I have reviewed and, if necessary, edited the RDSR for Brian Bergamaschi, a scientist whom I supervise. The RDSR:

- accurately represents the work conducted by this scientist, and
- is clearly written, using the USGS guidelines provided, including
  - following section limits
  - providing IPDS numbers and, when available, DOI numbers, for all papers listed in section 18, starting with papers initiated in 2014.

7/21/14

Supervisor Date

1. NAME: BRIAN A. BERGAMASCHI

2. DATE PREPARED: JULY, 2014
3. DUTY STATION: CALIFORNIA WATER SCIENCE CENTER, SACRAMENTO
4. REGION/RESEARCH DISCIPLINE: PACIFIC REGION, BIOGEOCHEMISTRY
5. CLASSIFICATION TITLE, SERIES, AND GRADE: RESEARCH CHEMIST, 1320, 14
6. DATE OF ENTRANCE ON DUTY: 11/1997
7. DATE OF LAST PROMOTION: 2006
8. DATE OF LAST RESEARCH GRADE REVIEW PANEL: 2010

9. EDUCATION:

George Washington University: B.Sc. 1983; Major emphasis, zoology; minor emphasis, biochemistry.

University of Washington; Ph.D. January 1995; Major emphasis, organic geochemistry/chemical oceanography; minor emphasis, biological oceanography

Carnegie Geophysical Institute: Postdoctoral Fellow, 1995; Measurement of carbon isotopic ratios of individual carbohydrates in environmental samples.

10. TECHNICAL TRAINING RECEIVED:

Environmental Applications of Ion Trap Mass Spectrometry, 1997, 2 Days, Varian Associates

Advanced Techniques in Ion Trap Mass Spectrometry, 1997, 3 Days, Varian Associates

Optical Instrument Calibration, 1999, 5 days, Oregon State University

Optical Oceanography, 2001, 5 weeks, 6 graduate credits, University of Maine

Multivariate Data Analysis, 2007, 1 week, CAMO

11. PROFESSIONAL EXPERIENCE:

11A. PRESENT ASSIGNMENT:

Research Chemist, USGS-WRD, Sacramento, CA, 1997-Present

My present position is as senior researcher and project chief within the Biogeochemistry Program in the California Water Science Center, Sacramento CA. My primary role continues to involve identification of significant research needs, development of funding sources for the research, design of the scientific approach, and broad oversight of the field and laboratory experiments. This work is as part of a collaborative team comprising researchers that I directly supervise, others within the CAWSC Biogeochemistry group, others within the broader CAWSC, at other USGS Centers, in other agencies, and at universities and consultancies.

The research I engage is typically highly complex and crosses multiple disciplines. For my projects, it falls to me to define the research objectives and approach, and to assemble the appropriate research team. I typically act as lead author on the proposal, am highly involved in conduct of the research, analysis of the data, and development of written products. I often train others in measurement and data analysis techniques.

My most important role is to mentor others in conducting aquatic biogeochemical research. For this reason, I often ask more junior researchers to act as project chief and to lead production of journal articles.

MAJOR CURRENT PROJECTS:

For the projects listed below I am the lead scientist of these collaborative interdisciplinary efforts. For the projects funded externally, I was lead author on the proposal, am responsible for one or more written products, received more than 6 months of salary, and am directly involved in the research. The time does not sum to 100% because of the time devoted to program development and

because I serve a consultative role on several projects run by others, helping with technical issues, data analysis, field measurements, and writing.

USGS LANDCARBON COASTAL CARON SEQUESTRATION ASSESSMENT (20%)

DATES: From: 2010 To: ONGOING

SOURCE OF FUNDING: USGS LandCarbon Program

PRIMARY RESEARCH QUESTION: My role: What are the interactions between terrestrial land use changes and coastal ocean carbon processes?

IN SITU MEASUREMENTS OF WATER AND PARTICLE PROPERTIES AS INDICATORS OF HABITAT QUALITY (40%)

DATES: From: 2011 To: ONGOING.

SOURCE OF FUNDING: US BUREAU OF RECLAMATION (presently $1.1M/yr)

PRIMARY RESEARCH QUESTION: How can in situ optical measurements be used to provide real-time assessment of habitat conditions?

LIBERTY ISLAND AND CACHE SLOUGH BIOGEOCHEMCIAL OBSERVATORIES (20%)

DATES: From: 2012 To: ONGOING.

SOURCES OF FUNDING: Interagency Ecological Program, Department of Water Resources, State and Federal Water Contractors Association, Bureau of Reclamation

PRIMARY RESEARCH QUESTION: What are the rates of primary production and nutrient utilization in shallow water tidal habitats and what are the major drivers controlling the rates?

11B. PREVIOUS PROFESSIONAL POSITIONS:

Formerly I was supervisor, lead scientist and project chief for the California Water Science Center Aquatic Organic Carbon Research project, focusing on carbon biogeochemistry in wetland and aquatic systems. In that capacity I built a large research group, comprising 5 RGE researchers, 5 high level technical support staff, and 6 lower level staff. I also led development of a laboratory program specializing in optical characterization, now certified as a USGS production laboratory. This project was recently folded into the CAWSC Biogeochemistry program.

SELECTED PREVIOUS PROJECTS:

The projects listed below are those for which I was lead author on the proposal, project chief, received more than 6 months of salary, and was highly involved in the research. Most represent multidisciplinary collaborative efforts.

CARBON SEQUESTRATION WETLAND FARMING AS A MEANS TO REVERSE SUBSIDENCE AND REDUCE FLOOD RISK

DATES: From: 2007 To: 2019 est.

SOURCE OF FUNDING: USGS; California DWR; $27M
DWR suspended project in 2008

PRIMARY RESEARCH QUESTION: To what extent and under what conditions may wetlands be used to sequester carbon, reduce GHG release, and accrete land surface?

AQUATIC REAL-TIME CARBON (ART-C) NETWORK

DATES: From: 2010 To: 2011

SOURCE OF FUNDING: USGS Land Use and Climate Change CEN

PRIMARY RESEARCH QUESTION: What is the high frequency variability and total flux of dissolved organic carbon, particulate organic carbon, and nitrate from watersheds into rivers, and from estuaries into the coastal ocean?

QUANTIFYING LOADS AND ASSESSING MANAGEMENT STRATEGIES FOR REDUCING DRINKING WATER CONSTITUENTS OF CONCERN IN WATERSHEDS.

DATES: From: 2005 To: 2010

SOURCE OF FUNDING: California State Water Quality Control Board, $4.5M

PRIMARY RESEARCH QUESTION: What are the watershed sources of NOM, nutrients, salts, sediments, and disinfection byproduct precursors, and can we accurately model them?

MERCURY RELEASE FROM DELTA WETLANDS: FLUXES.

DATES: From: 2004 To: 2007

SOURCE OF FUNDING: Bureau of Reclamation, $1.7M

PRIMARY RESEARCH QUESTION: What are the fluxes of Hg species onto and off a tidal wetland, and what is their relation to organic geochemical species (as determined using in-situ monitoring)

THE EFFECT OF ANIMAL FEEDING OPERATIONS ON WATER QUALITY

DATES: From: 2005 To: 2009

SOURCE OF FUNDING: CALFED, $1.1M

PRIMARY RESEARCH QUESTION: What are the impacts of Dairy operations on ground and surface water quality: pathogens, nitrate, pharmaceuticals? And can we trace these impacts using optical properties of NOM?

DISSOLVED ORGANIC CARBON RELEASE FROM DELTA WETLANDS: AMOUNTS, ALTERATIONS, AND IMPLICATIONS FOR DRINKING WATER QUALITY AND THE DELTA FOODWEB.

DATES: From: 2001 To: 2006

SOURCE OF FUNDING: California Department of Water Resources, $2.2M

PRIMARY RESEARCH QUESTION: What is the amount and chemical composition of NOM exported from tidal wetlands into the San Francisco Estuary?

IMPROVING DELTA DRINKING WATER QUALITY: MANAGING SOURCES OF DISINFECTION BYPRODUCT-FORMING MATERIAL IN THE STATE WATER PROJECT

DATES: From: 2002 To: 2007

SOURCE OF FUNDING: Association of Bay Area Governments, $1.2M

PRIMARY RESEARCH QUESTION: How much does biodegradation and photo-oxidation alter the amount and chemical composition of NOM in the 500 mile-long state water conveyance system?

Professional positions prior to employment at USGS

1995-1997 ORGANIC GEOCHEMIST, C.S.U.S.F./ E.C.O. Under contract to USGS, Sacramento CA.: Applied research involving the geochemistry of natural organic carbon.

1995 POSTDOCTORAL FELLOW, Carnegie Geophysical Laboratory, Washington D.C.: Investigated microbial alterations to the compound-specific stable carbon isotope ratio of sedimentary organic material.

1987-1995 RESEARCH ASSOCIATE, University of Washington, Seattle, WA.: Developed a new method for carbohydrate analysis, and applied it to the investigations of the cycling of natural organic material in marine environments.

1980-1987 PROJECT ENGINEER, CEC Inc., Annapolis, MD., and as independent consultant Designed, engineered, and supervised the construction of custom manufacturing systems, including chemical etching systems, high speed sortation systems, complex manufacturing systems, and others.

12. SIGNIFICANT RESEARCH ACCOMPLISHMENTS:

12a. RECENT ACCOMPLISHMENTS:

There are fundamental gaps in our understanding of how biogeochemical processes in aquatic systems are driven by interactions at the interface with terrestrial environments. These interactions – competing physical, biological and abiotic processes - determine water and habitat quality, with the relative magnitude of individual processes often entirely unknown. This is the focus of my research program. The difficulty is that interfacial environments are physically complex, with biogeochemical signals confounded by physical processes with widely varying time-scales. For example, studies must span time-scales associated with turbulence, tides, photo-exposure, wind, storms, and climatic variability (Bergamaschi et al., 2012b; Downing et al., 2009a). Quantitative studies in these systems require innovative techniques and methods capable of collecting data at time-scales faster than the rates of change in the system, and for periods long enough to capture all important drivers (Bergamaschi et al., 2010).

My group directly addresses this chronic mismatch between the scales of change in dynamic environments and the timescale of traditional sampling and analysis by developing new techniques (Downing et al., 2009; Pellerin et al., in prep). Traditional studies are usually limited to a relatively few discrete samples that must be collected and transported to the lab, where incredibly expensive analyses are performed in an attempt to understand extremely dynamic environmental processes. But data collected at frequencies lower than the frequencies on which processes actually occur can obscure true trends – a phenomenon commonly referred to as aliasing (Bergamaschi et al., 2001), confounding our understanding of fundamental processes (Downing et al., 2009a). The solution is to increase sampling frequency – by both (1) permitting faster analytical throughput in the laboratory so more samples can be collected, and (2) making analyses *in situ* that are normally only made in the laboratory. My group actively pursues both avenues of research.

To increase analytical throughput, I developed techniques to characterize optical properties of organic material (Fram et al., 1999; Wieshaar et al., 2003; Bergamaschi et al., 2005; Kraus et al., 2008) with the intention of using the organic material as a proxy for processes of interest. Optical properties measurements - spectral absorbance and fluorescence – provide limited compositional information about particulates and dissolved constituents (Bergamaschi et al., 2005; Kraus et al., 2008, Hernes et al., 2012). Optical measurements are easily and inexpensively made in the lab, permitting analysis of many more samples than conventional techniques. I worked with instrument manufacturers to further speed up these analyses (see section 14g), reducing analytical time to less than 3 minutes per sample (from >30 min.). Optical measurements have been resisted in the field of Organic Geochemistry because they violates the fundamental precept that the way to understand environmental processes is through explicit characterization of the composition of organic material. I saw, however, that optical properties measurements could be used in a fashion similar to isotopic measurements, which provide a link to sources of material independent of composition (Bergamaschi et al., 1999; Fram et al., 2001; Pellerin et al., 2009).

In addition to source-related information, optical measurements have the important advantage over isotopes of providing compositional information sufficient to broadly assess source and reactivity, which for many studies is an adequate analytical endpoint (Hernes et al., 2009; Hernes et al., 2013). As our group has incorporated these measurements, we have found that using the full spectrum of optical measurements provides more source information than originally thought, as well as compositional information related to environmental processes (Bergamaschi et al., 2005; Downing et al., 2009a). Incorporating optical measurements into studies that also used more classical techniques has lead to advances in our fundamental understanding of NOM sources and cycling (Chomycia et al., 2008; Eckard et al., 2007; Hernes et al., 2009; Hernes et al., 2008; Hernes et al., 2013; Stepanauskas et al., 2005b), while the direct linkages possible to intrinsic reactive properties has added great value in applied

studies, particularly for characterization of drinking water supplies (Bergamaschi et al., 1999; Kratzer et al., 2004; Kraus et al., 2008a; Kraus et al., 2010; Kraus et al., 2011).

This background in the theory and practice of making optical measurements in the laboratory has led directly to my recent scientific accomplishments which translate these measurements to the field. This was made possible by adapting existing field spectrophotometers and spectrofluorometers for analysis of chemical processes. The ability to observe compositional differences and other chemical differences directly in the environment, measuring optical parameters at rates fast enough to avoid aliasing the signals of physical and biological processes, represents a revolutionary advance in our ability to conduct our science. *Using these tools, we have uncovered variability in environmental processes never before observed and made measurements of fluxes never before possible. These innovations have altered our fundamental understanding of biogeochemical processes and called into question the accuracy of weekly or monthly monitoring efforts to assess flux.*

For example, one of our studies showed that riverine DOC composition unexpectedly varied diurnally by a significant amount, driven by interactions between photolytic and biological processes (Spencer et al., 2007). This was the first of many subsequent studies by others that observed this effect. A related study showed that nitrate varied by 30-50% diurnally in concert with variations in carbon quality (Pellerin et al., 2009). Yet another study used the spatial distribution of DOC in a reservoir to calculate the flux from the sediments (Downing et al., 2008). Using *in situ* measurements, we demonstrated that flux of NOM during storms cannot be quantified accurately using current techniques, and must be sampled at much higher frequencies (Saraceno et al., 2009). In tidal environments we have combined these techniques with measurements of physical dynamics to quantify the tidal flux of carbon and mercury from wetlands (Bergamaschi et al., 2012a; Bergamaschi et al., 2010; Bergamaschi et al., 2011; Bergamaschi et al., 2012b; Ganju et al., 2005). Quantification of tidally-driven fluxes in tidally environments has never before been possible over the long times necessary to account for natural variation and other drivers.

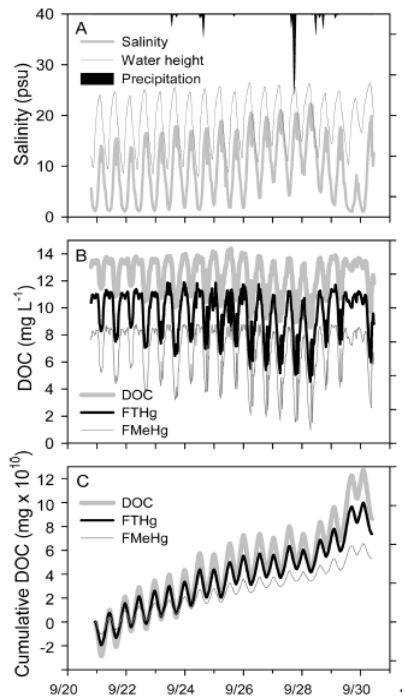

Figure 1 Times series of tidal-stream gage data and modeled constituent concentrations and fluxes in Shark River estuary at Gunboat Island (Bergamaschi et al., 2012b)

Although not as sexy as *in situ* measurements, it is important to note that the chemical characterization of organic material remains the backbone of our research, and the strength of our program relies on the combination of *in situ* and laboratory measurements (Downing et al., 2009b; Eckard et al., 2007; Fleck et al., 2014; Hernes et al., 2013). One recent study – the largest of its kind – examined variations in lignin phenol concentration and composition across the Sacramento-San Joaquin Delta (Eckard et al., 2007). The results show that historic studies have dramatically underestimated the temporal and spatial variability of organic geochemical processes as well as contributions of lower-watershed sources. Combining these classic chemical techniques with optical analyses has permitted us to estimate sources of NOM in the Delta as well as the impact on drinking water supplies (Hernes et al., 2009; Kraus et al., 2010; Kraus et al., 2011; Kraus et al., 2008b). The strength of my research program is the concerted use of in situ, laboratory optical, and direct chemical characterization in the same study.

Together these studies represent an entirely new approach to aquatic biogeochemistry – an approach which my group pioneered. Measurement of biogeochemical processes *in situ* and at temporal scales sufficient to resolve underlying processes represents a groundbreaking advance that will continue to yield important discoveries in the years ahead.

12B. OTHER CAREER ACCOMPLISHMENTS:

CONTINUOUS IN-SITU MONITORING IN AQUATIC SYSTEMS.

Much of my research involves development and use of continuous high-frequency *in situ* optical measurements to better understand biogeochemical dynamics in aquatic systems. The recent commercial availability of *in situ* optical sensors, together with new techniques for data collection and analysis, provides the opportunity to monitor a wide range of water-quality constituents on time scales in which environmental conditions actually change. We are only now scratching the surface of what is possible. One area of particular interest is the simultaneous *in situ* determination of nitrate concentration along with other parameters. My work has revealed high rates of variability in nitrate concentrations occurring in concert with other biogeochemical process -- even in unexpected places and at unexpected times (Bergamaschi et al., 2011; Pellerin et al., 2012; Pellerin et al., 2009). More fundamentally, this work has conclusively demonstrated that using weekly or monthly discrete sampling to calculate loads in rivers is fraught with error, even in places such as the lower Mississippi, where mixing might be expected to overwhelm environmental variability (Downing et al., 2009; Pellerin et al. 2009; Pellerin et al., 2011; Pellerin et al., in prep for ES&T).

We continue to expand our capabilities in the arena of continuous monitoring. We routinely monitor dissolved organic carbon, phytoplankton pigments, and nitrate (as well as other biogeochemically-significant parameters such as DO and pH). We have implemented continuous phosphate measurements and are presently beta-testing a field unit for ammonium (Downing et al., in prep). We are developing methods for routine particle size and particle composition (Bergamaschi et al., 2011; Sacaceno et al., 2011). Finally, we are developing methods to use this continuous data in biogeochemical models capable of assessing habitat quality in real time (Wu et al., in prep).

IN SITU FLUORESCENCE MEASUREMENTS FOR NATURAL ORGANIC MATTER AND MERCURY STUDIES.

As mentioned above, one area of my research has focused on developing methods and applications for the use of commercially-available fluorometers tuned for measurement of fluorescent dissolved organic matter (FDOM). My work has demonstrated that FDOM is especially useful for measuring the concentration of humic-rich soil-derived organic matter, and can often act as a proxy for contaminants such as mercury which are transported with this fraction of NOM. My publications are amongst the first to demonstrate the value of using these sensors to capture diel (Spencer et al., 2007), event (Saraceno et al., 2009) and seasonal (Pellerin et al., 2012) variability, and for calculating fluxes in tidal systems (Bergamaschi et al., 2011, 2012).

SENSOR CHARACTERIZATION AND DEVELOPMENT.

Since the researchers in the water quality field are rapidly adopting in situ optical methods, one key are of concern is the ability to collect consistent, comparable, high quality data. Given that this is still a nascent technology, my group and I have made significant investments into fundamental sensor characterization, methods development, and quality control (Bergamaschi and Pellerin, 2011; Bergamaschi et al., 2010). We recently produced a USGS Techniques and Methods Report for Optical Nitrate Sensors (Pellerin et al., 2013), and are preparing one for fluorescence sensors. We hope to continuously update these publications as the field continues to develop. We have also conducted fundamental research into characterizing sensor response to temperature and interferences from particles and colored organic matter (Saraceno et al., 2009; Downing et al., 2012; Pellerin et al., 2012; Pellerin et al., 2013). Finally, we are continuing to build and test custom fluorometers that measure compositional differences in organic matter. These are useful, for example, for tracing wastewater (Bergamaschi et al., 2005; Kraus et al., in prep; Corsi et al., in prep), agricultural discharge (Watanabe et al. 2010; Zamora et al., 2013), and for understanding source mixing (Bergamaschi et al., 2005). I currently have projects testing the application of several custom fluorometers in the laboratory and field.

NATURAL ORGANIC MATTER AND DRINKING WATER:

Drinking water utilities are interested in understanding the sources controlling NOM content in source waters because of regulations pertaining to disinfection byproduct (DBP) formation. Drinking waters must be disinfected for pathogen control, usually using chlorine. But an unfortunate side effect is that toxic byproducts (DBPs) are formed when NOM and bromide present in the source water react with the chemicals used for disinfection. My work demonstrated that reactivity with respect to formation of DBPs is related to the source of and processes that modify the NOM (Bergamaschi et al., 1999; Bergamaschi et al., 2000; Fram et al., 2003; Kraus et al., 2011). This simple finding has made reservoir managers and drinking water utilities realize that it is possible to manage THM formation through source control in the watershed.

ENVIRONMENTAL ROLES OF NATURAL ORGANIC MATTER:

My projects continue to make inroads into the function of NOM in aquatic ecosystems. Our analysis of historic time-series has shown that dissolved NOM is temporally and spatially variable in chemical composition as well as concentration (Bergamaschi et al., 2001; Sonnerup and Bergamaschi, 2003), necessitating a sampling regime that captures both dimensions of the variability. Variation in NOM composition dramatically affects its role in the environment.

For example, we have found that differences in the composition of NOM from different sources affects its response to photoexposure (Spencer et al., 2007; Stepanauskas et al., 2005a). In contrast to studies conducted on NOM from a single source, we found that the NOM composition from some sources significantly reduces the rates and extent of microbial NOM remineralization (Pellerin et al., 2010; Stepanauskas et al., 2005a). This finding has important management implications because it implies the ecological benefit of NOM released from some wetlands is much less than others. On a more fundamental level, this finding suggests a mechanism by which NOM may be stabilized while it is exported to the ocean – an important link in the global carbon cycle. Further, we showed through laboratory studies of plant leachates (Pellerin et al., 2010) that microbial degradation results in the preferential degradation of lignin under some conditions – lignin was formerly thought to be recalcitrant in the environment. We also have shown how NOM affects uptake of methyl mercury by algae (Luengen et al., 2012) and transport of metals (Moskalski et al., 2013).

In response to these observations, we have developed laboratory methods that may be used to characterize NOM composition inexpensively and to correlate these to the underlying chemistry (Hernes et al., 2009; Spencer et al., 2010).

CARBON CYCLING AT THE REGIONAL AND CONTINENTAL SCALE:

I have recently begun expanding my research into explore large-scale carbon cycling. Understanding carbon cycling is important for anticipating the global effects of rapidly increasing carbon dioxide concentrations in the atmosphere, but it also is central to understanding ecological processes at the regional level. For example, mass balance of available carbon sources in the San Francisco Estuary indicates that dissolved NOM supports 80% of the heterotrophic energetic requirements, but that remineralization prevents this material from supporting upper trophic levels (Bergamaschi et al., 2010; Bergamaschi et al., 2012b). There is a missing source of carbon. Balancing the carbon budget and understanding the carbon cycle in the estuary is one focus of my largest project.

I have also begun to use remotely sensed optical data to explore carbon dynamics at broad spatial scales. This has led to two new collaborative projects exploring carbon sequestration in estuaries and in wetlands. More significantly, I have used these techniques to examine carbon cycling in coastal oceans as part of the USGS LandCarbon program. We found that projected changes in the nutrient and sediment supply to coastal environments can significantly alter carbon cycling and carbon sequestration in coastal sediments, where 85% of ocean reduced carbon is stored (Bergamaschi et al., 2012c; Bergamaschi et al., 2014; Zhu et al., 2010).

13. SCIENTIFIC LEADERSHIP:

LEADERSHIP IN DEVELOPMENT OF NEW METHODS AND TECHNIQUES:

- Pioneered the application of in situ spectrophotometric and spectrofluorometric measurements for the purpose of resolving physically-coupled biogeochemical processes in the environment.
- Developed and published a novel method for analysis of fluorescence spectral data (the "Waterlyzer").
- Developed the application of simultaneous UV and fluorescence measurements to identify different water sources within a watershed.
- Developed a new method for purge and trap—gas chromatography—combustion—isotope ratio monitoring mass spectrometry to provide reliable isotopic values for volatile compounds and first to apply isotopic measurements to the study of DBP sources within watersheds.
- First to use kinetic methods to identify DBP precursor sources.
- Established a laboratory to analyze optical properties, disinfection byproducts, and NOM biomarkers.

LEADERSHIP IN MULTIDISCIPLINARY STUDIES:

One of my strongest contributions to scientific advancement is origination and leadership of large, multidisciplinary projects – projects that attempt to address complex issues comprehensively rather than piecemeal. Project leadership comprises a number of individual steps: recognition of scientific needs, recruitment of researchers, identification of funding sources, authorship of the proposals, and coordination of research activities. Each takes time.

There are many examples multidiciplinary/multi-investigator research projects in the lists in section 11. One particular example is the Willow Slough watershed project, which was a $4.5M multidiciplinary effort that involved hydrologic modelling (Kavvas, UCDavis), groundwater interactions (Deverel, Hydrofocus), soil biogeochemistry (Horwath, UCDavis), agricultural best management practices (Bachand, Bachand and assoc.), aqueous geochemistry (Hernes, UCDavis) and aquatic biogechemistry (me). I was the overall lead for the project proposal, and lead of the multidiciplinary science effort. The effort resulted in more than 15 publications characterizing DOC evolution, transport and reactivity in agricultural watersheds.

One of the things I enjoy most about my position at the USGS is that we are able to approach complex scientific problems holistically in research teams. The studies undertaken by my group typically involve numerous other USGS researchers in the CAWSC and other WSCs, as well as in NRP, BRD, and GD. We also actively collaborate with researchers at the University of California, University of Washington, University of New Hampshire, University of Georgia, University of Maine, Stanford, and elsewhere. Each of the projects has a strong commitment to student and postdoctoral education. As for any large, multi-investigator, field-based program, a great deal of time and effort is required to keep things from running off the rails.

14: SCIENTIFIC AND PUBLIC SERVICE:

14A. CURRENT MEMBERSHIPS IN PROFESSIONAL SOCIETIES:

American Geophysical Union

14B. TECHNICAL PRESENTATIONS:

Published abstracts since last promotion

135 total since last promotion, **9** invited. **68** since last review. **200+** career.

Presenting author underlined for oral presentations (last 5 years).

2006

1. Bergamaschi, Brian, Jacob Fleck, Brian Downing, Emanuel Boss, and George Aiken, (2006) Observed relationships between mercury species and properties of dissolved and particulate organic matter measured in situ in a tidal wetland in the San Francisco Estuary [abs.]: Abstract for 8th International Conference on Mercury as a Global Pollutant, Madison, WI, August 6-11 2006.
2. Fleck, J.A., B.A. Bergamaschi, B.D. Downing, M. Lionberger, D. Schoellhamer, E. Boss, and M. Stephenson, (2006) Measuring Hg and MeHg fluxes from dynamic systems using high resolution in situ monitoring, case study: the Sacramento-San Joaquin Delta tidal wetlands [abs.]: Abstract for 8th International Conference on Mercury as a Global Pollutant, Madison, WI, August 6-11 2006.
3. Spencer, R G, Pellerin, B A, Bergamaschi, B A, Downing, B D, Kraus, T E, Hernes, P J, 2006, Diel Variability in Dissolved Organic Matter Composition Determined by in-situ Optical Measurements. EOS TRANS. AGU, 87(52), FALL MEET. SUPPL., ABSTRACT B11C-1038
4. Silva, S.R., Kendall, C., Young, M.B., Rollog, M.E., Chang, C.C.Y., Bergamaschi, B.A., Kratzer, C.R., Stringfellow, W.T., Fleenor, W., Dahlgren, R.A., Paytan, A., 2006. Progress with tracing organic matter and nutrient sources using isotopic techniques, CWI talk, 10/06.
5. Silva, S R, Kendall, C Doctor, D H, Bergamaschi, B A, Fram, M S, Kraus, T, 2006, Sources and Cycling of Dissolved Organic Matter in the Sacramento - San Joaquin Delta, California, Using Carbon, Nitrogen, and Sulfur Isotopes. EOS TRANS. AGU, 87(52), FALL MEET. SUPPL., ABSTRACT B13A-1057
6. Pellerin, B.A. and Bergamaschi B.A. (2006) DISSOLVED ORGANIC MATTER FLUXES, QUALITY, AND REACTIVITY IN RUNOFF FROM AN AGRICULTURAL WATERSHED IN THE CENTRAL VALLEY, CALIFORNIA. In Erickson, Kulakow, and Rankin, eds. Future of Agriculture: Science Stewardship and Sustainability, Kansas State University Center for Hazardous Substance Research, Manhattan, KS.
7. Pellerin, B A, Bergamaschi, B A, Spencer, R G, 2006, Dissolved Organic Carbon and Optical Properties as Indicators of Trihalomethane Formation Potential in an Agricultural Watershed, EOS TRANS. AGU, 87(52), FALL MEET. SUPPL., ABSTRACT B11C-1035
8. Pellerin BA, BA Bergamaschi, BD Downing, TE Kraus, DH Doctor, C Kendall, ME Rollog, SR Silva and RA Dahlgren. High frequency monitoring of carbon, nitrogen and oxygen dynamics in the San Joaquin River, California. BIOGEOMON Symposium of Ecosystem Behavior, June 2006, Santa Cruz, CA.
9. Pellerin BA and BA Bergamaschi. Dissolved organic carbon concentrations and reactivity in surface water from the agricultural Willow Slough Watershed. CALFED Science Conference, October 2006, Sacramento, CA.
10. Hernes, P J, Bergamaschi, B A, Eckard, R S, 2006, Potential utility of optical proxies for lignin in DOM. EOS TRANS. AGU, 87(52), FALL MEET. SUPPL., ABSTRACT B11C-1041
11. Fleck, J.A., B.A. Bergamaschi, B.D. Downing, M.A. Lionberger, D.H. Schoellhamer, E. Boss, M. Stephenson, 2006. Assessing Mercury Loadings from Tidal Systems. CALFED Science Conference, October 23-25.
12. Fleck, J.A., B.A. Bergamaschi, B.D. Downing, M.A. Lionberger, D.H. Schoellhamer, E. Boss, and M. Stephenson, 2006. A Tool for Assessing Mercury Loadings from Restored Tidal Systems. Proceedings of the South Bay Science Symposium, June 6, 2006, San Jose, California, p. 9.

13. Fleck, J A, Bergamaschi, B A, Downing, B D, Lionberger, M A, Schoellhamer, D Boss, E Heim, W Stephenson, M, 2006, Measuring Hg and MeHg fluxes from dynamic systems using high resolution in situ monitoring - case study: the Sacramento-San Joaquin Delta, EOS TRANS. AGU, 87(52), FALL MEET. SUPPL., ABSTRACT B11C-1033
14. Eckard, R, Hernes, P, Bergamaschi, B, 2006, Ecosystem scale controls on the vascular plant component of dissolved organic carbon across a freshwater delta. EOS TRANS. AGU, 87(52), FALL MEET. SUPPL., ABSTRACT B33A-1168
15. Downing, B.D., J. Fleck, M. Lionberger, N. Ganju, E. Boss, D. Schoellhamer, B. Bergamaschi, 2006. Seasonal Changes in DOC Character and Flux from a Tidal Wetland. CALFED Science Conference, October 23-25.
16. Downing, B., J. Fleck, M. Lionberger, N. Ganju, E. Boss, D. Schoellhamer, and B. Bergamaschi, 2006. An In-situ Hydro-Optical Sampling System to Measure Seasonal Changes in DOC Character and Fluxes from a Tidal Wetland. Ocean Optics Conference 2006, Montreal, Quebec.
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113. Kraus, Tamara, Downing, B.D., Saraceno, J.F., Pellerin, B., Sauer, M.J., and Bergamaschi, B., 2013, Development of In Situ Fluorometers to Track Different Pools of Dissolved Organic Matter [abs]: ASLO 2013 Aquatic Sciences Meeting New Orleans, Lousiana, February 17-22, 2013:
114. Downing, B. D.; Pellerin, B. A.; Bergamaschi, B. A.; Kraus, T. E.; Saraceno, J. F.; Sauer, M. J.: IMPROVING DOC PROXY MEASUREMENTS THROUGH CORRECTION OF IN SITU DOM FLUORESCENCE FOR EFFECTS OF TURBIDITY AND INNER FILTERING. ASLO 2013 Aquatic Sciences Meeting New Orleans, Lousiana, February 17-22, 2013:
115. Downing, B., Bergamaschi, B., Pellerin, B., Saraceno, J., Sauer, M., Kraus, T., Burau, J., and Fujii, R., 2013, Continuous Water Quality Monitoring in the Sacramento-San Joaquin Delta to support Ecosystem Science: AGU Fall Meeting Abstracts, v. 1, p. 1512.
116. Pellerin, B., Bergamaschi, B., Saraceno, J., Downing, B., Crawford, C., Gilliom, R., and Frederick, P., 2013, In situ nitrate measurements capture short-term variability and seasonal transitions during a drought-flood year in the Mississippi River Basin: AGU Fall Meeting Abstracts, v. 1, p. 1524.
117. Saraceno, J., Bergamaschi, B., and Downing, B., 2013, The effects of particles and dissolved materials on in situ algal pigment fluorescence sensors: AGU Fall Meeting Abstracts, v. 1, p. 1515.
118. Zhu, Z., Bergamaschi, B., Hawbaker, T., Liu, S., Reed, B., Sleeter, B., Sohl, T., and Stackpoole, S., 2013, An Ecosystem Assessment of Carbon Storage and Fluxes Over Space and Time in the Conterminous United States: AGU Fall Meeting Abstracts, v. 1, p. 0472.

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119. Kraus, T., B. Downing, B. Bergamaschi, E. Stumpner, A. Story, K. O'Donnell, 2014. Real-time water quality mapping in and around tidal wetlands: high resolution data across space and time.2014 Joint Aquatic Sciences Meeting (JASM), May 18-23, Portland OR.
120. Bergamaschi, B., B. Downing, B. Pellerin, T. Kraus, J. Saraceno, S. Nagel, F. Anderson, J. Fleck, A. Hansen, A. Story, P. Kreun, and R. Fujii, 2014. Nutrient and organic carbon cycling processes in tidal marshes and shallow water habitats. 8th Biennial Bay-Delta Science Conference, October 28-30, Sacramento CA. (Invited)
121. O'Donnell, K., T. Kraus, B. Bergamaschi, B. Downing, A. Parker, N. Travis, E. Stumpner, and T. Mussen, 2014. In stream nitrate dynamics in the presence and absence of effluent in the Sacramento River, CA. 8th Biennial Bay-Delta Science Conference, October 28-30, Sacramento CA.
122. Kendall, C., T. Kraus, C. Schmidt, M. Guerin, B. Bergamaschi, M. Young, A. Parker, X. Peek, 2014. How Insights from Lagrangian-based Sampling Inform Interpretation of Nutrient and Organic Matter Isotope Trends in Ebb-flow Transects of the Sacramento River. 8th Biennial Bay-Delta Science Conference, October 28-30, Sacramento CA.
123. Stumpner, E., B. Bergamaschi, B. Downing, T. Kraus, A. Story, K. O'Donnell, 2014. Real-time water quality mapping in the Cache Slough Complex: high resolution data across space and time
124. Kraus, T., B. Bergamaschi, B. Downing, K. Carpenter, A. Parker, C.Kendall, E. Stumpner, K. O'Donnel, N. Travis, T. Mussen. 2014. Predicting the impact of reduced nutrient loading from wastewater effluent on foodweb dynamics in the Delta. 8th Biennial Bay-Delta Science Conference, October 28-30, Sacramento CA.

125. Lee, T., N. Travis, A. Parker, F. Wilkerson, T. Kraus, B. Bergamaschi, R. Dugdale, 2014. Analysis of Nutrient Mitigation and Organic Matter Production in Waters of Liberty Island. 8th Biennial Bay-Delta Science Conference, October 28-30, Sacramento CA.
126. Tsompanas, Alexander, Brian Bergamaschi, Bryan Downing. 2014. Method for Continuous In-situ Measurement of Phytoplankton Settling Rates Using Existing Flow-Through Fluorometers. 8th Biennial Bay-Delta Science Conference, October 28-30, Sacramento CA.
127. Travis, N., A. Parker, F. Wilkerson, T. Kraus, B. Bergamaschi, T. Mussen, T. Lee, 2014. Phytoplankton community response to ammonium-rich effluent in the Sacramento River. Interagency Ecological Program 2014 Annual Workshop, February 24-26, Folsom, CA.
128. O'Donnell, K., T. Kraus, B. Bergamaschi, B. Downing, Al. Parker, N. Travis, E. Stumpner, T. Mussen, 2014. In stream nitrate dynamics in the presence and absence of effluent in the Sacramento River, CA. Interagency Ecological Program 2014 Annual Workshop, February 24-26, Folsom, CA.
129. Stumpner, E., B. Bergamaschi, B. Downing, T. Kraus, A. Story, K. O'Donnell. 2014. Real-time water quality mapping in the Cache Slough Complex: high resolution data across space and time. Interagency Ecological Program 2014 Annual Workshop, February 24-26, Folsom, CA.
130. Nagel, S. B. Downing, B. Bergamaschi, J.F. Saraceno, B. Pellerin, T. Kraus and R. Fuji. 2014. Continuous monitoring reveals connectivity of conditions and processes in the lower Sacramento River and Liberty Island. Interagency Ecological Program 2014 Annual Workshop, February 24-26, Folsom, CA.
131. Bergamaschi, B., B. Downing, T. Kraus, B. Pellerin, J.F. Saraceno, J. Burau, R. Fujii and many others. Nutrient Dynamics from Liberty Island to the lower Sacramento River. Interagency Ecological Program 2014 Annual Workshop, February 24-26, Folsom, CA. (Invited)
132. Story, A., O'Donnell, K., Bergamaschi, B., Downing, B., 2014, Assessing habitat quality using new optical methods developed for in-situ, real-time detection of habitat quality indicators [abs.]: 8th Biennial Bay-Delta Science Conference, Sacramento, CA, October 28-30, 2014
133. Bergamaschi, Brian , Bryan Downing, Brian Pellerin, JohnFranco Saraceno, Jacob Fleck, 2014, New insights from continuous monitoring of nutrient dynamics in tidal wetlands [abs.]: 2014 AGU Ocean Sciences Conference, Honolulu, HI, February 23-28, 2014.
134. Bergamaschi, Brian, R. A. Smith, Jhih-Shyang Shih, T. L. Sohl, B. M. Sleeter, and Z. Zhu, 2014, Projected changes in nutrient and sediment delivery to and carbon accumulation in coastal oceans of the Eastern United States [abs.]: The Goldschmidt conference, Sacramento, CA, June 7-12, 2014
135. Bergamaschi, B.A., J.A. Fleck, B.D. Downing, B D.P. Krabbenhoft, G.R. Aiken, 2014, Outwelling of methylmercury from coastal and estuarine tidal wetlands [abs.]: The Goldschmidt conference, Sacramento, CA, June 7-12, 2014

Invited lectures and first-author technical presentations without published abstracts

(since last promotion).

50+ total; oral presentations; typically 30-40 minutes in length

2006. Sweetwater Authority Technical Briefing.
USGS Regional Science Technical Meeting
University of California Davis LAWR Hydrologic Sciences Seminar Series.

2007. NRCS Stakeholder outreach meeting
Willow Slough Technical Advisory Committee meeting.
Alabama Water Science Center Cooperator Seminar
USGS Chief Hydrologist's Seminar Series

2008. University of California Santa Cruz Oceanography Seminar Series

Willow Slough Technical Advisory Committee Meeting.
Invited talk at Baltimore LTER technical meeting

2009. CSUS Tiburon Marine Sciences Seminar Series
The Watershed Project
USGS Leetown Science Center
USGS NY Science Center Seminar
USGS Mentoring Exchange Webinar
Soil Conservation Service Community Workshop

2010. California State University Sacramento
NASA Blue Carbon Workshop
US Department of Agriculture
Metropolitan Water District
University of California Davis
Willow Slough Community Workshop

2011. California Regional Water Quality Control Board - Region 2
SWCCC Symposium
USGS Menlo Park
Environmental Protection Agency (Region 9)
State Water Quality Control Board
USGS Reston Land Use and Climate Change Brown Bag
Metropolitan Water District

2012. Sacramento Regional Sanitation District
Congressional staff briefing (Garamendi)
USGS Focus on California Science San Diego, CA
DWR Delta Mercury TMDL meeting
Metropolitan Water District
CA Department of Water Resources Fall Low Salinity Zone Workshop
US Fish and Wildlife

2013. State Water Quality Control Board
Bureau of Reclamation
US Fish and Wildlife
California Regional Water Quality Control Board - Region 2
University of California Davis
USGS Executive Leadership Team
North Coast Nutrient Meeting

2014. Center for Aquatic Biology and Aquaculture
Bay-Delta Science Program Brown Bag
Monterrey Bay Aquarium Research Institute
State and Federal Water Contractors
Bay-Delta Science Program Interior Flows Workshop
Bureau of Reclamation
Bay Delta Science Program Staff Delta Biogeochemistry
Romburg Tiburon Center for Marine Sciences
University of California Davis
University of California Merced

14C. RENDERING SCIENTIFIC JUDGMENT:

- Associate editor for JGR Biogeosciences, 2008 – 2011
- Associate editor for Biogeosciences (Not to be confused with JGR journal), 2011-present.
- Chair of RGE first level review panel (2014) and panelist in 2010 and 2006.
- Review journal articles for:

  JGR Biogeosciences, Biogeosciences, Global Biogeochemical Cycles, Geochimica Cosmochimica Acta, Organic Geochemistry, Carbohydrate Research, Marine Chemistry, Marine Geology, Journal of Soil Sciences, Wetlands, Limnology and Oceanography, Environmental Science and Technology, EOS, Ecosystems, Environmental Management and other journals. Review numerous draft reports and journal submissions for colleagues.
- Review proposals for NSF, NASA, EPA, Bay-Delta Science Program, NWIR, Sea Grant, CALFED, and others.
- Invited contributing author to the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP).
- Invited reviewer for Suisun Marsh Restoration Plan, a $3 billion dollar restoration effort.
- Invited reviewer for California Bay Delta Conservation Plan, a $25 billion dollar restoration effort.
- Invited technical reviewer of Delta Wetlands project feasibility documentation, a $4 billion dollar proposal for in-Delta water storage.

14D. LECTURESHIPS AND OTHER ACADEMIC SERVICE:

Appointments:

Adjunct Professor in Geology at the California State University, Sacramento (since 2006)

Graduate students and post-doctoral associates:

One of the contributions of which I am most proud is mentorship of students and early-career scientists. I am commited to funding graduate students and post-doctoral associates in most of my research projects. These individuals represent the furture of environmental science and the future of the USGS. I have been able to recruit several to remain at the USGS (Pellerin, Kraus, Downing, Saraceno, vonDessoneck) and help them get started. Below are listed students and post-docs working on my projects and actively mentored by me. (There are several other post-docs and students funded by my projects but for whom I only a minor role in mentorship.)

Graduate students funded by my projects and advised by me:

Sandrine Journet, Ph.D., Co-advisor. University of California, Davis.

Robert Eckard, Ph.D., Co-advisor. University of California, Davis.

Bryan Downing, MS, Advisor, California State University

JohnFranco Saraceno, MS, Co-advisor. California State University

Erica Kalve, MS, Advisor, California State University

Posdoctoral associates funded by my projects and mentored by me:

Michael Sauer—USGS Postdoc, Advisor, Coastal processes (LandCarbon).

Tamara Kraus – NRC Fellow, Advisor, Disinfection byproduct formation and NOM chemistry.

Brian Pellerin – NRC Fellow, Advisor, Watershed processes.

Naoko Watanabe – Co-advisor, Anthropogenic processes and NOM tracers.

Robert Spencer – Co-Advisor, Biogeochemical processes.

Ramunas Stepanauskas – Co-Advisor, Microbial biogeochemistry.

Posdoctoral associates funded externally:

Allison Luengen – Community Advisor, Bay-Delta Science Fellow, Phytoplankton-mercury interactions.

John Harrison – Community Advisor, Bay-Delta Science Fellow, Modeling DOC in watersheds.

Teaching:

Aqueous Geochemistry -- Taught 50% of a required, semester-long, 3 credit graduate-level course in fundamental principles of aqueous geochemistry at California State University.

Multiple appearances as guest lecturer in the CSUS Environmental Sciences and Geology Departments, and the UCDavis Land, Air, Water Resources Department. Courses on current topics in environmental sciences in California, water quality issues, organic geochemistry, and others.

14E. TECHNICAL TRAINING PROVIDED:

2006 Co-organizer, instructor: Water Quality Issues in Sacramento Delta, AGU Fall Meeting 1 day field trip

2008 Organizer and presenter: One day workshop: "Organic Carbon: The Good, the Bad and the Muddy." (Sacramento, CA, May 15, 2008)

2009 Co-organizer, instructor: USGS-CUAHSI Joint Workshop: "In Situ Sensors for Water Quality" (U. of Vermont, Aug 2-5, 2009)

2011 Co-organizer, instructor: USGS-CUAHSI Joint Workshop: "In Situ Optical Sensors" (Shepardstown, WV, June 2011)

2013 Instructor: Optical Water Quality Sensors for Nutrients: Concepts, Deployment, and Analysis (U. of Florida, Feb 13-15, 2013)

2014 Co-organizer, instructor: Short Course: Dissolved Organic Matter – What, Why, How. (9th National Monitoring Conference April 28 – May 2, 2014, Cincinnati, Ohio)

14F. SPECIAL ASSIGNMENTS:

None

14G. OTHER TECHNICAL ACTIVITIES:

GENERAL

- Invited by the UCDavis Center for Aquatic Biology and Aquaculture to organize and convene an all-day symposium on lower food web science in the San Francisco Estuary. A journal article summarizing the presentations is in preparation.
- Co-convener of more than 10 sessions at national meetings such as AGU, NMC, ASLO and others.
- Invited expert advisor to the State of Louisiana's wetland carbon market protocol development effort.
- Invited technical expert to the Conservation International protocol development effort.
- Invited participant in the tri-national North American Council on Environmental Cooperation workshop on "Blue Carbon."
- Invited participant and expert consultant in Alliance for Coastal Technologies comparison of in situ fluorescence measurement instrumentation. Publication in development
- Member of the Energy Independence and Security Act Biological Carbon Sequestration Core Team – LandCarbon. Lead author on coastal and estuarine processes.
- Founding member of Organizing Committee for Chapman Conference on Organic Matter Fluorescence, University of Birmingham, Edgebaston, Birmingham, U.K. 20-23 October 2008.
- USGS representative to United Nations Environmental Program Group on Earth Observations meeting, Geneva, Switzerland.

TECHNICAL CONSULTATIONS WITH AGENCIES AND CONSULTANCIES

- Frequently consulted by academics, consultants, Federal and State agencies, and USGS personnel from other programs about methods development and improvement in the continuous monitoring, NOM characterization, and trace-level organic materials.
- Invited participant and design charrette leader for Klamath Basin science plan development workshop; Regional Water Quality Control Board.
- Invited participant in Delta Mercury TMDL workshop; Regional Water Quality Control Board.
- Invited participant in Fall Low Salinity Zone workshop; Interagency Ecological Program
- Member of the Regional Water Quality Control Board nutrient monitoring development committee
- Consulted on specific technical aspects of projects to Sea Engineering, CH2M Hill, TetraTech, Larry Walker Assoc., and others.
- Member of the Bay Delta Program Water Quality Technical Committee and contributing author to CALFED Bay Delta Program Water Quality Technical Committee report identifying local activities which may improve drinking source water quality.
- Member of the Department of Water Resources TMDL Advisory Committee and the CALFED Dissolved Oxygen Technical Committee.
- One of two expert consultants to the Bay-Delta Science Program for analysis of historic DOC data.

TECHNICAL CONSULTATIONS WITH VENDORS

Much of the research we are engaged in requires development of new measurement technologies. Therefore, my research group works intimately with instrument manufacturers to develop and qualify these instruments and methods. This usually involves use of our data in the development phase and deployment on our project during the prototyping and demonstration phase. We frequently suggest modifications, improvements and expanded capabilities for their products. We regard this kind of close consultation as important for speeding development and adoption of new technologies and applications, i.e. for advancing the capabilities of the environmental monitoring field. To be clear, we are not taking full credit for these developments; we are just pleased and proud we can help move good ideas into the public domain more quickly than they might without our input.

Horriba Scientific – Recommended integration of CCD emission detection and simultaneous absorbance measurement. Input contributed to implementation of a new product line that reduced time for EEMs data collection from >40 min. to < 3 min as well as reduced instrument cost by 25%.

Campbell Scientific – Recommended implementation (and provided prototype) for submersible version of the CR1000 data logger; now a product (CS105). Recommended GUI development for water quality station setup. Presently under development, partly funded by one of our projects.

Turner Designs – Specified and tested fluorescence ratio instrument pair and deep UV fluorometer. Paid for initial prototypes. Now available for purchase and in use by other researchers.

WetLabs – Specified and paid for prototyping of 3-wavelength ExEm fluorescence instrument useful for wastewater detection. Now available for purchase and in use by other researchers. Beta testers for Cycle-P and Cycle N instruments. Many improvements have been made to modify original Cycle-P design to improve reliability in turbid environments. Testing and modification are under way for the Cycle-N.

Satlantic – Recommended many modifications to optical nitrate sensor which contributed to product changes and new product releases: improved algorithm for CDOM interference (implemented), shorter path length instrument for deployment (now a product), wiper (now available), variable integration time (now implemented).

YSI – Recommendations for new fluorescence sensor (under development; release in late 2014), higher frequency data collection (implemented), on-board data corrections for FDOM (under consideration).

UNPUBLISHED REPORTS

Bergamaschi, B. A., T. Kraus, and R. Fujii. 2007. Towards a New Conceptual Model for Drinking Water Concerns in the Sacramento-San Joaquin Delta.

Pellerin BA and Bergamaschi BA. 2011. In Situ Optical Sensors for Water Quality: A USGS Science Strategy for Continuous Monitoring in Watersheds. Internal Briefing Document for the Office of Water Quality, 20 pp.

Contributing author to the California Governor's Delta Vision Blue Ribbon Task Force Report.

Contributing author to Bay-Delta Comprehensive Monitoring and Assessment Plan. Author of section on NOM and Contributing author to Bay-Delta Comprehensive Monitoring and Assessment Plan. Author of section on NOM.

15. OUTREACH AND INFORMATION TRANSFER:

MEDIA:

- Many press contacts and articles regarding Carbon Farm project, including pieces in The New Scientist, Environmental Science and Technology (news section), The Wall Street Journal, The San Francisco Chronicle, The Sacramento Bee, San Jose Mercury News, Terrain Magazine, and others.
- Featured in a front page article in the Sacramento Bee regarding drinking water research.
- Featured in a cover story in New Scientist regarding wetland carbon sequestration.
- Press regarding drinking water quality (Cincinnati Inquirer, Davis Enterprise, San Jose Mercury News, San Francisco Chronicle, etc.)
- NOM and drinking water research featured in a 4-page spread of the Bay-Delta "Science in Action" Newsletter.
- Featured in Discovery Channel program on biological carbon sequestration
- Featured in award-winning USGS video "Organic Carbon and the World Around Us" produced by the Oregon Water Science Center.

HIGH-LEVEL BRIEFINGS:

- Assistant Secretary of Interior
- Deputy Assistant Secretary of Interior (several)
- USGS Director (3 different directors, 8 briefings total)
- USGS Assistant Directors (several different ADs, several briefings)
- Science Advisor to the Secretary of Interior
- Department of Interior CIO
- Science Advisor to the Assistant Secretary of Interior (Several)
- Everglades National Park Superintendent
- Florida Governor's Task Force on Climate Change
- California Department of Water Resources Director and Senior Staff (several)
- Bay Delta Science Program Director, Chief Scientist, staff (several)

OTHER:

- Author of 2 fact sheets and 2 briefing documents

- Briefings to numerous agencies – USDA, Fish and Wildlife, EPA, California Department of Food and Agriculture, State Water Quality Control Board, Regional Water Quality Control Board, and others
- Organized a seminar to train high school teachers in earth science (conducted at the USGS), and lectured at a statewide education conference on the same subject.

16. INVENTIONS, PATENTS HELD:

BERGAMASCHI, BRIAN A. (1995) Method and apparatus for carbohydrate analysis. U.S. Patent No. 5411892

17. HONORS, AWARDS, RECOGNITION, ELECTED MEMBERSHIPS:

USGS performance awards (cash and time off) 2009, 2010, 2011, 2012.

USGS 2008 Excellence in Science Award

USGS Quality Step Increase award for meritorious service – 3 times

USGS Special Service Award 1999

Barbara McClintock Post-Doctoral fellowship at the Carnegie Geophysical Laboratory, Washington, D.C.

Research award: Feasibility study for automation of carbohydrate analysis. University of Washington Royalty Research Fund.

National Science Foundation/ Office of Naval Research award for outstanding dissertation in chemical oceanography.

18. BIBLIOGRAPHY:

18A. PUBLISHED REPORTS:

Total number of publications: **68**
Number of publications since last promotion: **37**
Number of publications since last review: **25**
Number of journal articles: **42**
Number of USGS Professional Papers, WRIs and SIRs: **11**
Number of literature citations (via Google Citations): **>2300**
h factor (*h* = *h* number of publications cited *h* number of times; via Google Citations): **24**
i factor (*i* = number of publications published since 2009 cited more than 10 times): **31**

1. Hedges, J. I., and Bergamaschi, B. A., 1992, SEAWATER CARBON MEASUREMENT: Nature, v. 359, no. 6392, p. 202-202.

2. Hedges, J. I., Bergamaschi, B. A., and Benner, R., 1993, Comparative analyses of DOC and DON in natural waters: Marine Chemistry, v. 41, no. 1, p. 121-134.

3. Hopkinson, C., Cifuentes, L., Burdige, D., Fitzwater, S., Hansell, D., Henrichs, S., Kahler, P., Koike, I., Walsh, T., and Bergamaschi, B., 1993, MEASUREMENT OF DISSOLVED ORGANIC-CARBON AND NITROGEN IN NATURAL-WATERS: Marine Chemistry, v. 41, no. 1-3, p. 23-36.

4. Bergamaschi, B. A., and Hedges, J. I., 1995, A multichambered apparatus for HF solvolysis experiments: reaction of cellulose HF solvolysis products with acetic acid and acetic anhydride: Carbohydrate research, v. 267, no. 1, p. 115-126.

5. Bergamaschi, B. A., and Hedges, J. I., 1996, A one-pot procedure for the quantitative conversion of glycosides into acetylated glycosyl fluorides: Carbohydrate research, v. 280, no. 2, p. 345-350.

6. Bergamaschi, A., Kuivila, K. M., and Fram, A. S., 1997a, Pesticides associated with suspended sediments in the San Francisco Bay Estuary, US Geological Survey Open-File Report 97-24.

7. Bergamaschi, B. A., Crepeau, K. L., and Kuivila, K. M., 1997b, Pesticides associated with suspended sediments in the San Francisco Bay Estuary, California, Open-File Report, U.S. Geological Survey, p. iii, 19 p. :ill., map ;28 cm.

8. Bergamaschi, B. A., Tsamakis, E., Keil, R. G., Eglinton, T. I., Montlucon, D. B., and Hedges, J. I., 1997c, The effect of grain size and surface area on organic matter, lignin and carbohydrate concentration, and molecular compositions in Peru Margin sediments: Geochimica Et Cosmochimica Acta, v. 61, no. 6, p. 1247-1260.

9. Bergamaschi, B. A., Baston, D. S., Crepeau, K. L., and Kuivila, K. M., 1999a, Determination of pesticides associated with suspended sediments in the San Joaquin River, California, USA, using gas chromatography-ion trap mass spectrometry: Toxicological & Environmental Chemistry, v. 69, no. 3-4, p. 305-319.

10. Fram, M. S., Fujii, R., Weishaar, J. L., Bergamaschi, B. A., and Aiken, G. R., 1999a, How DOC Composition May Explain the Poor Correlation Between Specific Trihalomethane Formation Potential and Specific UV Absorbance, in Morganwalp, D. W., and Buxton, H. T., eds., Toxic Substances Hydrology Program--Proceedings of the Technical Meeting, Charleston, South Carolina, March 8-12, 1999--Volume 2 of 3--Contamination of Hydrologic Systems and Related Ecosystems, U.S. Geological Survey Water-Resources Investigations Report 99-4018B, p. 423-430.

11. Bergamaschi, B. A., Fram, M. S., Fujii, R., Aiken, G. R., Kendall, C., and Silva, S. R., 1999b, The carbon isotopic composition of trihalomethanes formed from chemically distinct dissolved organic carbon isolates from the Sacramento-San Joaquin River Delta, California, USA, in Morganwalp, D. W., and Buxton, H. T., eds., Toxic Substances Hydrology Program--Proceedings of the Technical Meeting, Charleston, South Carolina, March 8-12, 1999--Volume 2 of 3--Contamination of Hydrologic Systems and Related Ecosystems, U.S. Geological Survey Water-Resources Investigations Report 99-4018B, p. 8-12.

12. Fram, M. S., Fujii, R., Weishaar, J. L., Bergamaschi, B. A., and Aiken, G. R., 1999b, How DOC composition may explain the poor correlation between specific trihalomethane formation potential and specific UV absorbance: Water Resources Investigations Report: WRI, p. 99-4018.

13. Bergamaschi, B. A., Fram, M. S., Kendall, C., Silva, S. R., Aiken, G. R., and Fujii, R., 1999c, Carbon isotopic constraints on the contribution of plant material to the natural precursors of trihalomethanes: Organic Geochemistry, v. 30, no. 8A, p. 835-842.

14. Bergamaschi, B. A., Kuivila, K. M., and Fram, M. S., 1999d, Pesticides associated with suspended sediments in the San Francisco Bay during the first flush, December 1995, in Morganwalp, D. W., and Buxton, H. T., eds., U.S. Geological Survey Toxic Substances Hydrology Program--Proceedings of the Technical Meeting, Charleston, South Carolina, March 8-12, 1999--Volume 2

of 3--Contamination of Hydrologic Systems and Related Ecosystems, U.S. Geological Survey Water-Resources Investigations Report 99-4018B, p. 23-33.

15. Bergamaschi, B. A., Walters, J. S., and Hedges, J. I., 1999e, Distributions of uronic acids and O-methyl sugars in sinking and sedimentary particles in two coastal marine environments: Geochimica Et Cosmochimica Acta, v. 63, no. 3-4, p. 413-425.

16. Bergamaschi, B. A., Walters, J. S., and Hedges, J. I., 1999f, The occurrence and distribution of uronic acids and sugar methyl ethers in sediment trap materials and sediments of two coastal marine environments: Geochimica et Cosmochimica Acta, v. 63, p. 413-425.

17. Fujii, R., Ranalli, A. J., Aiken, G. R., and Bergamaschi, B. A., 2000, Dissolved organic carbon concentrations and compositions, and trihalomethane formation potentials in waters from agricultural peat soils, Sacramento-San Joaquin Delta, California; implications for drinking-water quality, Water-Resources Investigations Report, U.S. Dept. of the Interior, U.S. Geological Survey ; Information Services [distributor], p. vi, 75 p. :ill., maps ;28 cm.

18. Bergamaschi, B. A., Kuivila, K. M., and Fram, M. S., 2001, Pesticides associated with suspended sediments entering San Francisco Bay following the-first major storm of water year 1996: Estuaries, v. 24, no. 3, p. 368-380.

19. Fram, M. S., Bergamaschi, B. A., and Fujii, R., 2002a, Improving water quality in Sweetwater Reservoir, San Diego County, California; sources and mitigation strategies for trihalomethane (THM)-forming carb, Fact Sheet, p. 4 p.

20. Fram, M. S., Berghouse, J. K., Bergamaschi, B. A., Fujii, R., Goodwin, K. D., and Clark, J. F., 2002b, Water-quality monitoring and studies of the formation and fate of trihalomethanes during the third injection, storage and recovery test at Lancaster, Antelope Valley, California, March 1998 through April 1999, Open-File Report, p. 48 p.; 48 illus.; 27 tables.

21. Crepeau, K. L., Kuivila, K. M., and Bergamaschi, B., 2002, Dissolved pesticides in the Alamo River and the Salton Sea, California, 1996-97, Open-File Report, p. 7 p.

22. Fram, M. S., Bergamaschi, B. A., Goodwin, K. D., Fujii, R., and Clark, J. F., 2003, Processes Affecting the Trihalomethane Concentrations Associated with the Third Injection, Storage, and Recovery Test at Lancaster, Antelope Valley, California, March 1998 through April 1999, Water-Resources Investigations Report, p. 72 p.

23. Stepanauskas, R., Moran, M. A., Bergamaschi, B. A., and Hollibaugh, J. T., 2003, Covariance of bacterioplankton composition and environmental variables in a temperate delta system: Aquatic Microbial Ecology, v. 31, no. 1, p. 85-98.

24. Weishaar, J. L., Aiken, G. R., Bergamaschi, B. A., Fram, M. S., Fujii, R., and Mopper, K., 2003, Evaluation of specific ultraviolet absorbance as an indicator of the chemical composition and reactivity of dissolved organic carbon: Environmental Science & Technology, v. 37, no. 20, p. 4702-4708.

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26. Kratzer, C. R., Dileanis, P. D., Zamora, C., Silva, S. R., Kendall, C., Bergamaschi, B. A., and Dahlgren, R. A., 2004, Sources and Transport of Nutrients, Organic Carbon, and Chlorophyll-a in the San Joaquin River Upstream of Vernalis, California, during Summer and Fall, 2000 and 2001, Water-Resources Investigations Report, p. 124 p.

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    ROLE: General oversight of research, conducted statistical data analysis, assisted with writing. Concept and design of study 30% Data production 0% Interpretation 5% Writing 5%

45. Pellerin, B. A., Hernes, P. J., Saraceno, J., Spencer, R. G., and Bergamaschi, B. A., 2010, Microbial degradation of plant leachate alters lignin phenols and trihalomethane precursors: Journal of Environmental Quality, v. 39, no. 3, p. 946-954.

ROLE: Conceived of the study, wrote the proposal, was project chief, assisted with data analysis and writing.
Concept and design of study 30% Data production 5% Interpretation 20% Writing 5%

46. Sickman, J. O., DiGiorgio, C. L., Lee Davisson, M., Lucero, D. M., and Bergamaschi, B., 2010, Identifying sources of dissolved organic carbon in agriculturally dominated rivers using radiocarbon age dating: Sacramento–San Joaquin River Basin, California: Biogeochemistry, v. 99, no. 1-3, p. 79-96.

    ROLE: Assisted by providing samples, helped with data interpretation and writing.
    Concept and design of study 5% Data production 10% Interpretation 10% Writing 5%

47. Spencer, R. G. M., Aiken, G. R., Dyda, R. Y., Butler, K. D., Bergamaschi, B. A., and Hernes, P. J., 2010, Comparison of XAD with other dissolved lignin isolation techniques and a compilation of analytical improvements for the analysis of lignin in aquatic settings: Organic Geochemistry, v. 41, no. 5, p. 445-453.

    ROLE: Assisted in study design, provided equipment and taught operation, and some writing.
    Concept and design of study 10% Data production 5% Interpretation 10% Writing 5%

48. Watanabe, N., Bergamaschi, B. A., Loftin, K. A., Meyer, M. T., and Harter, T., 2010, Use and Environmental Occurrence of Antibiotics in Freestall Dairy Farms with Manured Forage Fields: Environmental Science & Technology, v. 44, no. 17, p. 6591-6600.

    ROLE: Conceived of the study, wrote the proposal, was project chief, assisted with field work, data analysis and writing.
    Concept and design of study 80% Data production 20% Interpretation 20% Writing 30%

49. Zhu, Zhiliang, and Reed, B.C., eds., 2014, Baseline and projected future carbon storage and greenhouse-gas fluxes in ecosystems of the eastern United States: U.S. Geological Survey Professional Paper 1804, 204 p., http://dx.doi.org/10.3133/pp1804

    ROLE: First author of section on coastal ocean assessment.
    Section: Concept and design of study NA Data production NA Interpretation NA Writing 100%

50. Pellerin, B. A., Bergamaschi, B. A., Murdoch, P., Downing, B. D., Saraceno, J. F., Aiken, G. R., and Streigl, R., 2011a, The Aquatic Real-Time Network: In situ optical sensors for monitoring the Nation's water quality. , USGS Fact Sheet 2011-3061.

    ROLE: Co-developed concept, co-authored proposal, was project chief
    Concept and design of study 50% Data production 20% Interpretation 50% Writing 50%

51. Bergamaschi, B. A., Fleck, J. A., Downing, B. D., Boss, E., Pellerin, B., Ganju, N. K., Schoellhamer, D. H., Byington, A. A., Heim, W. A., Stephenson, M., and Fujii, R., 2011, Methyl mercury dynamics in a tidal wetland quantified using in situ optical measurements: Limnology and Oceanography, v. 56, no. 4, p. 1355-1371.

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    ROLE: Developed methods, assisted with interpretation and writing.
    Concept and design of study 30% Data production 0% Interpretation 20% Writing 10%

54. Florsheim, J. L., Pellerin, B. A., Oh, N. H., Ohara, N., Bachand, P. A. M., Bachand, S. M., Bergamaschi, B. A., Hernes, P. J., and Kavvas, M. L., 2011, From deposition to erosion: Spatial and temporal variability of sediment sources, storage, and transport in a small agricultural watershed: Geomorphology, v. 132, no. 3-4, p. 272-286.

    ROLE: Wrote proposal, oversaw study, provided data, assisted with field work, helped write.
    Concept and design of study 10% Data production 5% Interpretation 5% Writing 5%

55. Kraus, T. E. C., Bergamaschi, B. A., Hernes, P. J., Doctor, D., Kendall, C., Downing, B. D., and Losee, R. F., 2011, How reservoirs alter drinking water quality: Organic matter sources, sinks, and transformations: Lake and Reservoir Management, v. 27, no. 3, p. 205-219.

    ROLE: Conceived of the study, wrote the proposal, developed methods, assisted with field work, had a large role in data interpretation, and assisted with writing.
    Concept and design of study 80% Data production 30% Interpretation 40% Writing 20%

56. Pellerin, B. A., and Bergamaschi, B. A., 2011, Coordinating Standards and Applications for Optical Water Quality Sensor Networks: Meeting Summary: EOS, v. 92, no. 30.

    ROLE: Concept and design of study NA Data production NA Interpretation NA Writing 50%

57. Bergamaschi, B., Fleck, J., Downing, B., Boss, E., Pellerin, B., Ganju, N., Schoellhamer, D., Byington, A., Heim, W., Stephenson, M., and Fujii, R., 2012a, Mercury Dynamics in a San Francisco Estuary Tidal Wetland: Assessing Dynamics Using In Situ Measurements: Estuaries and Coasts, p. 1-13.

58. Bergamaschi, B. A., Krabbenhoft, D. P., Aiken, G. R., Patino, E., Rumbold, D. G., and Orem, W. H., 2012b, Tidally Driven Export of Dissolved Organic Carbon, Total Mercury, and Methylmercury from a Mangrove-Dominated Estuary: Environmental Science & Technology, v. 46, no. 3, p. 1371-1378.

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greenhouse-gas fluxes in ecosystems of the Western United States, U.S. Geological Survey Professional Paper 1797, US Geological Survey, p. 143-158.

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    ROLE: Co-developed idea for study, was project chief, oversaw experimental work, provided statistical analysis and modeling, funded project, helped analyze results, helped write.
    Concept and design of study 50% Data production 20% Interpretation 50% Writing 40%

61. Luengen, A. C., Fisher, N. S., and Bergamaschi, B. A., 2012, Dissolved organic matter reduces algal accumulation of methylmercury: Environmental Toxicology and Chemistry, v. 31, no. 8, p. 1712-1719.

    ROLE: Co-developed idea, provided sample isolates, assisted in experimental design, data interpretation, and writing.
    Concept and design of study 30% Data production 0% Interpretation 30% Writing 10%

62. Hernes, P. J., Spencer, R. G. M., Dyda, R. Y., Pellerin, B. A., Bachand, P. A. M., and Bergamaschi, B. A., 2013, DOM composition in an agricultural watershed: Assessing patterns and variability in the context of spatial scales: Geochimica Et Cosmochimica Acta, v. 121, p. 599-610.

    ROLE: Wrote proposal, oversaw study, provided data, assisted with field work, helped write.
    Concept and design of study 60% Data production 10% Interpretation 20% Writing 5%

63. Oh, N.-H., Pellerin, B. A., Bachand, P. A. M., Hernes, P. J., Bachand, S. M., Ohara, N., Kavvas, M. L., Bergamaschi, B. A., and Horwath, W. R., 2013, The role of irrigation runoff and winter rainfall on dissolved organic carbon loads in an agricultural watershed: Agriculture, Ecosystems & Environment, v. 179, no. 0, p. 1-10.

    ROLE: Wrote proposal, oversaw study, provided data, assisted with field work, helped write.
    Concept and design of study 40% Data production 10% Interpretation 10% Writing 5%

64. Moskalski, S. M., Torres, R., Bizimis, M., Goni, M., Bergamaschi, B., and Fleck, J., 2013, Low-tide rainfall effects on metal content of suspended sediment in the Sacramento-San Joaquin Delta: Continental Shelf Research, v. 56, p. 39-55.

    ROLE: Co-wrote proposal, assisted with field work, helped with writing.
    Concept and design of study 20% Data production 10% Interpretation 10% Writing 5%

65. Pellerin, B. A., Bergamaschi, B.A., Downing, B.D., Saraceno, J.F., Garrett, J.A., Olsen, L.D., 2013, Optical techniques for the determination of nitrate in environmental waters: Guidelines for instrument selection, operation, deployment, maintenance, quality assurance, and data reporting U.S. Geological Survey Techniques and Methods 1–D5, 37 p.

ROLE: Co-developed concept, helped with experimental work, helped with writing.
Concept and design of study 50% Data production 10% Interpretation 40% Writing 25%

66. Zamora, C., Dahlgren, R. A., Kratzer, C. R., Downing, B. D., Russell, A. D., Dileanis, P. D., Bergamaschi, B. A., and Phillips, S. P., 2013, Groundwater Contributions of Flow, Nitrate, and Dissolved Organic Carbon to the Lower San Joaquin River, California, 2006–08, U.S. Geological Survey Scientific Investigations Report 2013–5151, 105 p.

    ROLE: Developed method, conducted field work and wrote section on river transect.
    For that section:
    Concept and design of study 100% Data production 75% Interpretation 90% Writing 80%

67. Bergamaschi, B. A., Smith, R. A., Sauer, M. J., Shih, J.-S., and Ji, L., 2014, Terrestrial Fluxes of Nutrients and Sediment to Coastal Waters and Their Effects on Coastal Carbon Storage in the Eastern United States, in Zhu, Z., and Reed, B. C., eds., Baseline and projected future carbon storage and greenhouse-gas fluxes in ecosystems of the eastern United States, U.S. Geological Survey Professional Paper 1804, US Geological Survey, p. 85-114.
    http://dx.doi.org/10.3133/pp1804

68. Fleck, J. A., Gill, G., Bergamaschi, B. A., Kraus, T. E., Downing, B. D., and Alpers, C. N., 2014, Concurrent photolytic degradation of aqueous methylmercury and dissolved organic matter: Science of The Total Environment, v. 484, p. 263-275.
    http://dx.doi.org/10.1016/j.scitotenv.2013.03.107

    ROLE: Developed method, helped with experiment design, data interpretation and writing
    Concept and design of study 20% Data production 0% Interpretation 10% Writing 10%

18B. REPORTS ACCEPTED FOR PUBLICATION:

None

19. PUBLICATIONS:

I have selected three relatively recent papers because they tell the story about how and why I develop new methods for in situ optical measurements, and how they can be used in combination with other data to quantify biogeochemical processes in rivers, estuaries, and coastal systems over broad spatial and temporal scales.

The first paper shows how in situ optical measurements may be used simply and economically to quantify processes in physically complex environments. It also shows how and why "following the carbon" can provide information about other processes; this is because dissolved organic carbon can often act as a proxy for other constituents of interest. Further, this paper demonstrates that tidally-driven fluxes can be important in regional and global budgets, and thus need to be better understood.

The second and third papers provide a glimpse into where my research is going. One direction (#2) expands the use and utility of in-situ optical measurements monitoring by integrating simple biogeochemical models with remote sensing optical measurements. Another direction (#3) is to improve in situ characterization of particle dynamics in physically complex aquatic environments. Advances in this area are at the scientific forefront, and are essential to better understand biogeochemical rates, assess habitat quality, and more effectively monitor ecosystem services.

Significant Publication 1:

Bergamaschi, B. A., Krabbenhoft, D. P., Aiken, G. R., Patino, E., Rumbold, D. G., and Orem, W. H., 2012, Tidally Driven Export of Dissolved Organic Carbon, Total Mercury, and Methylmercury from a Mangrove-Dominated Estuary: Environmental Science & Technology, v. 46, no. 3, p. 1371-1378.

Background

I include this paper as one of my representative publications because it shows why and how studies of natural organic carbon can provide information about many different biogeochemical processes at the same time that they provide fundamental information about carbon cycling. The cycling and transport of carbon drives a host of other processes; following the carbon can provide a means to quantify underlying processes. This paper is also an example of the simple field methods we have developed from more complex and intensive initial studies (see Significant Publication 3). Further, the study clearly demonstrates the linkage between the various elements of my research, showing how lab optical measurements (SUVA and fluorescence) inform the field observations, how the field observations can be coupled with measurements of physical dynamics to permit quantification of fluxes at large scales in tidal environments, and that understanding these fluxes is important to regional and global budgets. For example, while the global flux of dissolved organic carbon from mangroves represents approximately 10% of the terrestrial flux of organic carbon to the oceans – a significant term in global and regional carbon budgets – there were no methods available to measure this flux directly until we pioneered the method. This also applies to our approach to measuring mercury and methyl mercury fluxes.

Role

Conceived approach, developed methods, conducted field work, performed data analysis, wrote publication.

Results

The results represent the first-ever direct measurement of dissolved organic carbon, mercury, and methyl mercury over a full lunar tidal cycle. The magnitude of the measured DOC flux was much larger than reported using most other methods, but *the real surprise was that the magnitude of the mercury and methyl mercury fluxes were 40 times greater than the highest values generally reported for wetlands*. Although further work needs to be done, the results suggest that mangroves take up gaseous elemental mercury stomatally, incorporating it into their tissues, and releasing it into the water as they senesce and decay. Coastal wetlands, of course, are ideal biogeochemical factories for mercury methylation, explaining why coastal sportfish have elevated mercury concentrations.

The study itself was intended to be just a preliminary "snapshot" to see if measured fluxes could explain the mercury and organic carbon occurrence observed in the coastal ocean of southwestern Florida. It answered that question in the affirmative and provided many insights into the underlying processes, highlighting new areas in need of investigation. As a result, there is now an effort to measure these fluxes continuously within Everglades National Park.

Impact

The USGS has long been a world leader in measurement of riverine fluxes of dissolved constituents. The methods we developed and used here for dissolved organic carbon and mercury permit us to extend these flux measurements into tidal reaches of estuaries and coastal zones, where much of the U.S. population resides, and where there is a glaring lack of knowledge about the rates and extent of biogeochemical processes.

Perhaps most importantly, this paper demonstrates that we have developed a portable, inexpensive and easily deployable methodology for measuring fluxes in tidal regimes that is highly informative. Many research groups and consultants are now applying the technique.

Significant Publication 2:

Bergamaschi, B. A., Smith, R. A., Sauer, M. J., Shih, J.-S., and Ji, L., 2014, Terrestrial Fluxes of Nutrients and Sediment to Coastal Waters and Their Effects on Coastal Carbon Storage in the Eastern United States, in Zhu, Z., and Reed, B. C., eds., Baseline and projected future carbon storage and greenhouse-gas fluxes in ecosystems of the eastern United States, U.S. Geological Survey Professional Paper 1804, US Geological Survey, p. 85-114.

Background

I include this chapter (from a recent LandCarbon professional paper) because it shows one of the major new directions of my research – integration of fluxes into simple biogeochemical models to examine important processes across broad spatial scales. The idea is to use remote sensing measurements (which measure the same optical properties that we measure in situ and in the lab) to spatially extend the study domain. This approach may permit the USGS to exponentially extend the impact of its measurements and monitoring programs by linking them across space and, with the monitoring approach described in the other two significant publications, across time.

Role

Conceived approach, developed and published methods, directed biogeochemical modeling, performed data analysis, wrote publication.

Results

The study described in this chapter (now in preparation for journal publication) quantifies the fluxes of nutrients, carbon, and sediments into estuaries and coastal waters under present (baseline)

conditions, and three IPCC development scenarios to 2050. (The scenarios and land use modelling are described in other chapters.) The study further estimates the potential changes in phytoplankton production in the coastal ocean that may result from projected future increases in nutrients, and assesses the extent that this may affect coastal carbon burial.

Impact

The study represents the first-ever examination of future potential fluxes of nutrients, sediment and carbon. That the study was conducted in a spatially explicit manner makes it useful to resource and environmental managers because they can use the data to anticipate, for example, areas of eutrophication (possible "dead zones") and areas where wetlands may be lost to sediment starvation. LandCarbon is currently in the process of making the data searchable by watershed and available for download online to facilitate their use.

The results are significant for understanding carbon cycling in the coastal ocean, but they also are important to resource managers because they affect commercial seafood harvest, recreational use of the nation's coastal waters, and coastal water quality. Results from this study led to funding of two NASA projects on use of remote sensing to assess wetland sustainability.

Significant Publication 3:

Bergamaschi, B. A., Fleck, J. A., Downing, B. D., Boss, E., Pellerin, B., Ganju, N. K., Schoellhamer, D. H., Byington, A. A., Heim, W. A., Stephenson, M., and Fujii, R., 2011, Methyl mercury dynamics in a tidal wetland quantified using in situ optical measurements: Limnology and Oceanography, v. 56, no. 4, p. 1355-1371.

Background

This paper may seem superficially similar to Publication 1, but the methods are significantly more complex and forward-looking. I chose it because it highlights the ability to use in situ optical measurements to understand and quantify particle-related processes.

Role

Conceived approach, developed methods, wrote proposal, performed data analysis, wrote publication.

Results

What we found in this study was that the amount of methyl mercury associated with particles varied significantly, often driving the majority of the flux *even as the particle concentration remained relatively constant.* The optical methods we used were able to distinguish differences between the particles coming into the wetland and those leaving the wetland. We have expanded these capabilities in future studies to specifically examine particle re-suspension, particle sinking, particle function in estuary food-webs, and for tracking of different particle sources.

Impact

The methods described in this paper and in allied publications (Bergamaschi et al., 2012a; Downing et al., 2009a; Ganju et al., 2005) are the first to permit direct *quantitative* measurements of dissolved and particulate fluxes simultaneously in tidal environments, and are widely applicable. The methods have been adopted by several research groups and consulting companies for a variety of applications. The methods have been adapted and approved by the EPA for monitoring transport of PCBs, mercury, and methyl mercury at superfund sites in tidal systems. In California, this paper contributed to establishing a first-of-its kind TMDL for methyl mercury efflux from tidal wetlands and the method is currently being used to quantify changes in methyl mercury flux caused by wetland restoration.

REFERENCES

Roger Fujii
SUPERVISOR
rfujii@usgs.gov
(916) 278-3055
Roger can provide background on my role in program development, research direction, and how my research addresses important questions in the San Francisco Estuary and Delta.

George Aiken
NRP Researcher, Boulder Colorado
graiken@usgs.gov
(303) 541-3036
George can provide insight into the maturation of my research over my career, how the different elements of my research tie together, and what aspects of carbon and mercury science my research addresses.

Emmanuel Boss
Professor, University of Maine School of Marine Sciences
emmanuel.boss@maine.edu
(207) 581-4378
Emmanuel is a physical oceanographer, specializing in the theory and practice of using in-situ optical properties measurements in aquatic systems. Of the people on this list, he can speak most knowledgably to how my research advances in-situ optical sensor measurement capabilities.

Brian Pellerin
RGE Scientist, California Water Science Center
bpeller@usgs.gov
(916) 278-3167
Brian can provide background on how in situ optical monitoring has revolutionized water quality monitoring and speak to the role my research group played in advancing applications and instrument performance characterization, as well as the instruments themselves. Brian used to be in my research group. I recruited him as a NRC postdoctoral fellow and we still collaborate extensively.

David Krabbenhoft
RGE Scientist, Wisconsin Water Science Center
dpkrabbe@usgs.gov
(608) 821-3843 or (608) 335-4234
Dave can provide background on how the tools and methods I developed have been applied to mercury studies, can comment on collaborations I have with other researchers in WI and on my leadership role in the Carbon Farm project.

Lisa Windham-Myers
NRP Researcher, Menlo Park, California
lwindham-myers@usgs.gov
(650) 329-4447
Lisa can speak most knowledgeably about my activities in the arena of biological carbon sequestration – both the Carbon Farm project and the LandCarbon project. She is aware of the wetland work I have done and how it fits into the broader field. She is also aware of my role in developing protocols for registration of wetland biosequestration projects in carbon cap-and-trade markets.

Peter Hernes
Professor, Land Air and Water, University of California, Davis, CA
pjhernes@ucdavis.edu
(530)-752-7827
Peter, an organic geochemist, is the most knowledgeable person listed about how my research fits onto the broad academic fields of organic geochemistry and aquatic biogeochemistry.

Bergamaschi, B., Fleck, J., Downing, B., Boss, E., Pellerin, B., Ganju, N., Schoellhamer, D., Byington, A., Heim, W., Stephenson, M., and Fujii, R., 2012a, Mercury Dynamics in a San Francisco Estuary Tidal Wetland: Assessing Dynamics Using In Situ Measurements: Estuaries and Coasts, p. 1-13.

Bergamaschi, B., and Pellerin, B., 2011, Coordinating standards and applications for optical water quality sensor networks: Eos, Transactions American Geophysical Union, v. 92, no. 30, p. 251-251.

Bergamaschi, B. A., Downing, B. D., Pellerin, B. A., and Saraceno., J. F., 2010, In Situ Sensors for Dissolved Organic Matter Fluorescence: Bringing the Lab to the Field: USGS Water Resources Discipline Instrument News, no. 125, p. 1-2.

Bergamaschi, B. A., Fleck, J. A., Downing, B. D., Boss, E., Pellerin, B., Ganju, N. K., Schoellhamer, D. H., Byington, A. A., Heim, W. A., Stephenson, M., and Fujii, R., 2011, Methyl mercury dynamics in a tidal wetland quantified using in situ optical measurements: Limnology and Oceanography, v. 56, no. 4, p. 1355-1371.

Bergamaschi, B. A., Fram, M. S., Kendall, C., Silva, S. R., Aiken, G. R., and Fujii, R., 1999, Carbon isotopic constraints on the contribution of plant material to the natural precursors of trihalomethanes: Organic Geochemistry, v. 30, no. 8A, p. 835-842.

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