AQAST Spotlight: Gabriele Pfister & Colorado CDPHE

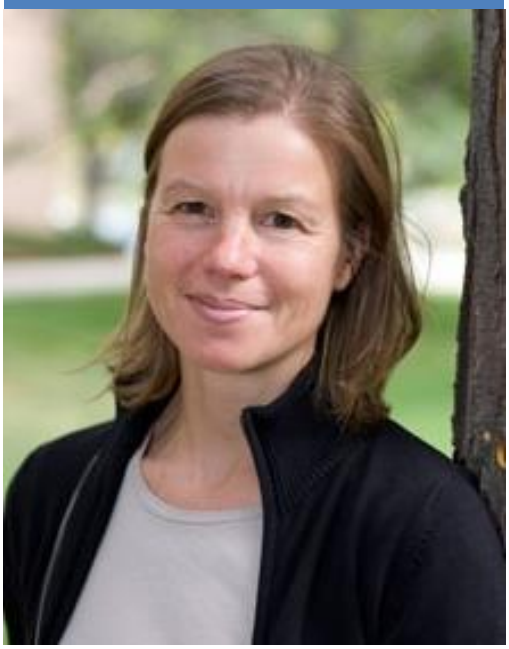
FRAPPÉ Campaign Brews Up Excitement in Colorado
By Ben Kaldunski & Tracey Holloway

What does a popular beverage with foam, ice, and coffee have to do with air quality? Well, perhaps not much, unless the tireless scientists involved in the FRAPPÉ (Front Range Air Pollution and Photochemistry Éxperiment) campaign needed a refreshing jolt of caffeine during the hot summer of 2014. However, any major effort needs a catchy title, and FRAPPÉ was born. FRAPPÉ brought groups together for exciting science, health-relevant data collection, and many late nights of collaboration and coffee.

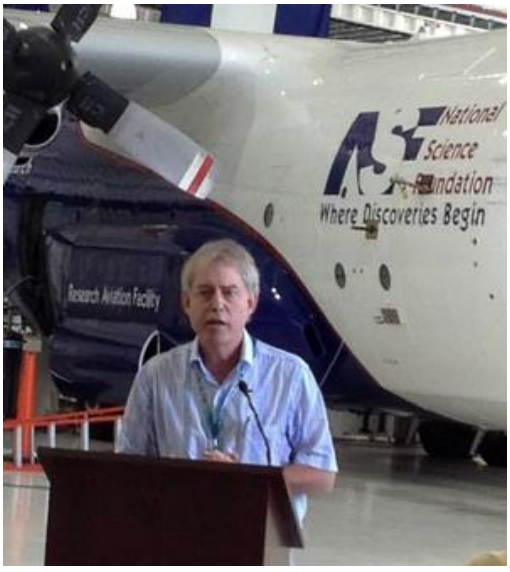
"FRAPPÉ was designed to look at summertime air quality in the Colorado Front Range to figure out what factors contribute to air pollution in that region," said Gabriele Pfister, a scientist at the National Center for Atmospheric Research (NCAR) and co-lead investigator of the unprecedented campaign. "We wanted to know the role of different emission sources, what is the role of transport, and why our models often were failing to deliver an accurate representation of summertime ozone," Pfister said.

Beyond the experience from the research community, Pfister - a member of NASA's Air Quality Applied Sciences Team (AQAST) – and her colleagues sought to engage the expertise of Colorado's air quality managers. Gordon Pierce, Patrick Reddy and Daniel Bon of the Colorado Department of Public Health and Environment (CDPHE), were members of the FRAPPÉ team who played critical roles in defining the campaign, daily flight planning and weather forecasting. "We would not have had a campaign without the involvement of the Colorado CDPHE," Pfister said. "Their years of experience with local weather and air quality forecasting were the biggest contributions to successful flight planning during FRAPPÉ."

The campaign, which received funding from the State of Colorado and the National Science Foundation, utilized a three-pronged approach that combined pollution measurements from satellite instruments, ground monitors, and multiple aircraft flying daily missions around the Front Range. The massive collaborative effort yielded a treasure trove of data that the FRAPPÉ team has been poring over since the field campaign ended in mid-August 2014. While the first big wave of results won't be released until early May, the team is looking to address some of the air quality management community's most pressing concerns. "We will be able to refine our emissions inventories for urban sources, oil and gas operations, agricultural emissions, nitrogen deposition in Rocky Mountain National Park, and improve our understanding of atmospheric chemistry," Bon said.



Dr. Gabriele Pfister was the co-lead investigator of the FRAPPÉ campaign, an unprecedented effort to understand air quality in Colorado's Front Range (Image courtesy of NCAR/UCAR).



Patrick Reddy was an integral member of the forecasting team that ensured FRAPPÉ's aircraft made successful flights each day during the month long campaign (Image courtesy of Colorado CDPHE).

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Nitrogen acts as a fertilizer that favors some plants over others, destabilizing the park's delicate ecosystems. Bon said that about half of the nitrogen deposited in Rocky Mountain National Park originates from agricultural sites in the Front Range.

Reddy said the Colorado CDPHE was very interested in understanding the in-flow and out-flow of air masses over the mountains and nearby plains, as well as building a detailed inventory of emissions sources and their contribution to air quality across the Front Range. "We're convinced that the ground samples and aircraft measurements gave us a very good snapshot of emissions from the oil and gas fields, agriculture, and urban sources," he said. "We're confident that the scientists now have the data necessary to determine which areas are most sensitive to ozone-forming pollutants, and how the previous day's air quality can contribute to the next day's problems."

FRAPPÉ also provided a unique opportunity to test the performance of air quality models in real-time applications. Pfister's group ran a version of the Weather Research and Forecasting (WRF) model that used "tracers" to represent different emissions source categories. "The model wasn't right all the time, but it was doing very well most of the time," Pfister said. Reddy was also deeply involved in air quality forecasting during the FRAPPÉ campaign. "We got a glimpse this summer of how various models perform in terms of being useful for forecasting and policy-related modeling," he said.

Pfister's work with FRAPPÉ exemplifies the ethos of engagement with the air quality management community that defines AQAST. NCAR scientist Frank Flocke was co-lead investigator with Pfister, and AQAST members Brad Pierce, Pius Lee, Anne Thompson, Russell Dickerson, Jana Milford and Daven Henze were also involved with different aspects of the campaign. "We've never experienced this level of involvement from the scientific community that included aircraft, modeling, ground monitoring, the whole nine yards," Reddy said. "The state was extremely pleased with how the campaign was planned and adjusted in order to address our needs and concerns," he added. "I can't imagine the project going any better than it did."

The FRAPPÉ campaign utilized two research aircraft provided by NASA as part of the DISCOVER-AQ program, and a large C-130 aircraft provided by the National Science Foundation. NASA's P-3B aircraft flew multiple missions over the Rocky Mountains (shown above) to examine pollution profiles and weather patterns that cause poor air quality (Image courtesy of F. Flocke).