



Jet Propulsion Laboratory
California Institute of Technology



EARTH ENERGY IMBALANCE ASSESSMENT WORKSHOP

15-17 May 2023 | ESA-ESRIN
Frascati (Rome), Italy

HYBRID EVENT

PROGRAMME

Monday 15 May 2023

DAY 1

TIME	TITLE	
	OPENING SESSION Chairs: Benoît Meyssignac and Jérôme Benveniste	
9:00	Welcome From ESA and Sponsors (WCRP, NASA, NOAA) + Logistics Briefing (ESA)	
9:25	Introductory science talk	Benoit Meyssignac
	SESSION 1: Science questions associated with EEI Co-Chairs: Seiji Kato, Benoit Meyssignac, Maria Hakuba, Norman Loeb	
9:35	Changes in Earth's Energy Imbalance Since 2000	Norman Loeb
9:55	In Search of Constraints: The Critical Role of EEI in Closing the Global Energy and Water Cycles	Tristan L'Ecuyer
10:15	Heat stored in the Earth system 1960-2020: Where does the energy go?	Karina Von Schuckmann
10:35	Trends and variability in Earth's Energy Imbalance since 2006	Maria Hakuba
10:55-11:20	COFFEE BREAK	

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	SESSION 1: Science questions associated with EEI Co-Chairs: Seiji Kato, Benoit Meyssignac, Maria Hakuba, Norman Loeb	
11:20	Summary of Earth Energy Balance Assessment Report from the 2022 BIPM-WMO Metrology for Climate Action Workshop	Greg Kopp
11:37	Historical observations of the Earth energy budget show the time-variations of the climate feedback parameter are associated with the Pacific Decadal Oscillation	Benoit Meyssignac
11:54	Spectrally Resolved Changes in Longwave EEI from Global-Scale Line-by-Line Calculations and Observations	David Paynter
12:11	Reconciling and Improving Formulations for Thermodynamics and Conservation Principles in Earth System Models (ESMs)	Peter Lauritzen
12:28	Intermodel spread of ocean heat uptake efficiency traced to ocean salinity	Brian Soden
12:45	On how Deep Argo can help close the sea level budget	Nathalie Zilberman/William Llovel
13:02-14:00	LUNCH (Canteen is available after 13:00, not before)	

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14:00-15:00	SESSION 1 - Discussion Chairs: All of the above co-chairs of Session Blocks	
15:00	SESSION 2: Space techniques to measure the EEI Co-Chairs: Felix Landerer, Maria Hakuba, Benoit Meyssignac	
15:00	Understanding the non-closure of the global mean sea level budget for the EEI estimate	Anne Barnoud
15:20	Diagnosing recent halosteric sea level changes	James Reagan
15:40	Earth's Energy Imbalance from the geodetic ocean perspective	Felix Landerer
16:00	Consistency of a space geodetic observations-based Earth energy imbalance estimate with various estimates from the scientific community	Florence Marti
16:20-16:50	COFFEE BREAK	

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DAY 1

	SESSION 2: Space techniques to measure the EEI Co-Chairs: Felix Landerer, Maria Hakuba, Benoit Meyssignac	
16:50	<u>In calculating and propagating uncertainties from space altimetry measurements to the earth energy imbalance</u>	Michaël Ablain
17:10	<u>From the uncertainties in the barystatic sea-level rise to uncertainty in the geodetic estimate of the Earth Energy Imbalance</u>	Alejandro Blazquez
17:30	<u>A novel approach for assessing regionally differentiated ocean contributions to Earth Energy Imbalance from GRACE(-FO) and multi-mission altimetry</u>	Bernd Uebbing
17:50	Estimating Upper Ocean Heat Content in the North Atlantic Ocean With The NOAA Next-Generation Enterprise Ocean Heat Content Algorithm	Deirdre Byrne
18:10	<u>Recent updates to uncertainties in global and regional sea level trends and accelerations derived from satellite radar altimetry</u>	Pierre Prandi
18:30-20:00	POSTER SESSION & Ice Breaker	
20:00	Bus to Frascati	

Tuesday 16 May 2023

DAY 2

TIME	TITLE	
09:00-10:00	SESSION 2 - Discussion Chairs: All of the above co-chairs of Session Blocks	
10:00	SESSION 3: In situ techniques to measure the EEI Co-Chairs: Mickael Kuusela, Lijing Cheng, Tim Boyer	
10:00	GEWEX Earth's Energy Imbalance Comparison of in situ Ocean Heat Content time series	Tim Boyer
10:20	An update for IAP ocean heat content data and implications for EEI	Lijing Cheng
10:40	Estimating Ocean Global Heat Content and Steric Sea Level using optimal interpolation tool for synthesis of global in situ dataset (ISAS)	Nicolas Kolodziejczyk
11:00-11:30	COFFEE BREAK	

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DAY 2

11:30	Evaluating past ocean heat content change using synthetic observations: the MapEval4OceanHeat initiative	Matt Palmer
11:50	Locally Stationary Mapping and Uncertainty Quantification of Global Ocean Heat Content with Argo Floats	Mikael Kuusela
12:10	Toward improved ocean heat content mapping and uncertainty quantification by modeling vertical spatio-temporal dependence	Thea Sukianto
12:30	Bias in Argo salinity, the impact, and the best ways to use Argo data	Annie Wong
12:50	Regional changes in OHC on seasonal to longer timescales.	Donata Giglio
13:05-14:00	LUNCH (Canteen is available after 13:00, not before)	
14:00-15:00	SESSION 3 - Discussion Chairs: All of the above co-chairs of Session Blocks	

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	SESSION 4: Reanalyses techniques to measure the EEI and Surface flux component approach Co-Chairs: Gael Forget, Jim Carton, Seiji Kato	
15:00	Regional Earth Energy Imbalance in the Sunlit Ocean Layer	Gael Forget
15:20	Assessing ocean heat content and its uncertainty from ensemble ocean reanalyses	Andrea Storto
15:40	OHU 1992-2022 from the latest ECCO global ocean state estimate and the implications of outstanding observational data misfits	Ian Fenty
16:00-16:30	COFFEE BREAK	
16:30	Warming Trend and Ocean Heat Balance in the Gulf of Mexico between 1970 and 2020	Zhankun Wang
16:50	On the usefulness of reanalyses for estimation of global and regional EEI	Michael Mayer

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17:10	Regional energy budget over ocean derived from satellite observations	Seiji Kato
17:30	A quantitative assessment of air-sea heat flux trends from ERA5 since 1950 in the North Atlantic basin	Johannes Mayer
17:50	Global/regional EEI estimates from ocean/sea ice reanalyse	Jim Carton
18:10-19:00	POSTER SESSION	
19:15	Bus to restaurant	
19:30	Social Dinner (Sponsored by the French Space Agency, CNES, and CNRS)	

Wednesday 17 May 2023

DAY 3

TIME	TITLE	
09:00-10:00	SESSION 4 - Discussion Chairs: All of the above co-chairs of Session Blocks	
10:00	SESSION 5: Future concepts to measure EEI Co-Chairs: Norman Loeb, Jérôme Benveniste	
10:00	On the future of Earth radiation and energy imbalance measurements	Maria Hakuba
10:20	Traceable Radiometry Underpinning Terrestrial- and Helio- Studies (TRUTHS) - A 'gold standard' imaging spectrometer in space to support climate emergency research	Nigel Fox
10:40	The Earth Climate Observatory: a space mission concept for the monitoring of the Earth Energy Imbalance	Steven Dewitte
11:00-11:30	COFFEE BREAK	

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11:30	Sampling strategies for Earth Energy Imbalance measurements using a satellite radiometer	Thomas Hocking
11:50	Ocean conductivity content as a potential constraint on ocean heat content estimates	David Trossman
12:10-13:00	SESSION 5 - Discussion Chairs: All of the above co-chairs of Session Blocks	
13:00-14:00	LUNCH (Canteen is available after 13:00, not before)	
14:00-16:00	Overall Discussion Chairs: All of the above co-chairs of all Session	
16:00-16:30	COFFEE BREAK	

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DAY 3

16:30	CLOSING SESSION	
	Chairs: Benoît Meyssignac, Maria Hakuba, Sieji Kato, Tim Boyer and Jérôme Benveniste	
16:30	Recommendation Reports from all Session Chairs (10' each = 50')	
17:20-17:45	<u>Final Discussion on Recommendations and Closing Remarks</u>	
17:45	End of Workshop	

Posters

Session	Posters		
1	1	Revisiting the global energy budget dynamics with a variable climate feedback parameter	Benoit Meyssignac
1	2	Theoretical approach to constrain the magnitude of EEI	Miklos Zagoni
2	3	Global Ocean Heat Content Observation Capabilities of Current and Future Satellite Gravity Missions	Marius Schlaak
2	4	Towards determining the absolute value of the Earth Energy Imbalance with CLARA onboard NorSat-1	Margit Haberreiter
3	5	Updated and improved estimate of uncertainties of XBT measurements in the Mediterranean Sea	Franco Reseghetti
3	6	Robust increase of Earth's Energy Imbalance observed since at least sixty years	Audrey Minière
4	7	Budyko-Sellers 2.0: The Fractional Energy Balance Equation (FEBE)	Shaun Lovejoy
4	8	Estimating the North Atlantic meridional heat transport since 2002 from the North Atlantic energy budget derived from satellite data.	Benoit Meyssignac
5	9	Direct Earth's Energy Imbalance Measured From Space	Manuel Rodrigues

Detailed logistic and scientific information
can be found at: www.wcrp-esa-eeia-2023.org

