Session: B4 Oral presentation

Objectively Analyzed air-sea Fluxes (OAFlux) for improved representation of short and long-term changes in global ocean heat, freshwater, and momentum fluxes

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Climate data records of air-sea heat (latent, sensible, shortwave, and longwave), momentum, and freshwater (evaporation) fluxes are highly needed for understanding and attributing causes of climate change and variability and for assessing global energy budget and water cycle associated with the changing climate. However, almost all components of air-sea exchange processes are not directly observed over the global oceans. Constructing global air-sea fluxes requires the use of flux bulk parameterizations with surface meteorological variables (e.g., wind speed, temperature, humidity, cloud cover, etc) as input. Data sources for these flux-related variables include in situ measurements, satellite remote sensing, and atmospheric reanalyses, all of which have at least one of the four deficiencies: (1) incomplete global coverage, (2) relatively short time series, (3) systematic bias, and (4) random error. In the past 10 years, efforts have been made at WHOI to improve estimates of global air-sea fluxes through synthesis of advantages of existing data sources. The efforts have led to establishing the project of Objectively Analyzed air-sea heat Fluxes (OAFlux). The improvement is made through implementing a two-step approach: quantification and characterization of errors/biases in input data sources using in situ flux buoy observations as validation database, and application of advanced objective analysis approach to incorporate the error information in constructing optimal flux-related surface meteorology. The project currently online distributes 1-degree gridded global fields of ocean evaporation, latent and sensible heat fluxes since 1958, which is developed from combining multi satellite sensors and four atmospheric reanalyses to produce optimal flux-related variables and using these estimates as input to compute global fluxes from COARE algorithm 3.0. The project have recently developed high-resolution global fields of ocean vector winds from July 1987 onward through merging 11 satellite sensors including microwave radiometers and scatterometers. The improved quality of OAFlux fields has been demonstrated by many users from various applications, including climate science and climate service application. This shows that the combined use of objective analysis and in situ flux buoy validation data base are an effective platform for reducing errors/biases in input data sources, and for producing consistent long-term time series that are suitable for studying climate variation patterns in air-sea exchange processes. Striking low-frequency variations are clearly shown in OAFlux 50 year time series, and these changes have important implications for understanding global climate system in a warm climate. The OAFlux project is an-ongoing project. The current effort is directed toward a global net heat flux dataset with reduced biases/errors, especially in satellite-based surface radiation estimates.