

Laboratoire d'Océanographie Physique et Spatiale
Institut Français de Recherche pour l'Exploitation de la Mer
ZI Pointe du Diable, CS10070, 29280 Plouzané, France

Office Phone: (33) 2 29 00 85 23
e-mail: sophia.brumer@ifremer.fr
website: sophia-e-brumer.github.io

Research Interests

Air-sea interactions; coupled atmosphere-ocean-wave modeling; coastal monitoring; renewable energy; wave dynamics; cyclones; climate; boundary layer turbulence and its effects on heat, gas, and momentum transport; wind and wave energy; wave, wind, flux, turbulence measurements; image analysis; remote sensing; big data.

Education

- 2017 **Ph.D., Columbia University in the City of New York (USA)**
Department of Earth and Environmental Sciences (DEES)
Thesis: Wave breaking in high wind speeds and its effects on air-sea gas transfer.
Advisors: C. J. Zappa (LDEO), A. Gordon (DEES), A. Sobel (DEES)
- 2011–2015 **M.Phil., Columbia University (USA)** – Grade Point Average (GPA): 3.95/4
Department of Earth and Environmental Sciences (DEES)
- 2007–2011 **M.Sci. in Physical 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.
Advisors: J. Hirshi (NOC), A. Megann (NOC), S. Chen (RSMAS)
- 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)

Professional Employment

- 2018–present **Postdoctoral Fellow** of the French National Center for Space Studies (CNES) in the Laboratory for physical and spatial oceanography (LOPS) at Ifremer.
- 2017–2018 **Postdoctoral Researcher** for the French Center of Scientific Research (CNRS) in LOPS.
- 2011–2017 **Graduate Research Fellow** at Lamont-Doherty Earth Observatory (LDEO); Columbia Univ.
- 2009–2010 **Research Assistant** in the Hurricane Modeling Lab at RSMAS.
- summer 2009 **Intern** at the Institute of Ocean Sciences (IOS), Vancouver Island, Canada

Fellowships and Awards

- 2018 **CNES post-doctoral fellowship**
Awarded for the project: “Remote Sensing of Waves in Coastal Seas and Modeling their Role in the coupled Ocean-Atmosphere System”
- 2017 **European Commission Marie Skłodowska-Curie Actions Seal of Excellence**
Awarded 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 **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.

Publications

- 2017 **Brumer, S.E.**, C.J. Zappa, B.W. Blomquist, C.W. Fairall, A. Cifuentes-Lorenzen, J.B. Edson, I.M. Brooks, and B.J. Huebert. (2017). Wave-related Reynolds number parameterizations of CO₂ and DMS transfer velocities. *Geophys. Res. Letters*, 44. doi: 10.1002/2017GL074979.
- Blomquist, B.W., **S.E. Brumer**, C.W. Fairall, B.J. Huebert, C.J. Zappa, I.M. Brooks, M. Yang, L. Bariteau, J. Prytherch, J.E. Hare, H. Czerski, A. Matei and R.W. Pascal (2017). Wind Speed and Sea State Dependencies of Air-Sea Gas Transfer: Results From the High Wind Speed Gas Exchange Study (HiWinGS). *J. Geophys. Res. Oceans*, 2169-9291, doi: 10.1002/2017JC013181.
- Brumer, S.E.**, C.J. Zappa, I.M. Brooks, H. Tamura, S.M. Brown, B.W. Blomquist, C.W. Fairall, and A. Cifuentes-Lorenzen, 2017: Whitecap Coverage Dependence on Wind and Wave Statistics as Observed during SO GasEx and HiWinGS. *J. Phys. Oceanogr.*, 47, 2211-2235, doi: 10.1175/JPO-D-17-0005.1.
- 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. *J. Phys. Oceanogr.*, 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 preparation **Brumer, S.E.**, V. Garnier, J.-L. Redelsperger, M.-B. Bouin, Impacts of surface gravity waves on a coastal tidal front: a high resolution coupled modeling perspective.
- Garnier V., **S.E. Brumer**, J. Pianezze, M. Accensi, A. Thevenin, T. Odaka, J.L. Redelsperger, M.-N. Bouin, F. Ardhuin. Evaluation of the air-sea interactions from a numerical ocean-atmosphere-wave coupled system dedicated to coastal processes : application to the Ushant front. To be submitted to GMD.
- Hooker G., **S.E. Brumer**, C.J. Zappa, and E. Monahahn. The SST dependence of Wind-Speed Parameterization of Oceanic Whitecap Coverage.
- Brumer, S.E.** and C.J. Zappa. A novel framework for gas transfer in wave breaking conditions. Brooks I.M., **S.E. Brumer** et al. A comparison of modelled and observed wave spectra during the High Wind Gas Exchange Study.
- Zappa, C.J., **S.E. Brumer**, 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)

- 2018 **Brumer, S.E.**, V. Garnier, J.-L. Redelsperger, M.-N. Bouin, F. Ardhuin, and M. Accensi: Coupled Modeling of Air-Sea Processes in the Iroise Sea at High Horizontal Resolution. 21st Conference on Air-Sea Interaction, Oklahoma City, USA. (oral)
- Brumer, S.E.**, Wave breaking in high wind speeds and its effects on air-sea gas transfer. Laboratoire d'Océanographie Physique et Spatiale Seminar, Ifremer, Plouzané, FR. (oral)
- Brumer, S.E.**, C.J. Zappa, B.W. Blomquist, C.W. Fairall, A. Cifuentes-Lorenzen, J.B. Edson, I.M. Brooks, and B.J. Huebert. Wave-related Reynolds number parameterizations of CO₂ and DMS transfer velocities. AGU Ocean Sciences, Portland, USA. (oral)
- 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)

Teaching Experience

- 2018–present **Instructor** at the European Institute for Marine Studies - Wind Waves.
- 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.

Workshops and Symposiums

- 2018 Journes Nationales SWOT
Physical Oceanography Dissertation Symposium (PODS X)
LOPS OASIS coupler tutorial
- 2017 Ifremer MARS 3D tutorial
Météo France MesoNH tutorial
- 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

Service

- 2015–present **Reviewer** for the Journal of Physical Oceanography and the Journal of Geophysical Research
- 2014–2017 **Mentoring Award Committee Member** - LDEO.
- 2012–2017 **Graduate Student Peer Mentor** to 3 junior DEES students.
- 2011–2016 **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.

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

Research Projects

- 2017–present **AMICO**
Actions towards integrated operational coastal modeling funded by the French "Ministère de l'Environnement, de l'Energie et de la Mer" in the framework of the COPERNICUS program. Coupled coastal ocean-wave-atmosphere modeling at high horizontal resolution (400-1000m) using the ocean Model for Applications at Regional Scale (MARS3D), the third generation wind and wave model WaveWatchIII (WW3) and the non-hydrostatic mesoscale atmospheric model of the French research community (MesoNH). Focus region: the Iroise Sea, where a strong tidal current and an intense seasonal SST front interact with mesoscale weather systems and long fetch waves.
- 2013–present **HiWinGS**
Analysis of the data collected for the High Wind speed 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 WW3 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.
- 2013–2017 **SO GasEx**
Southern Ocean Gas Exchange Experiment 2008. Whitecap detection in shipborne visible imagery and computation of wave statistics from RIEGL laser altimeter and WAMOS wave radar system. Investigation of sea-state dependence of gas transfer velocities and evaluation of wave dependent Reynolds number parameterizations performance compared to traditional wind-only ones. National Oceanic and Atmospheric Administration grant NA07OAR4310094.
- 2013–2017 **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.
- 2013–2017 **IcePod**
Visible and IR imagery mapping, PIV and optical flow analysis to study meltwater 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. 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. Related the scales of turbulence determined from IR imagery directly to subsurface scales of turbulence demonstrating ability to remotely estimate riverine flow rate, subsurface turbulence and bathymetry at low winds. Evaluated the validity of several bulk-skin temperature models. Investigated surface roughness effects generated by the wind gusts which have the potential to both physically disrupt the Tskin as well as change surface electromagnetic properties. 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 2017 Research Cruise - BBWAVES**

5 days, Iroise Sea to study interactions between the surface wave field and air-sea fluxes in the presence of strong current gradients. Helped with polarimetric and stereo imagery acquisition, drifting wave buoys deployment, flux measurements.
RV Thalia, PI: P. Sutherland (IFREMER).

Fall 2016 Research Cruise - Study of the Sea-Surface Microlayer and Air-Sea Boundary

5 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).

2015–2017 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 CO₂.

Summer 2014 Research Experiment - Cranberry Lake

In collaboration with Dr. Miller (State Univ. of New York, Albany), 1 week deployment of subsurface velocimeter and velocity profilers from a pontoon boat in Cranberry Lake, NY.

2013–2017 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 Research Cruise - HiWinGS

6 weeks 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 Wind-Wave Tank Test - Luminy Marseille

In collaboration with Ph.D. students from the University of Heidelberg and Dr. Caulliez. 2 week long experiment in the wind-wave tank of IRPHE (Institut de Recherche sur les Phénomènes Hors Équilibre) testing a reflecting stereo slope gauge, an active control flux system, and a Nortec VectrinoII profiling Velocimeter.

Spring 2010 Research Cruise - Pre ITOP Test Deployment

1 week in international waters off Jacksonville, FL. Assemblage and deployment of the ASIS (Air-Sea Interaction Spar) and EASI (Extreme Air Sea Interaction) buoys.
RV Oceanus, PIs: W. Drennan, H. Graber, B. Haus (RSMAS).

Summer 2009 Research Cruise - Sardine Survey

3 weeks off Vancouver Island; in charge of CTD and bongo net casts. Participated in fish identification, counting, weighing; stomach content analysis.
RV Ricker, PI: S. MacFayden (Pacific Biological Station).