Comments from Public Consultation on ECV Requirements 13/01 – 13/03 2020 for:

# Ocean surface heat flux

TABLE is WRONG!!! Same as the Latent one

## ECV Product: Radiative heat flux

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| --- | --- | --- | --- | --- | --- |
| **Name** | Latent heat flux | | | | |
| **Definition** | The heat exchanged between the ocean and atmosphere resulting from the balance between radiation leaving the sea surface (reflected and emitted) and radiation passing through the sea surface into the ocean; often divided into an infrared or longwave and a visible or shortwave components. | | | | |
| **Unit** |  | | | | |
| **Note** | Surface heat flux is the rate of exchange of heat, per unit area, crossing the sea surface from ocean to atmosphere. It has units Watts per squared meter. The net heat flux is the sum of turbulent (latent and sensible) fluxes and the radiative (short wave and long wave) components. Oceanographic convention is that a positive flux implies heating of the ocean. Latent heat flux is associated with the phase change of water during evaporation or condensation and proportional to evaporation. Sensible heat flux is the rate at which heat is transferred from the ocean to the atmosphere by conduction and convection. In the tropics, latent heat flux is typically an order of magnitude greater than sensible heat flux, but in polar regions they are similar in magnitude. Downward shortwave at the surface is predominantly visible light. Upward shortwave flux is reflected sunlight, often determined by parameterization of surface albedo. While sensible, latent, and longwave heat fluxes occur at the sea surface, the shortwave radiation penetrates seawater and is absorbed with depth. These fluxes are major contributors to energy and moisture budgets, and are largely responsible for thermodynamic coupling of the ocean and atmosphere on all scales. Variability of these fluxes is in part related to largescale variability in weather (climate) patterns. For most regions, the two major components are the net shortwave gain by the ocean and the latent heat flux loss by the ocean. | | | | |
| **Requirements** | | | | | |
| **Item needed** | **Unit** | **Metric** | **[1]** | **Value** | **Derivation and References and Standards** |
| **Horizontal Resolution** | km |  | G | 10 |  |
| B | 25 |  |
| T | 100 |  |
| **Vertical Resolution** |  |  | G |  |  |
| B |  |  |
| T |  |  |
| **Temporal Resolution** |  |  | G | hourly |  |
| B | 3-hourly |  |
| T | Daily |  |
| **Timeliness** |  |  | G |  |  |
| B |  |  |
| T |  |  |
| **Required Measurement Uncertainty** | W/m2 |  | G | 10 | . |
| B | 10 |  |
| T | 10 |  |
| **Stability** | W/m2 |  | G | 2 |  |
| B | 2 |  |
| T | 2 |  |
| **Standards and References** |  | | | | |
| **Adaptation and Extremes** | | | | | |
|  | Relevant? (Yes/No) | Sugg. Req. sufficient? (Yes/No) | Explanation | | |
| **Adaptation[2]** |  |  |  | | |
| **Extremes[3]** |  |  |  | | |

[1]Goal (G); Breakthrough (B)(not mandatory, more as one possible); Threshold (T), for definitions see [Guidelines](http://tiny.cc/ecv-review)

[2] Is the ECV Product directly relevant to support Climate Adaptation?

[3] Can the ECV Product be used to monitor climate extremes or aspects of extremes?

### Comment 1

|  |  |
| --- | --- |
| Author: Patrick Hyder | Email: patrick.hyder@googlemail.com |
| General comment relating to all ocean surface heat flux components:  The current community view of the requirement for air-sea fluxes is summarised by Cronin et al, 2019 (see below). As technology becomes available, higher accuracy would be desirable to meet science objectives.  Meghan F. Cronin et al (2019). Air-Sea Fluxes With a Focus on Heat and Momentum, Frontiers in Marine Science, 6, article 430, p1-30.  https://www.frontiersin.org/articles/10.3389/fmars.2019.00430/full | |

### Comment 2

|  |  |
| --- | --- |
| Author: Patrick Hyder | Email: patrick.hyder@googlemail.com |
| The name in the table seems to say latent heat rather that radiative heat flux? Apologies if I have misunderstood the document. | |

### Comment 3

|  |  |
| --- | --- |
| Author: ECMWF | Email: ecresgcosreqs@gmail.com |
| Another general comment applying to all components of the ocean surface energy flux:  The "threshold" temporal and spatial resolution given in the table may be appropriate for ocean data assimilation purposes, but for climate monitoring it is too strict. For climate monitoring more reasonable values may be 250km and monthly as "threshold" resolution. I presume the choice of values depends on the target group.  Uncertainty: 10Wm-2 as a "threshold" value is very ambitious. This may be achievable by single sites where in-situ measurements are taken, but I am not aware of a global data set which satisfies this requiremement (neither reanalyses nor satellite-based data sets) in a point-wise sense. Maybe in a global ocean average sense.  It may also be worth considering specifying requirements for ocean net surface flux (i.e. the sum of turbulent and radiative fluxes), as this is very relevant from a climate monitoring stand point (e.g. through its relationship with ocean heat content changes) and allows for an alternative method of estimation, namely as a residual from the atmospheric energy budget, where satellite-based radiative fluxes at top-of-the-atmosphere are combined with atmospheric lateral energy transports taken from reanalysis. Net surface energy flux inferred this way may achieve point-wise uncertainties order 10Wm-2 on a monthly time scale. See Meyssignac et al (2019) and references therein. (Michael Mayer, ECMWF)  Meyssignac, Benoit, et al. "Measuring global ocean heat content to estimate the Earth energy imbalance." Frontiers in Marine Science 6 (2019): 432. | |

## ECV Product: Sensible heat flux

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| --- | --- | --- | --- | --- | --- |
| **Name** | Sensible heat flux | | | | |
| **Definition** | The heat exchanged between the atmosphere and ocean when a warmer ocean warms the air above or when a cooler ocean cools the air above. | | | | |
| **Unit** |  | | | | |
| **Note** | Surface heat flux is the rate of exchange of heat, per unit area, crossing the sea surface from ocean to atmosphere. It has units Watts per squared meter. The net heat flux is the sum of turbulent (latent and sensible) fluxes and the radiative (short wave and long wave) components. Oceanographic convention is that a positive flux implies heating of the ocean. Latent heat flux is associated with the phase change of water during evaporation or condensation and proportional to evaporation. Sensible heat flux is the rate at which heat is transferred from the ocean to the atmosphere by conduction and convection. In the tropics, latent heat flux is typically an order of magnitude greater than sensible heat flux, but in polar regions they are similar in magnitude. Downward shortwave at the surface is predominantly visible light. Upward shortwave flux is reflected sunlight, often determined by parameterization of surface albedo. While sensible, latent, and longwave heat fluxes occur at the sea surface, the shortwave radiation penetrates seawater and is absorbed with depth. These fluxes are major contributors to energy and moisture budgets, and are largely responsible for thermodynamic coupling of the ocean and atmosphere on all scales. Variability of these fluxes is in part related to largescale variability in weather (climate) patterns. For most regions, the two major components are the net shortwave gain by the ocean and the latent heat flux loss by the ocean. | | | | |
| **Requirements** | | | | | |
| **Item needed** | **Unit** | **Metric** | **[1]** | **Value** | **Derivation and References and Standards** |
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| B | 25 |  |
| T | 100 |  |
| **Vertical Resolution** |  |  | G |  |  |
| B |  |  |
| T |  |  |
| **Temporal Resolution** |  |  | G | hourly |  |
| B | 3-hourly |  |
| T | Daily |  |
| **Timeliness** |  |  | G |  |  |
| B |  |  |
| T |  |  |
| **Required Measurement Uncertainty** | W/m2 |  | G | 10 | . |
| B | 10 |  |
| T | 10 |  |
| **Stability** | W/m2 |  | G | 2 |  |
| B | 2 |  |
| T | 2 |  |
| **Standards and References** |  | | | | |
| **Adaptation and Extremes** | | | | | |
|  | Relevant? (Yes/No) | Sugg. Req. sufficient? (Yes/No) | Explanation | | |
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## ECV Product: Latent heat flux

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | Latent heat flux | | | | |
| **Definition** | The heat exchanged between the ocean and atmosphere associated with the phase change from liquid to gas of seawater during evaporation or from gas to liquid during condensation. | | | | |
| **Unit** |  | | | | |
| **Note** | Surface heat flux is the rate of exchange of heat, per unit area, crossing the sea surface from ocean to atmosphere. It has units Watts per squared meter. The net heat flux is the sum of turbulent (latent and sensible) fluxes and the radiative (short wave and long wave) components. Oceanographic convention is that a positive flux implies heating of the ocean. Latent heat flux is associated with the phase change of water during evaporation or condensation and proportional to evaporation. Sensible heat flux is the rate at which heat is transferred from the ocean to the atmosphere by conduction and convection. In the tropics, latent heat flux is typically an order of magnitude greater than sensible heat flux, but in polar regions they are similar in magnitude. Downward shortwave at the surface is predominantly visible light. Upward shortwave flux is reflected sunlight, often determined by parameterization of surface albedo. While sensible, latent, and longwave heat fluxes occur at the sea surface, the shortwave radiation penetrates seawater and is absorbed with depth. These fluxes are major contributors to energy and moisture budgets, and are largely responsible for thermodynamic coupling of the ocean and atmosphere on all scales. Variability of these fluxes is in part related to largescale variability in weather (climate) patterns. For most regions, the two major components are the net shortwave gain by the ocean and the latent heat flux loss by the ocean. | | | | |
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