

2nd GEWEX Earth's Energy Imbalance Assessment Workshop

Logistics

When: June 1-5, 8:30 am - 6:00 pm

Where: Justine Ballroom, Hotel Dena, Pasadena, CA

Agenda with Presentations: <https://www.gewexevents.org/meetings/eei2026/agenda/>

Day 1 Agenda, June 1, 2026

Setting the stage		
08:00	Registration	Wing Sze Lui-Small, JPL
08:30	Logistics	Maria Hakuba, JPL
08:40	NASA Welcome	David Considine, NASA
08:50	JPL Welcome	Duane Waliser, JPL
09:00	Workshop goals & priorities	Maria Hakuba, JPL
09:20	Introductory Talk	Graeme Stephens, JPL (invited)
09:40	How the 26-year CERES record of Earth's energy imbalance challenges understanding	Clare Singer (invited) University of Colorado, Boulder
10:00	BREAK	
Theme 1: Science of Earth's Energy Imbalance		
Chairs: Senne van Loon, Mark Zelinka, Patrick Taylor		
10:20	Inferred surface energy fluxes: uncertainties and EO-based land constraints	Susanna Winkelbauer (v) University of Vienna
10:40	The Atmosphere's Substantial Role in Interannual Variability of Earth's Energy Imbalance	Michael Mayer (v) University of Vienna
11:00	Declining wildfire and biomass burning aerosol emissions may explain increasing energy imbalance, and could fast track future global warming	Thorsten Mauritsen (v) Stockholm University
11:20	Assessment of the Earth's Net Incoming Energy	Greg Kopp (v) Univ. of Colorado/LASP, Boulder
11:40	Discussion Theme 1 - Part 1	Chairs: Senne van Loon, Mark Zelinka, Patrick Taylor
12:10	LUNCH	
Theme 1: Science of Earth's Energy Imbalance		
13:40	Constraining Ocean-Surface Net Heat Flux for Global and Regional EEI Closure	Lisan Yu Woods Hole Oceanographic Inst.
14:00	How Historical and Future Radiative Forcing Shapes the Evolution and Spatial Structure of Earth's Energy Imbalance	Lynn Hirose Princeton University
14:20	Excessive 21st century solar absorption in the North Pacific basin attributed to poleward shift of the storm tracks and to aerosol emission decreases	George Tselioudis NASA GISS, Columbia University
14:40	Climate models with moderate climate sensitivity best simulate the magnitude of Earth's energy imbalance	Kyriaki Bimpiri (v) Stockholm University
15:00	Limits in the Current EEI Observing System and Scientific Benefits of Continuity and Improved Accuracy, Precision and Stability	Benoit Meyssignac LEGOS, Toulouse

15:20	BREAK	
15:40	Posters Theme 1	
Theme 1: Science of EEI - Energy & Water Cycle focus		
16:20	An observational constraint on land surface energy partitioning reveals stronger future atmospheric heating over land	Weijie Zhang UC Berkeley
16:40	Gauge-Invariant Atmospheric Energy Flux: Extracting Key Structures in Atmospheric Energy Transport	Kuniaki Inoue Columbia University & NASA GISS
17:00	Discussion Theme 1 - Part 2	Chairs: Senne van Loon, Mark Zelinka, Patrick Taylor
17:40	ADJOURN	

Day 2 Agenda, June 2, 2026

Theme 2: Advances in estimating Ocean Heat Content and Earth's heat inventory		
Chairs: Donata Giglio, Andrew Delman, Lisan Yu		
08:00	Registration	Wing Sze Lui-Small, JPL
08:30	Logistics	Maria Hakuba, JPL
08:40	Earth's heat inventory	Karina v. Schuckman (v) (invited) Mercator Ocean, France
09:00	Towards daily, near-global ground heat flux estimates from machine learning methods	Francisco José Cuesta-Valero (v) Leipzig University
09:20	Assessing regional Ocean Heat Content based on a consistently processed GRACE(-FO) gravity, satellite altimetry and in-situ Argo profile data record within a joint inversion scheme	Bernd Uebbing (v) University of Bonn
09:40	Estimating Ocean Heat Content from the Propagation Speed of Long-Range Internal Tides	Zhongxiang Zhao University of Washington
10:00	BREAK	
Theme 2: In-situ Ocean Focus		
10:20	MapEval4OceanHeat (ME4OH): an objective assessment of mapping methods used to estimate ocean heat content change	Donata Giglio (invited) University of Colorado, Boulder
10:40	Locally stationary Argo Ocean heat content estimates: Modeling, validation and uncertainty quantification	Mikael Kuusela (v) Carnegie Mellon University
11:00	Advances in spatio-temporal modeling of ocean heat content with Argo floats	Thea Sukianto Carnegie Mellon University
11:20	Updates and Improvements to RFROM ocean heat content estimates	John Lyman (v) PMEL/CIMAR
11:40	Discussion Theme 2 - Part 1	Chairs: Donata Giglio, Andrew Delman, Lisan Yu
12:10	LUNCH	
13:40	Posters Theme 2	
Theme 2: Satellite, Model and Deep Ocean Focus		
14:10	A Shortened History of Ocean Temperature and Heat Flux Determinations	Carl Wunsch (v) (invited)
14:40	Inferring Ocean Heat Uptake from Satellite Gravimetry and Altimetry	Andrew Delman, JPL
15:00	Ocean heat uptake estimate from a combination of Altimetry, gravimetry and in-situ data allows to close the energy budget at the $\pm 0.5 \text{ Wm}^{-2}$ level (2σ) on yearly time scale	Thomas Duvignacq CNRS / LEGOS, France
15:20	Uncertainty in Ocean heat uptake estimate from the combination of Altimetry, gravimetry and in-situ data	Robin Fraudeau Magellium, France

15:40	BREAK	
16:00	OHC Variability from the Latest ECCO State Estimate	Ian Fenty, JPL
16:20	Ocean Heat uptake and its relationship to rising SST in the NCEI and SODA4 products	Jim Carton University of Maryland
16:40	Assessing Deep and Abyssal Ocean Heat Content Changes with a Dynamically Consistent Ocean State Estimate	Xinfeng Liang University of Delaware
17:00	Refined Estimates of Global Ocean Deep and Abyssal Decadal Warming Trends	Gregory Johnson (v) Univ. of Washington & NOAA PMEL
17:20	Discussion Theme 2 - Part 2	Chairs: Donata Giglio, Andrew Delman, Lisan Yu
18:00	ADJOURN	

Day 3 Agenda, June 3, 2026

Theme 3: Earth radiation at the TOA, surface and in the atmosphere		
Chairs: Ryan Kramer, George Tselioudis, Maria Hakuba		
08:00	Registration	Wing Sze Lui-Small, JPL
08:30	Logistics	Maria Hakuba, JPL
08:40	Attribution of the Earth's Energy Imbalance and implications for the future	Gavin Schmidt (v) NASA
09:00	Negligible Contribution from Aerosols to Recent Trends in Earth's Energy Imbalance	Chanyoung Park (v) University of Miami
09:20	Investigating regional contributions to anomalies of global TOA, surface, and atmospheric irradiance change using satellite observations	Seiji Kato (v) NASA Langley Research Center
09:40	Developing Radiative Forcing & Feedback Climate Data Records for Understanding Observed Radiation Trends and Evaluating Models	Ryan Kramer (v) NOAA GFDL
10:00	BREAK	
10:20	Observation-based Estimate of Radiative Feedback and Effective Radiative Forcing	Senne Van Loon Colorado State University
10:40	Observed trends in the Earth's energy imbalance suggest a potentially high equilibrium climate sensitivity	Xianan Jiang UCLA
11:00	Large-Scale Shifts in Regional Atmospheric Radiative Absorption Driven by CMIP7 Aerosol Forcing Updates	Chongxing Fan Princeton University
11:20	Discussion Theme 3 - Part 1	Chairs: Ryan Kramer, George Tselioudis, Maria Hakuba
12:00	LUNCH & Transfer to JPL	
13:00	JPL TOUR START	
15:30	JPL TOUR END	
17:30	No-Host Dinner	

Day 4 Agenda, June 4, 2026

Theme 3: Earth radiation at the TOA, surface and in the atmosphere		
Chairs: Ryan Kramer, George Tselioudis, Maria Hakuba		
08:00	Registration	Wing Sze Lui-Small, JPL
08:30	Logistics	Maria Hakuba, JPL
08:40	Recent cloud trends and extremes reaffirm established bounds on cloud feedback and aerosol-cloud interactions	Mark Zelinka (invited) Lawrence Livermore National Lab

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09:00	How the planet's prevailing cloud systems govern the variability of net TOA radiation and EEI	Lazaros Oreopoulos NASA-GSFC
09:20	Earth hemispheric albedo symmetries and their implication for EEI	Jianhao Zhang Univ. of Colo. Boulder/NOAA CSL
09:40	Assessing Earth's energy imbalance trend in the early 21st century in two high-resolution coupled models	Yan-Ting Chen Princeton University
10:00	BREAK	
Theme 3: Earth radiation at the TOA, surface and in the atmosphere		
10:20	Assessing the reliability of surface radiation measurements for trends within surface energy budget observations	Laura Riihimaki (invited) CIRES/CU Boulder/NOAA GML
10:40	Confirming a Critical Foundation of Global Warming: Direct Observational Evidence from Space of the Impact of CO2 Growth on Longwave Spectral Radiances	Joao Teixeira, JPL
11:00	Global trends in Earth's spectrally resolved outgoing longwave radiation	Mareya Saba Princeton University
11:20	SORACES: Method and instrument design for more accurate estimation of annual changes in spectral outgoing radiation (200-1100 nm)	Christoph Jacobi (v) Leipzig University
11:40	Posters Theme 3	
12:30	LUNCH	
Theme 3: Earth radiation at the TOA, surface and in the atmosphere		
14:00	Discussion Theme 3 - Part 2	Chairs: Ryan Kramer, George Tselioudis, Maria Hakuba
Theme 4: Future Ocean, ERB and EEI Observing Systems Chairs: Mark Richardson, James Reagan, Benoit Meyssignac		
14:40	Framework for an Earth Radiation Budget Satellite Mission: An Imperative to Track and Understand Earth's Energy Imbalance	Norman Loeb (invited) NASA Langley Research Center
15:00	Earth's Radiation Budget Observations from Space: Progress on and Risks to Continuity	Peter Pilewskie (invited) LASP/CU Boulder
15:20	Prospects for Earth Energy Imbalance Research and Applications within the NASA Earth Science Division	David Considine (v) NASA
15:40	BREAK	
16:00	What are the data requirements for addressing science questions as the radiation budget record gets longer?	Mark Richardson, JPL
16:20	Exploring the angular dimension of Earth's Radiation Budget with Libera	Jake Gristey CIRES / NOAA CSL / LASP
16:40	ECO, an Earth Explorer 12 candidate: unveiling EEI to steer climate action	Thomas August ESA
17:00	Bridging the Gap: Addressing Earth Radiation Budget Continuity via a Novel SmallSat Approach	Alexander Jarnot NASA Langley Research Center
17:20	Discussion Theme 4 - Part 1	Chairs: Mark Richardson, James Reagan, Benoit Meyssignac
17:40	ADJOURN	

Day 5 Agenda, June 5, 2026

Theme 4: Future Ocean, ERB and EEI Observing Systems Chairs: Mark Richardson, James Reagan, Benoit Meyssignac		
08:00	Registration	Wing Sze Lui-Small, JPL
08:30	Logistics	Maria Hakuba, JPL

08:40	The Earth Climate Observatory space mission concept for the monitoring of the Earth Energy Imbalance and the Earth Radiation Budget	Steven Dewitte (v) Royal Observatory of Belgium
09:00	Sampling the Earth's energy imbalance with the Earth Climate Observatory (ECO) constellation	Thomas Hocking (v) Stockholm University
09:20	On the horizon: the Earth Climate Observatory (ECO)	Björn Linder (v) Stockholm University
09:40	Measuring the Earth's Energy Imbalance from satellite accelerometry	Lluc R. Busquets Soler Univ. of Colorado, Boulder/JPL
10:00	Feasibility study of a time-mean Earth energy imbalance estimate derived from Satellite Laser Ranging measurement of the Earth Radiation Pressure	Alice Chapiron CNES / GET, University of Toulouse
10:20	BREAK	
Theme 4: Future Ocean, ERB and EEI Observing Systems		
10:40	NASA Atmosphere Investigator Meeting Out-brief	Patrick Taylor NASA Langley Research Center
11:00	Discussion Theme 4 - Part 2	Chairs: Mark Richardson, James Reagan, Benoit Meyssignac
11:40	Recommendations by Theme & Wrap-up	Theme Chairs
12:30	Meeting Adjourn/LUNCH	
14:00	GDAP Report planning	Workshop Chairs (Open to all)
16:00	ADJOURN	

Posters

Theme 1: Science of Earth's Energy Imbalance		
01v	Expectations for EEI trends from reduced-complexity frameworks	Boriana Chtirkova (v) Princeton University chtirkova@princeton.edu
02v	Coupling Between Mesoscale Organization, Propagation Speed, and Dust Loading in Extreme Rainfall-Producing Mesoscale Convective Systems over West Africa.	Dame Gueye (v) University Gaston Berger, Senegal gueye.dame2@ugb.edu.sn
01	Early-Stage Investigation of Optical Effects of Black Carbon Inclusions within Cloud Droplets	Hasnaa Shosha Michigan Technological University
02	Application of Data Science and ICT for Climate and Ocean Observation: Critical Infrastructure Required for Communication.	Kalpana Chaudhari Shah And Anchor Kutchhi Engineering College, And ISDR
03	GRACE water storage change constrains land energy partitioning and co-evolves with CERES net radiation	Elahe Tajfar, JPL
03v	Flux-Driven Surface Temperature Responses to Forest-Cropland Transitions in India Using the ICON Model	Jyoti Sharma (v) Indian Institute of Science Education and Research Bhopal jyoti21@iiserb.ac.in
04	Above ground energy and water fluxes reveal groundwater dynamics in tropical peatlands	Rui Cheng Claremont McKenna College
Theme 2: Advances in estimating Ocean Heat Content and Earth's heat inventory		
05	Mode water, a key pathway for earth energy imbalance to deep ocean	Yuanyuan Song, MIT
06	Sensitivity of Global Ocean Heat Content Estimates Under Different Vertical and Horizontal Resolutions	James Reagan NOAA/NESDIS/NCEI

07	A new analytical framework for estimating ocean heat content from satellite altimetry, space gravimetry, and in situ observations	Sebastien Fourest CNES, France
Theme 3: Earth radiation at the TOA, surface and in the atmosphere		
04v	The Pattern Effect Down Under: Southern Ocean cloud regime transitions control evolution of climate sensitivity across climate models	Killian McSweeney (v) Colorado State University killian.mcsweeney@colostate.edu
05v	Integer structures in 30 years of GEWEX data	Miklos Zagoni (v) Eotvos Lorand University miklos.zagoni@gmail.com
08	Spatiotemporal Variability and Trends of Aerosols by using Long-Term Earth Observation Records	Muhammad Zeeshaan Shahid Univ. of Punjab, Lahore Pakistan
09	Spatial structure of land evapotranspiration partitioning as a missing constraint on Earth's radiative variability	Elahe Tajfar, JPL
10	Top-of-Atmosphere Longwave Flux Retrievals from AIRS Using CERES and Machine Learning	Chris Wilson, JPL
11	New Hyperspectral Infrared Sounder Products and Tools for Characterizing Earth's Radiation Budget	Qing Yue, JPL
12	Tropospheric NO ₂ Variability from Sentinel-5P as a Constraint on Short-Lived Anthropogenic Radiative Forcing Relevant to Earth's Energy Imbalance	Venkata Sri Varshini Budi International Space University, France
13	ESA's Ninth Earth Explorer mission FORUM - characterizing the far-infrared spectrum of Earth's outgoing long-wave radiation	Ed Malina, ESA
14	EarthCARE Synergy Products and Their Contribution to Constraining Earth's Energy Imbalance	Ed Malina, ESA