Lamont-Doherty Earth Observatory of Columbia University
Ocean and Climate Physics - 204 Oceanography
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Research Interests

Air-sea interaction; remote sensing; coupled atmosphere-ocean-wave modeling; wave dynamics; wave-current, wave-atmosphere interaction; cyclones; storm surges; boundary layer turbulence and its effects on heat, gas, and momentum transport; wind and wave energy; wave, wind, flux, and turbulence measurements; image analysis.

Education

2015–present	**Ph.D. Candidate, Columbia University in the City of New York (USA)** Department of Earth and Environmental Science (DEES) Thesis: *Wave breaking in high wind speeds and its effect on air-sea gas transfer.*
2011–2015	**M.Phil., Columbia University (USA)** – Grade Point Average (GPA): 3.95/4 Department of Earth and Environmental Science (DEES)
2007–2011	**M.Sci. in Oceanography, University Of Southampton (UK) – First Class Honours** School of Ocean and Earth Science (SOES), National Oceanography Center (NOC) Dissertation: *On the Upper Ocean Response to Tropical Cyclones - A study based on modeling, remotely sensed and in-situ observations.*
2009–2010	**Study Abroad Year at the University of Miami (USA)** – GPA: 3.69/4 Rosenstiel School of Marine and Atmospheric Science (RSMAS)
2007	**European Baccalaureate, European School Munich (Germany)** – 8.8/10 (DE: 1.1)

Work and Teaching Experience

2011–present	**Graduate Research Fellow** at the Lamont-Doherty Earth Observatory (LDEO); Columbia Univ.
2012–2015	**Teaching Assistant** at Columbia University - Air-Sea Interaction; Introduction to Physical Oceanography; The Climate System; Introduction to Atmospheric Science.
2010–2011	**Teaching Assistant** at Southampton University - Quantitative Earth and Ocean Science.
2009–2010	**Research Assistant** in the Hurricane Modeling Lab at RSMAS.
summer 2009	**Internship** five weeks at the Institute of Ocean Sciences (IOS), Vancouver Island, Canada.

Publications

2016	Zappa, C.J., M.L. Banner, R.P. Morison and **S.E. Brumer** (2016). On the variation of the effective breaking strength in oceanic sea states. *JPO*, 46(7), 2049-2061, doi:10.1175/JPO-D-15-0227.1.
	Brumer, **S.E.**, C.J. Zappa, S.P. Anderson and J.P. Dugan (2016). Riverine Skin Temperature Response to Subsurface Processes in Low Wind Speeds, *J. Geophys. Res. Oceans*, 121, doi:10.1002/2015JC010746.
in review	**Brumer**, **S.E.** et al. On the dependence of whitecap coverage on environmental parameters observed during HiWinGS and SO GasEx. *JPO*.
submitted	**Brumer**, **S.E.** et al., Wave-related Reynolds number parameterizations of CO_2 and DMS transfer velocities. *GRL*.
in preparation	**Brumer**, **S.E.** et al. Wave breaking and sea state dependence of gas transfer of varying solubility.
	Brooks I.M., **S.E. Brumer** et al. A comparison of modelled and observed wave spectra during the High Wind Gas Exchange Study.
	Blomquist B., C.Fairall, B.Huebert, **S.E. Brumer** et al. Air-sea transfer of CO_2 and DMS under high wind speed conditions: results from the High Wind speed Gas exchange Study
	Brumer, **S.E.**, C.J. Zappa, S.P. Anderson, S. Zuckerman, and J.P. Dugan. Wind gusts effects on water surface radiance in low to moderate wind speeds.

Abstracts and Presentations (lead author or presenter)

2016 **Brumer**, **S.E.**, C.J. Zappa, C. Fairall, B. Blomquist, M. Yang, I. Brooks, B. Huebert, and H. Tamura: Gas transfer under high wind and its dependence on wave breaking and sea state. EGU General Assembly, Vienna, AU. (poster)

Brumer, **S.E.**, C.J. Zappa, C. Fairall, B. Blomquist, M. Yang, I. Brooks, B. Huebert, and H. Tamura: Observations of whitecaps during HiWinGS, their dependence on wave field and relation to gas transfer velocities. AGU Ocean Sciences, New Orleans, USA. (oral)

2015 **Brumer**, **S.E.**, C.J. Zappa, C. Fairall, B. Blomquist, M. Yang : Wave breaking and sea state dependence of gas transfer velocities. The 7th International Symposium on Gas Transfer at Water Surfaces, Seattle, USA. (oral)

Zappa C.J., **S.E. Brumer**, S. Brown, D. LeBel, W. McGillis, P.Schlosser, B. Loose: Effects of Ice Floes and Leads on Sea Surface Skin Temperature, Mixing, and Gas Transfer in Marginal Ice Zones. The 7th International Symposium on Gas Transfer at Water Surfaces, Seattle, USA. (oral)

Brumer, **S.E.**, C.J. Zappa, C. Fairall, B. Blomquist, M. Yang: Wave breaking and sea state dependence of gas transfer velocities. 95th AMS annual meeting, 19th conference on Air-sea Interaction, Phoenix, USA. (oral)

2014 **Brumer**, **S.E.**, C.J. Zappa, W. McGillis, S. Brown: Gas Transfer in Seasonal Ice Zones. AGU Ocean Sciences, Honolulu, USA. (oral)

2013 **Brumer**, **S.E.**, C.J. Zappa, S. Brown, W. McGillis, B. Loose: Skin Temperature Processes in the Presence of Sea Ice. AGU Fall Meeting, San Francisco, USA. (poster)

2012 **Brumer**, **S.E.**, C.J .Zappa, J. Dugan, S. Anderson: Using skin temperature variability to quantify surface and subsurface estuarine processes. AGU Fall Meeting, San Francisco, USA. (oral)

Workshops and other Conferences attended

2016 NCEP/NOAA Wave Summer Workshop

2015 Mentoring Physical Oceanography Women to Increase Retention Patullo Conference

2013 Geoscience Graduate Student Symposium at Lamont

2012 Graduate Student Symposium in Princeton

Fellowships and Awards

2017 **Marie Sklodowska-Curie Actions Seal of Excellence**
Awarded by the European Commission for the proposal: "Surface Wave Impact on the Air-Sea Carbon Flux".

2016 **GSAS Conference Matching Travel Funds Award**
Awarded by the Graduate School of Arts and Sciences (GSAS) in support for presenting at the 2016 European Geophysical Union (EGU) General Assembly, Vienna, AU.

2015 **2nd prize for best oral presentation**
95th Annual Meeting of the American Meteorology Society, Phoenix, USA.

2014 **GSAS Conference Matching Travel Funds Award**
In support for presenting at the 2014 Ocean Sciences Meeting in Honolulu, USA.

2013 **Chevron Student Initiative Fund Award**
Grant awarded to establish a Weather Station and Air Quality Monitor at LDEO.

2011–2012 **Faculty Fellowship**
Columbia Univ. Graduate School of Arts and Sciences award for incoming Ph.D. students.

2007–2011 **Continuation Scholarships**
Awarded to the top 10 students from all study programs within SOES; obtained every year.

Advisors

2011–present **C. J. Zappa, A. Gordon, A. Sobel** - LDEO, Columbia University.

2010–2011 **J. Hirshi, A. Megann** - NOC.

2009–2011 **S. Chen** - RSMAS.

Research Projects

2013–present **HiWinGS**

Analysis of the data collected for the High Wind Gas Exchange Study in 2013. Whitecap tracking in high frequency shipborne visible imagery to determine whitecap fraction and breaking crest length distribution following Phillips et al. (1985). Calculation of various wave breaking statistics. Wave field statistics calculation from RIEGL altimeter, wave rider buoy and WaveWatch-III hindcast. 2D wave spectra separations to differentiate wind sea and swell systems. Regression modeling for improved parameterizations of the whitecap fraction. Development of sea state and whitecap dependent gas transfer velocity parameterizations and refinement of physical based models such as the NOAA-COARE gas transfer model for gases or varying solubilities. National Science Foundation Grant OCE-1537890.

2013–present **SO GasEx**

Southern Ocean Gas Exchange Experiment 2008. Whitecap detection in shipborne visible imagery and computation of wave statistics from RIEGL and WAMOS wave radar system. Investigation of sea-state dependence of gas transfer velocities and evaluation of wave dependent Reynolds number parameterizations compared to traditional wind-only ones.

2013–present **GAPS**

Gas transfer Across Polar Sea ice - Laboratory experiment in the test basin of the US Army Corps of Engineers, Cold Regions and Engineering Laboratory (CREEL). Performed data analysis to study the effects of ice flow coverage and lead size or fetch on subsurface turbulence and air-sea transfer of heat and gas. This included analysis of InfraRed (IR) imagery: calibration, ice detection, noise filtering, active control flux technique laser tracking and calculation of turbulent kinetic energy dissipation rates from subsurface acoustic velocity profilers. National Science Foundation Grant ANT 09-44643.

2013–present **IcePod**

Visible and IR imagery mapping, PIV and optical flow analysis to study metlwater plume dynamics. (http://www.ldeo.columbia.edu/res/pi/icepod/).

2011–present **RIDE-2**

Riverine Dynamics Experiment 2 - in collaboration with Areté Associates, 2 day field campaign in the Hudson River Estuary in 2010. Related the scales of turbulence determined from IR imagery directly to the subsurface scales of turbulence demonstrating the ability to remotely estimate riverine flow rate, subsurface turbulence and bathymetry under low speed winds. Evaluated the validity of several bulk-skin temperature models. Quantified the gust signature in both large and small-scale water surface skin temperature (Tskin) variability and investigated surface roughness effects generated by the wind gusts which have the potential to both physically disrupt the Tskin as well as change the surface electromagnetic properties. Analysis of ship based IR imagery: calibration, sky-temperature correction, re-projection, optical flow, particle image velocimetry, 3D spectral analysis do determine advective flow, determination of coherent feature sizes. Analysis of cliff based imagery: advective signal enhancement through 3D Fourier filtering, tracking gust signatures and characterizing their size and propagation speeds. Office of Naval Research Awards N00014-11-1-0922 and N00014-15-1-2153.

2009–2011 **Upper Ocean Response to Hurricanes**

Analyzed ocean model (HYCOM, 3D PWP) output and compared them to satellite data (TMI and AMSR-E, Ssalto/Duacs) and in situ AXBT measurements collected during the Impacts of Typhoons on the Ocean in the Pacific field campaign; oceanographic properties analyzed: sea surface height, sea surface temperature, mixed layer depth, ocean heat content, and currents. Developed storm relative quadrant analysis to quantify asymmetry of response. In charge of automated real-time hurricane tracks KML file generation for in-bedded Google map display on lab website during the 2010 Atlantic hurricane season.

Field and Lab Experience

Fall 2016 **Research Cruise - Study of the Sea-Surface Microlayer and Air-Sea Boundary**
Five week cruise from Darwin, Australia to Guam. Aim: to study the role of surfactants on atmosphere-ocean interactions; In charge of polarimetric and InfraRed imagery recording. Set up of air-sea flux package, installation of radiometers, pyranometer, pyrgeometer, and Riegl laser altimeter. Help with UAV missions.
RV Falkor, PI: O. Wurl (Oldenburg, Germany).

2015–present **Eddy Covariance Flux Mast**
Setup and maintenance of a meteorological station in Jamaica Bay, NY, as part of the Science and Resilience Institute @ Jamaica Bay (www.srijb.org). Calculation and archiving of eddy covariance fluxes of heat, momentum and CO_2.

Summer 2014 **Cranberry Lake**
In collaboration with Dr. Miller of State University of New York, Albany, one week deployment of subsurface velocimeter and velocity profilers from a pontoon boat in Cranberry Lake, NY.

2013–present **LDEO Weather station**
Set up and maintenance of the Lamont-Doherty Earth Observatory weather station. Maintenance of station's website (http://weather.ldeo.columbia.edu/) and data archival.

Fall 2013 **HiWinGS Research Cruise**
Six weeks in the North Atlantic, 100 miles south of the tip of Greenland; 60°0.0'N, 45°0.0'W. A panoply of ship and spar buoy based measurements aimed at investigating the physical processes controlling air-sea gas exchange at high winds. Focusing on the effect of waves on gas exchange, through wave breaking and bubble-mediated exchange. In charge of high frequency visible imagery for whitecap detection and tracking.
RV Knorr, PIs: B. Blomquist, C. Fairall, and J. Hare (NOAA ESRL); B. Huebert (U. Hawaii)

Summer 2012 **Luminy Marseille**
In collaboration with Ph.D. students from the University of Heidelberg and Dr. Caulliez: two week long experiment in the wind-wave tank of IRPHE (Marseille) testing a reflecting stereo slope gauge, an active control flux system and a Nortec VectrinoII profiling Velocimeter.

Spring 2010 **Research Cruise**
One week in international waters off Jacksonville, FL. Assemblage and deployment of the ASIS (AirSea Interaction Spar) and EASI (Extreme Air Sea Interaction) buoy.
RV Oceanus, PIs: W. Drennan, H. Graber, B. Haus (RSMAS).

Summer 2009 **Internship at the Institute of Ocean Sciences, Vancouver Island, Canada**
Three week sardine survey off the coast of Vancouver Island; in charge of CTD and bongo net casts. Participated in fish identification, counting, weighing; stomach content analysis.
RV Ricker, PI: S. MacFayden.

Service

2015–present **Reviewer** for the Journal of Physical Oceanography and the Journal of Geophysical Research
2014–present **Mentoring Award Committee Member** - LDEO.
2012–present **Graduate Student Peer Mentor** to 3 junior DEES students.
2011–present **Open House Volunteer** - LDEO.
2016 **Girls' Science Day Volunteer** - Columbia University.
2013–2014 **Ocean and Climate Physics Division Seminar Coordinator** - LDEO.
2013 **Guest lecturer for STEM disciplines** - NY Academy of Science, after-school program.
2012–2014 **Graduate Student Council Co-chair** - DEES; Columbia University
2012–2014 **Graduate Student Advisory Council, Quality of Life Chair** - GSAS; Columbia Univ.
2010–2011 **Mentor** to students from the Univ. of Miami attending Southampton Univ. and vice versa.

Professional Affiliations

2014–present	The Oceanography Society (TOS)
2014–present	European Geosciences Union (EGU)
2012–present	American Geophysical Union (AGU)
2012–present	American Meteorological Society (AMS)

Relevant Classes

2007–2015

Introduction to Numerical Methods - K. Mandli; Columbia University
Machine Learning - N.Verma; Columbia University
Extreme Weather and Climate seminar - A. Fiore; Columbia University
Air-Sea Interaction - C. Zappa; Columbia University
Ocean Mixing and Turbulence - A. Turnherr; Columbia University
Ocean Dynamics - Y. Ou; Columbia University
Quantitative Methods Data Analysis - D. Martinson; Columbia University
Geophysical Fluid Dynamics - L. Polvani; Columbia University
Atmosphere Thermodynamics - C. Clement, University of Miami
Applied Ocean Hydrodynamics - J. Willemsen, RSMAS
Mechanics and Thermodynamics of the Air-Sea Interface - B. Haus, H. Graber, RSMAS
Weather Analysis - D. Nolan, , University of Miami
Air-Sea Interaction - L. Shay, RSMAS
Introductory Remote Sensing - I. Robinson; University of Southampton
Global Ocean Monitoring - H. Bryden, University of Southampton
Climate Dynamics - K. Oliver, University of Southampton
Coastal and Estuarine Oceanography 1 & 2 - A. Kemp, C. Amos, University of Southampton

Languages

English, **French**, **German** - native speaker level
Spanish - very good passive, good active; **Italian** - basic knowledge

Programming Skills

OS: Windows, Linux, Unix (Mac, Solaris); **Languages**: Matlab, LaTeX, Bash, Perl, kml, Python, Fortran

References

Dr. C. Zappa - zappa@ldeo.columbia.edu
Dr. I. Brooks - i.brooks@see.leeds.ac.uk
Prof. M. Banner - m.banner@unsw.edu.au
Dr. C. Fairall - chris.fairall@noaa.gov
Prof. A. Gordon - agordon@ldeo.columbia.edu