

Greg Blumberg

NASA POSTDOCTORAL PROGRAM FELLOW

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Education

University of Oklahoma

Norman, OK

DOCTOR OF PHILOSOPHY IN METEOROLOGY

June 2014 - May 2018

- **Dissertation:** "Observations and Simulations of Moisture Changes Occurring Around Sunset at the ARM Climate Research Facility"

MASTERS OF SCIENCE IN METEOROLOGY

August 2011 - August 2013

- **Thesis:** "Developing a Statistical Thermodynamic Retrieval for Ground-Based Infrared Spectrometers"

BACHELOR OF SCIENCE IN METEOROLOGY

August 2007 - May 2011

- **Minor:** Mathematics

Teaching and Research Interests

Severe convective weather, mesoscale planetary boundary layer heterogeneity and transitions, atmospheric dynamics, numerical weather prediction, coastal meteorology, land-atmosphere interactions, applied meteorology, forecasting, air quality, launch range safety and risk assessments, in-situ and remote sensing atmospheric profiling techniques, meteorological education and communication

Teaching Experience

University of Oklahoma School of Meteorology

Norman, OK

INSTRUCTOR FOR ATMOSPHERIC DYNAMICS 2 (METR 3123)

Summer 2018

- Designed and taught a curriculum for an intensive 8-week summer course on atmospheric dynamics for junior-level meteorology majors with creative and engaging lessons. Atmospheric dynamics concepts covered include: balanced flow, circulation, vorticity, Rossby wave behavior, potential vorticity, boundary layer phenomena, and differences between the barotropic and baroclinic atmospheres. Learning outcome assessments included tests and homework.

INSTRUCTOR FOR INTRODUCTION TO METEOROLOGY 1 LAB (METR 2011)

Spring 2018

- Designed and taught a curriculum for sophomore-level meteorology majors to improve critical thinking skills, reinforce meteorological concepts, and develop common skills and competency in tools (e.g., hand analysis, satellites, numerical weather prediction, programming, sounding analysis) used in the field of meteorology. Learning outcome assessments used a combination of oral and written formats (e.g., presentations and written reports).

TEACHING ASSISTANT FOR SEVERE AND UNUSUAL WEATHER (METR 2603)

Spring 2013

- Graded homework assignments and covered classes for the primary instructors. Course materials exposed non-majors to meteorological concepts focused to understanding hazardous and severe weather (e.g., winter weather, severe storms).

TEACHING ASSISTANT FOR MEASUREMENTS LAB (METR 3613)

Fall 2011, 2012

- Led meteorology majors through hands-on lab exercises designed to understand various properties of instruments using breadboards, thermometers, anemometers, and tipping bucket rain gauges. Engaged students in field research projects to solidify instrument and measurement concepts. Built writing skills by assigning full-length lab reports designed to teach common writing practices used in scientific journals.

TEACHING ASSISTANT - INTRODUCTION TO WEATHER AND CLIMATE FOR NON-MAJORS (METR 1013)

Spring 2011

- Developed and presented weekly lessons to teach a high-level overview of meteorological topics (e.g., fronts, mountain weather, severe storms) to non-majors at the university. Graded weekly lab reports.

Other Formal and Informal Learning Interventions

Online and in-person

SCIENTIFIC CODING WORKSHOP FOR THE NWC REU PROGRAM

Summer 2017, 2018

- Instructed and developed a 1-day workshop for Dr. Daphne LaDue to teach National Weather Center (NWC) Research Experiences for Undergraduates (REU) Program participants the Python language and common concepts in scientific coding. Topics covered include understanding coding errors and syntax, statistical analysis, and plotting data.

INSTRUCTOR FOR WDTD/CAPS TRAINING

October 2016, Fall 2018

- Trained meteorologists from Japan and the Chinese Meteorological Agency on the severe weather forecasting process using ingredients-based forecasting techniques and hand analysis from real-time data.
- Designed and taught an online curriculum on integrating the output from convection allowing numerical weather prediction models with common forecasting practices to predict a variety of thunderstorm hazards.
- Leveraged the expertise of the Weather Decision Training Division (WDTD) and Center for Analysis and Prediction of Storms (CAPS) as well as Dr. Daphne LaDue's expertise on how adult and higher education impacts professional learning and cognition.

- Developed and taught over the Internet (e.g., Skype and email) and in-person an informal mentoring and education program to a variety of neurodiverse and underrepresented high school and undergraduate students. Topics included an introduction to undergraduate-level meteorology concepts, observing systems, analysis techniques, computer programming, writing and research skills, and weather forecasting. Through my mentoring, these students demonstrated their acquired meteorological knowledge by performing research that was presented at professional conferences and/or published in peer-reviewed journals (see citations below with * footnotes).

LEAD CAREERS WEATHER CAMP EVALUATOR

Summer 2010, 2011

- Contracted work through NCAS-M (NOAA Center for Atmospheric Sciences and Meteorology) to observe and contribute in instructing their U.S. high school level weather camp programs. Other goals included recruiting underrepresented and neurodiverse groups into meteorology and other STEM fields and helping them network with professionals at meteorology conferences. For each camp, evaluation reports were written to improve camp curriculum goals and assess learning outcomes. Reports were used in reporting to the National Science Foundation (Award #0914676).

Research Experience

NASA Goddard Space Flight Center

Greenbelt, MD

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July 2019 - Now

- Initiated transformative, internationally-relevant research demonstrating how incorporating numerical weather prediction models into distant focusing overpressure (DFO) risk assessments at space launch ranges can improve public safety and significantly reduce costly delays from undue conservatism. By networking with Dr. Ahmed Fadl, the capability of this work to help mitigate launch risks has attracted the attention of several funding sources in the space transportation and safety community (e.g., FAA, NASA, DoD).
- Studied atmospheric boundary layer and aerosol feedbacks from biomass burning in Southeast Asia using small Uncrewed Aerial Systems (sUAS), NASA ground-based remote sensors, and the NASA Unified Weather Research and Forecasting (NU-WRF) with chemistry (WRF-CHEM) system. Collaborated with scientists and graduate students at National Central University in Taiwan and National Oceanic and Atmospheric Administration (NOAA) as a part of NASA's Seven SouthEast Asian Studies (7-SEAS) Mission.
- Strengthened collaborations between the Goddard and Wallops campuses by building relationships based on common planetary boundary layer (PBL) observation and modeling needs between the Wallops Range Mission Management Office, regional stakeholders for the DelMarva Mesonet Project, and NASA Decadal Survey PBL Incubation activities.
- Began field work exploring the use of Advancing Earth Research Observations with Kites and Atmospheric/Terrestrial Sensors (AEROKATS) kites to enable low-cost, distributed networks of PBL thermodynamic, turbulence, trace gas, and aerosol observations.

Cooperative Institute for Mesoscale Meteorology Studies

Norman, OK

GRADUATE RESEARCH ASSISTANT

June 2014 - May 2018

- Assisted in deploying and operating the Collaborative Lower Atmosphere Mobile Profiling System (CLAMPS) during the Plains Elevated Convection At Night (PECAN) and the Land-Atmosphere Feedback Experiment (LAFE) field projects.
- Performed research at NOAA's National Severe Storms Laboratory (NSSL) designed to improve the understanding of how radiosondes and the data fusion of ground-based remote sensors (e.g., AERI, Doppler wind lidar, Raman lidar, microwave radiometer) instruments can be used to diagnose the ingredients relevant to deep moist convection.
- Conducted experiments using observations and simulations from the Oklahoma Mesonet and ARM Southern Great Plains climate facility to gain a process-level understanding of the PBL water vapor evolution during the Southern Great Plains afternoon to evening transition.

RESEARCH FELLOW

August 2013 - June 2014

- Enhanced the speed and accuracy of the AERI optimal estimation (AERIOe) thermodynamic retrieval algorithm.
- Published in the peer-reviewed literature the accuracy of AERI retrieval methods in comparison to other thermodynamic profiling technologies.
- Mentored undergraduate student research using AERIOe retrievals to assess the accuracy of planetary boundary layer parameterization schemes from convective-scale ensemble numerical weather prediction forecasts.

University of Oklahoma School of Meteorology

Norman, OK

GRADUATE RESEARCH ASSISTANT

January 2012 - August 2013

- Developed and tested statistical thermodynamic retrievals for the AERI using linear regression, principle component analysis, and machine learning concepts.
- Published analyses of the AERI thermodynamic retrievals and nocturnal boundary layer during the student run, multi-institutional Lower Atmospheric Boundary Layer Experiment (LABLE) field experiment.

NOAA Storm Prediction Center

Norman, OK

UNDERGRADUATE RESEARCH INTERN

Fall 2010

- Performed qualitative research on common severe weather preparedness criteria StormReady certified amusement parks and developed new criteria to be applied to future amusement park StormReady certification.
- Compiled a database of U.S. large venue locations to be integrated into AWIPS for the purpose of heightening forecaster situational awareness and impact-based forecasts.

Peer Reviewed Publications

Blumberg, W. G., U. Jeong, S. C. Tsay, C. Wang, M. Wang, and J. Santanello, 2021: Mountain-Valley Processes Facilitating Aerosol Upwelling During Biomass Burning Season in Northern Thailand, *Remote Sensing*, in progress.

Blumberg, W. G., D. D. Turner, S. Cavallo, J. Basara, and A. Shapiro, 2021: Environmental changes supportive of severe, moist convection in northern Oklahoma during the evening transition, *J. Appl. Met. Climo.*, in progress.

Blumberg, W. G., and A. M. Fadl, 2021: Effects of environmental heterogeneity on distant focusing overpressure risk assessments at coastal space ports, *J. Space Safety Eng.*, submitted.

Wagner, T. J., D. D. Turner, T. Heus, and **W. G. Blumberg**, 2021: Observing profiles of derived kinematic field quantities using a network of profiling sites, *J. Atmo. Ocea. Tech.*, accepted with revisions.

Smith, E. N., B. R. Greene, T. M. Bell, **W. G. Blumberg**, R. Wakefield, D. Reif, Q. Niu, Q. Wang, and D. D. Turner, 2021: Evaluation and applications of multi-instrument boundary-layer thermodynamic retrievals, *Boundary-Layer Meteorology*, **181**, 95-123, doi:10.1007/s10546-021-00640-2.

Bolton, M. J.* , **W. G. Blumberg**, L. K. Ault, H. M. Mogil, and S. H. Hanes, 2020: Initial evidence for increased weather salience in autism spectrum conditions, *Weather, Climate, and Society*, **12**, 293-307, doi:10.1175/WCAS-d-18-0100.1.

Blumberg, W. G., D. D. Turner, S. Cavallo, J. Basara, A. Shapiro, and J. Gao, 2019: An analysis of the processes affecting rapid near-surface water vapor increases during the afternoon to evening transition in Oklahoma, *J. Appl. Met. Climo.*, **58**, 2217-2234, doi:10.1175/JAMC-D-19-0062.1

Turner, D. D. and **W. G. Blumberg**, 2018: Improvements to the AERIOe Thermodynamic Profile Retrieval Algorithm, *IEEE Sel. Top. Appl. Earth Obs. Remote Sens.*, doi:10.1109/JSTARS.2018.2874968.

Blumberg, W. G., T. J. Wagner, D. D. Turner, and J. Correia Jr., 2017: Quantifying the accuracy and uncertainty of diurnal thermodynamic profiles and convection indices from the Atmospheric Emitted Radiance Interferometer, *J. Appl. Met. Climo.*, **56**, 2747-2766, doi:10.1175/JAMC-D-17-0036.1

Blumberg, W. G., K. T. Halbert*, T. A. Supinie, P. T. Marsh, R. L. Thompson, and J. A. Hart, 2017: SHARPPy: An open source sounding analysis toolkit for the atmospheric sciences, *Bull. Amer. Met. Soc.*, **98**, 1625-1636, doi:10.1175/BAMS-D-15-00309.1

Blumberg, W. G., D. D. Turner, U. Loehnert, and S. Castleberry, 2015: Ground-based temperature and humidity profiling using spectral infrared and microwave observations. Part II: Retrieval performance in all-sky conditions, *J. Appl. Met. Climo.*, **54**, 2305-2319, doi:10.1175/JAMC-D-15-0005.1

Bonin, T. A., **W. G. Blumberg**, P. M. Klein, and P. B. Chilson, 2015: Thermodynamic and turbulence characteristics of the Southern Great Plains nocturnal boundary layer under differing turbulent regimes. *Boundary-Layer Meteorology*, **157**, 401-420, doi:10.1007/s10546-015-0072-2

Klein P., T. A. Bonin, J. F. Newman, D. D. Turner, P. B. Chilson, C. E. Wainwright, **W. G. Blumberg**, S. Mishra, M. Carney, E. P. Jacobsen, and R. K. Newsom, 2014: The 2012 lower atmospheric boundary layer experiment. *Bull. Amer. Met. Soc.*, **96**, 1743-1764, doi:10.1175/BAMS-D-132-00267.1

* a co-author who was an undergraduate mentee.

Selected Conference Proceedings

Blumberg, W. G., and A. M. Fadl, 2021: Effects of environmental heterogeneity on distant focusing overpressure risk assessments at coastal space ports, 11th International Association for the Advancement of Space Safety Conference, virtual, USA.

Blumberg, W. G., and A. M. Fadl, 2020: Consequences of Meteorological Assumptions on DFO in Complex Terrain, 127th Range Safety Working Group, virtual, USA.

Blumberg, W. G., and A. M. Fadl, 2020: Effects of spatiotemporal variability on Distance Focused Overpressure (DFO). 126th Range Safety Working Group, virtual, USA.

Blumberg, W. G., S. C. Tsay, A. Loftus, U. Jeong, D. B. Wolff, and A. M. Fadl, 2020: Ongoing and Future NASA SMARTLabs PBL Studies in Coastal and Polluted Environments, Atmospheric Boundary Layer Processes: Accomplishments to Date and Future Research Endeavours, Boston, MA, USA.

Blumberg, W. G., and A. M. Fadl, 2019: Understanding the Impact of Meteorological Spatiotemporal Variability on Distant Focusing Overpressure Risk, A21S - Sounds of the Solar System: Geophysical and Planetary Acoustics Papers, San Francisco, CA, USA.

Santanello, J. A. Jr., S. Q. Zhang, D. D. Turner, P. Lawston, and **W. G. Blumberg**, 2019: PBL Thermodynamic Profile Assimilation and Impacts on Land-Atmosphere Coupling, Atmospheric Processes, San Francisco, CA, USA.

Wagner, T. J., **W. G. Blumberg**, D. D. Turner, T. A. Bonin, A. Choukulkar, A. Brewer, R. K. Newsom, and V. Wulfmeyer, 2018: Characterizing Water Vapor Advection During LAFE with Thermodynamic and Kinematic Profilers, 23rd Symposium on Boundary Layer and Turbulence, Oklahoma City, OK, USA.

Bonin, T. A., D. D. Turner, R. K. Newsom, L. K. Berg, **W. G. Blumberg**, A. Behrendt, V. Wulfmeyer, A. Choukulkar, R. M. Banta, Y. Pichugina, C. J. Senff, R. M. Hardesty, and W. A. Brewer, 2018: Observed Characteristics of the Boundary-Layer Evolution during Evening Transitions in North-Central Oklahoma, 23rd Symposium on Boundary Layer and Turbulence, Oklahoma City, OK, USA.

Blumberg, W. G., and D. D. Turner, 2018: Demystifying the 6 o'clock Magic Phenomenon: Environmental Changes during the Southern Great Plains Afternoon to Evening Transition, San Diego, CA, USA.

Bolton, M. J.* , **W. G. Blumberg**, H. M. Mogil, and L. K. Ault, 2018: Exploring Differences in Weather Knowledge and Perceptions in Autistic and Non-Autistic Individuals, Sixth Symposium on Building a Weather-Ready Nation: Enhancing Our Nation, Austin, TX, USA.

Blumberg, W. G. and D. D. Turner, 2017: Observations of the Afternoon to Evening Transition Occurring Within the Southern Great Plains Severe Convective Environment. Special Symposium on Severe Local Storms: Observation Needs to Advance Research, Prediction, and Communication, Seattle, WA, USA

Blumberg, W. G. and T. A. Supinie, 2017: Adding Difficulty in Weather Forecasting Challenges to Enhance Learning. 26th Symposium on Education, Seattle, WA, USA

Bolton, M.* , G. Wise* and **W. G. Blumberg**, 2016: Color Blindness in the Weather Enterprise: Discussion, and a Look at Solutions. National Weather Association's 41st Annual Meeting, Norfolk, VA, USA

Blumberg, W. G., T. J. Wagner, and D. D. Turner, 2016: Monitoring the Evolution of Deep Convection Through the Use of Ground-Based Spectral Infrared Thermodynamic Sounders. 32nd Conference on Environmental Information Processing Technologies, New Orleans, LA, USA.¹

Wagner, T. J., and **W. G. Blumberg**, 2016: Near-continuous Profiling of Atmospheric Stability During Severe Weather Events. 20th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), New Orleans, LA, USA.

Blumberg, W. G. and D. D. Turner, 2015: Insights Regarding the Use of Ground-Based Spectral Infrared Thermodynamic Sounders in Forecasting Deep Convection. National Weather Association's 40th Annual Meeting, Oklahoma City, OK, USA¹

Bolton, M.* , and **W. G. Blumberg**, 2015: Learning Disorders (LD) in the Meteorological Community: Implications for Communication and Education. National Weather Association's 41st Annual Meeting, Oklahoma City, OK, USA¹

Halbert, K. T.* , **W. G. Blumberg**, and P. Marsh, 2015: SHARPPy: Fueling the Python Cult. 5th Symposium on Advances in Modeling and Analysis Using Python, Phoenix, AZ, USA¹

Yuhas, J. A., **W. G. Blumberg**, K. Halbert*, M. Yalch*, T. Ruggiero*, E. Mushlitz*, M. Stropkay*, J. Bailey-Wells*, O. Braunstein*, and S. Nadler*, 2015: A University/High School Forecasting Classroom. 24nd Symposium on Education, Austin, TX, USA

Harrison, D.* , Z. A. Roux*, A. McGovern, and **W. G. Blumberg**, 2015: Promoting a Weather Ready Nation Through Serious Games. 24nd Symposium on Education, Austin, TX, USA

Wagner, T. and **W. G. Blumberg**, 2015: Ground-based Infrared Sounders: A New Look at Their Capabilities for Operational Meteorologists. 19th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), Phoenix, AZ, USA

Turner, D. D. and **W. G. Blumberg**, 2014: A Future Ground-based Network of Thermodynamic Boundary Layer Profilers: The Infrared Spectrometer Option. The World Weather Open Science Conference, Montreal, Quebec, Canada

Blumberg, W. G. and D. D. Turner, 2014: Benefits of Ground-Based AERI Retrievals in Operational Forecasting. IGARSS, Quebec City, Quebec, Canada

Bonin, T. A., P. M. Klein, P. B. Chilson, J. F. Newman, **W. G. Blumberg**, and D. D. Turner, 2014: Analysis of Turbulence and Thermodynamics Associated with Low-Level Jets. AMS 21st Symposium on Boundary Layers and Turbulence, Leeds, United Kingdom

Turner, D. D., **W. G. Blumberg**, N. Anderson, and A. Dzambo 2014: Characterizing the Structure of the Boundary Layer with AERI and Doppler Lidar. ASR PI Meeting, Potomac, MD, USA

Blumberg, W. G., D. D. Turner, and P. Klein, 2013: Developing a Statistical Thermodynamic Profiling Retrieval for the AERI. Gordon Research Conference for Radiation and Climate, New London, NH, USA

Blumberg, W. G., P. Klein, and D. D. Turner, 2013: Developing a Statistical Thermodynamic Profiling Retrieval for the AERI. 17th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Austin, TX, USA.

Yuhas, J. A., **W. G. Blumberg**, K. Halbert*, C. Balboni*, L. Wallis*, and E. Mushlitz*, 2013: The Concord-Carlisle High School / Oklahoma University Forecasting Group - An experiment in teaching through social media. 22nd Symposium on Education, Austin, TX, USA

Halbert, K. T.* and **W. G. Blumberg**, 2013: Forecasting and Analysis in Python: So Easy, a Caveman Can Do It. 3rd Symposium on Advances in Modeling and Analysis Using Python, Austin, TX, USA

Halbert, K. T.* and **W. G. Blumberg**, 2012: Utilizing Divergence Tendency in Forecasting Convective Initiation. 26th Conference on Severe Local Storms, Nashville, TN, USA²

Blumberg, W. G., S. Malla, D. V. Morris and H. M. Mogil, 2012: Evaluating a Nationwide Summer Weather Camp Program. 21st Symposium on Education, New Orleans, LA, USA

Blumberg, W. G., K. A. Kloesel, and R. Edwards, 2011: Investigations of hazardous weather preparedness at amusement parks. 2011 National Severe Weather Workshop, Norman, OK, USA

Blumberg, W. G., K. A. Kloesel, and R. Edwards, 2011: Investigations of hazardous weather preparedness at amusement parks. 10th Annual Student Conference, Seattle, WA, USA

Bain, A. L., K. D. Sherburn, N. R. Ramsey, and **W. G. Blumberg**, 2011: Oklahoma Weather Lab: An opportunity for operational meteorology for students at the University of Oklahoma. 10th Annual Student Conference, Seattle, WA, USA

Lopes, R., **W. G. Blumberg**, C. B. Rubin, D. Neal, K. Stevens, 2010: Using Social Media in Disaster Preparedness and Response Breakout Session. 13th Annual Emergency Management Higher Education Conference, Emmitsburg, MD, USA

¹ paper won an award.

* undergraduate or high school co-author.

Students Mentored

Eric Allen: NASA Intern for Wallops Flight Facility, Summer 2020
Matt Bolton: NCAS-M weather camp alumnus, 2015 - 2018
Sam Degelia: research assistant as OU meteorology senior, 2014 - 2015
Kelton Halbert: NCAS-M weather camp alumnus, 2011 - 2013
Olivia Braunstein: Morristown-Beard School, 2013 - 2015
Sam Nadler: Morristown-Beard School, 2013 - 2015
Celeste Balboni: Concord-Carlisle high school student, 2012 - 2013
Lili Wallis: Concord-Carlisle high school student, 2012 - 2013
Emily Mushlitz: Concord-Carlisle high school student, 2012 - 2013
Joe Puma: NCAS-M weather camp alumnus, 2010 - 2013
Rachel Norris: NCAS-M weather camp alumnus, 2013 - 2016

Leadership and Service

NASA Goddard Association of Postdoctoral and Early Career Scholars	Member
Range Commanders' Council DFO Common Standards Working Group	Member, meteorology consultant
AMS Nationwide Network of Networks Committee	Member
2016, 2017 Spring OWL General Meeting	Developed and led forecasting challenges
Serve Moore, OK Tornado Cleanup	Volunteer Weather Forecaster
National Weather Camp Program Planning Committee	Member
Foot's Forecast	Severe Weather Advisor and Education Consultant
Oklahoma Weather Lab (OWL)	Director of Development, 2010-2011
National Severe Weather Workshop 2011	Volunteer Weather Briefer

Software Development

SHARPPy

SOUNDING AND HODOGRAPH ANALYSIS AND RESEARCH PACKAGE IN PYTHON

April 2014 – Current

- SHARPPy provides an open-source set of sounding and hodograph analysis routines to the meteorological community. It is used worldwide and the package has been referenced nearly 100 times in the peer-reviewed literature. SHARPPy development involves collaborations with NOAA Storm Prediction Center forecasters and is co-developed with Kelton Halbert (University of Wisconsin-Madison) and Tim Supinie (OU/CAPS).

MWRoe/AERloe

OPTIMAL ESTIMATION RETRIEVALS FOR GROUND-BASED MICROWAVE AND IR SENSORS

April 2013 – May 2018

- MWRoe/AERloe are retrieval algorithms using the optimum estimation method to solve for the thermodynamic profiles, cloud properties, and trace gas concentrations from ground-based active and passive sensors. Developed with Dave Turner (NOAA/ESRL) and described in Turner and Blumberg (2019). These two algorithms have been integrated into and succeeded by the TROPoe software package.

Languages: Python, IDL, FORTRAN, C++, C

Awards, Honors, and Grants

NASA SED Diversity, Inclusion, and Equity Award	August 2021
NASA Postdoctoral Fellowship	July 2018 - present
Alan R. Moller Severe Weather Education/Research Scholarship	March 2009