidema of the state of atmospheric science. “That’s been such fur throughout my career.”

As a master’s student in the early 1990s, she saw little in situ data on shallow clouds and other phenomena. “But before all this ARM data from so many places,” says Zuidema. “It has been a data revolution. We have so much more at our fin understand these clouds. I feel really lucky.”

Since starting out, she adds, “modeling capabilities have increased multitudes,” and instruments have become more ple expensive because of advances in small-scale electronics.

In pursuit of her corner of cloud science, Zuidema uses all this to her advantage as a practitioner of data integration—th combining datastreams from satellites, aircraft, ground instruments, and models to answer science questions.

“They all give you different views,” she says of the data sources.

In simplified terms, satellites provide large-scale context, but not views of small-scale processes, as ground instrument structure, as aircraft do.

All these views are available within ARM data, with particular strengths being the resolution of the diurnal and seasonal Zuidema. “All that reach, 24/7, for 365 days a year.”

She may feel lucky for other reasons: loving nature, trail running, outdoor photography, hiking—and just looking up.

“I love looking at clouds,” says Zuidema, a scientist with an eye for art. “I do like thinking about why they are there. But are beautiful.”

Read more profiles of UEC members.

# # #

ARM is a DOE Office of Science user facility operated by nine DOE national laboratories.