ESA Support to Science Element

Ocean Heat Flux (OHF) – Minutes of teleconference on 24 June 2015

ESA Contract No. 4000111424/14/I-AM

Prepared by Jean-François Piollé, IFREMER

Reference :

Issue No.: 1.0

Date of Issue: 30 June 2015

1 AGENDA

- Introduction, status and progress over the last months : Jean-François (5-10 min)
- Status of EO gathering, archiving, and availability : Antoine (5 min)
- Status of the homogenization of turbulent fluxes : Abderrahim (+ reporting for Antoine, Sergey) (5 min)
- Status of the generation of regional heat constraints for the cage study : Karina (+ reporting for Maria, Keith (10 min)
- Status of the sensitivity studies and algorithm improvement : Abderrahim (+ reporting for Axel), (10 min)
- Status of the use improved retrieval methods for wind speed and humidity : Abderrahim (10 min)
- Status of the evaluation data sets and error characteristics : Rick (10 min)
- Status of the sensitivity examinations: Shubha, Hayley (10 min)
- Status of OHF portal : Jean François (5 min)
- Plans (tasks, future meetings, ...) (5 min)
    - Organization of the coming OHF meeting
    - Participation to meetings such as:
        - SOOS/WCRP/ESA workshop on Southern Ocean air-sea fluxes : Frascati, Italy, 21-23 September, 2015
        - Workshop on energy flow through the climate system: 29 September 01 October 2015 MetOffice - Exeter - UK
        - GEWEX (Earth Observation for Water Cycle Science 2015 20th-23rd October 2015 ESA-ESRIN, Italy)
- Actions, AOB

2 PARTICIPANTS

Abderrahim (AB), Jean-François, Antoine, Pierre-Philippe (PPM), Karina, Shuba, Hayley, Rick

3 WP 1 : REQUIREMENT BASELINE

A consolidated version (v2.1) has been delivered to ESA. Review and feedback from ESA is expected.

4 WP 2 : REFERENCE DATASET GENERATION

Antoine presented the list of reference fluxes that have been collected. They all have been homogenized to OHF grid (daily 0.25x0.25 grid), using arithmetic mean for temporal resampling and bilinear interpolation for spatial resampling. Only the latest version of HOAPS and MERRA are missing but will be completed in the next weeks.

Abderrahim presented an analysis of these re-interpolated datasets and highlighted that the interpolation did not introduce any major impact on product quality. Comparison has been performed with the resampling scheme used by Sergey Gulev (Akima interpolation) and it was shown that both methods don't exhibit any major differences. PPM raise possible impact of interpolation in high latitudes : this is acknowledged by the team but the current interpolation is deemed good enough as a starter for flux assessment and intercomparison. Further investigations aiming at the characterization of propagating flux patterns will be performed at local scales.

The 1st version of the OHF reference dataset can be considered as complete, even if further additions may be provided along the project course.

5 WP 3 : PRODUCT GENERATION, INTERCOMPARISON AND UNCERTAINTY CHARACTERIZATION

5.1 TASK 3.1

The studies performed to meet Task 3.1 requirements dealing with “Assess the impact of improved SST data” , “Assess impact of improved retrieval methods for winds and specific air humidity, and with “Assess impact of improved bulk parameterizations” , were summarized and presented.

As a part of OHF project, the sensitivity of turbulent fluxes to SST has been analyzed. To meet the requirements, Two SST products namely NOAA OISST and ESA CCI OSTIA have been used for flux calculations. Even though the two resulting flux fields exhibit quite similar spatial and temporal features, differences are depicted at various scales. The former may reach 30W/m² for latent as well as for sensible heat fluxes differences. Comparisons of the two types of fluxes against daily fluxes estimated from OceanSites buoy measurements indicate that fluxes calculated based on the use of OSTIA show better results. Such results will be shared and discussed with OHF scientific members. It is expected to use CCI SST OSTIA for the reprocessing of turbulent fluxes over global oceans.

Previous studies showed that surface winds as well as specific air humidity both require

significant improvements. New daily-averaged surface winds, including wind speed, wind direction, wind stress, and the associated components, are computed from the newly available QuikSCAT V3 L2 data. Their accuracy is mainly determined through comprehensive comparison with buoy data derived from more than 190 moorings. The results lead to significant improvements compared to previous winds used for flux calculations.
To enhance the specific air humidity derived from remotely sensed data, the new specific air humidity (Qa) is derived from the reprocessed fundamental climate data record (FCDR) SSM/I brightness temperatures (Tb). The latter are produced by the Colorado State University with NOAA funding support. A new model relating Qa to Tb is developed and validated mainly based on the of ICOADS data.

Both the new surface winds and specific humidity are used for the calculation of 10 years of daily turbulent fluxes over global oceans. The product is indicated as IFREMER V4. Report providing details of the quality of the newly flux estimates was provided to OHF members.

The presentation from PML highlighted the progress made towards task 3 and deliverable 3.1 (Flux assessment report). The methodology behind the sensitivity tests was described to remind participants of the approach. Briefly, an optical model is coupled to the general ocean turbulence model (GOTM) to derive heat fluxes and upper ocean dynamics (SST, Mixed Layer Depth). This allows for a detailed understanding of how optical characteristics influence light absorption over depth, and consequently impact upper ocean dynamics and surface heat fluxes. Application of the optical model to derive maps of light at MLD from ocean color CCI data was also described. Results were presented summarizing the completed sensitivity experiments and example satellite data processing, covering points 1, 2 and 4 in the work package. Additional work to be done was listed, including some additional sensitivity experiments to investigate the effect of non-uniform [Chl a] profiles (point 3 in work package). Questions were put to the team as to whether an additional flux product of light at MLD would be useful for the project and users. Background, methodology and results so far have been written in to a report which can be incorporated in to deliverable 3.1 as required.

Abderrahim suggested further collaboration between IFREMER and PMEL to assess the sensitivity of the heat oceanic heat budget including the fluxes generated within OHF project. The expected results would be used as indicator for flux quality.

5.2 TASK 3.3

Karina (MIO) reported the latest actions aiming at the determination of the consistency checks of the turbulent fluxes based on the cage studies. They involve two main steps namely “Development on scientific communication and valorization” and “Development of a scientific network leading into the method development of the <method of cages>”.

The overall context for the scientific communication is further developed under the auspices

of the 6th CLIVAR research focus CONCEPT-HEAT (http://www.clivar.org/about/research-foci#six) and the ISSI international working group on "Consistency of Integrated Observing Systems Monitoring the Energy Flows in the Earth System) (http://www.issibern.ch/workinggroups/monitorenergyflow/). More specifically, the scientific communication activity is related to the submission of a community perspective paper "Earth Energy Imbalance: an imperative for climate monitoring" to Nature Climate Change.

The development of a method for product error assessment of the OHF project through the "cage approach", requires the estimations of several components of the physical budget to implement the approach, and to apply this to different boxes of the global ocean. In particular, we plan to derive four components:

1 a reference estimates of box mean temporal changes for OHC
2 one reference of box mean radiative flux estimate
3 one reference estimate of lateral HF at the boundaries of each box
4 a set of box mean turbulent fluxes from the "OHF reference data set"

The current status of development for the "concept of cages" for each component i)-iv) is:

i) The software for OHC estimates is developed and will be distributed together with OHC values by MIO (task: Generation of regional heat constraints for cage study) in July 2015 to Ifremer.

ii) &iv) A scientific discussion had been established between MIO and DWD during a meeting at DWD in May 2015 in order to strengthen the scientific collaboration for the "concept of cages". Collaboration had been agreed between DWD and MIO with J. Trendmann (DWD) for ii) and A. Andersson for iv). For the latter, support from Ifremer had been agreed during a telephone discussion (A. Bentamy).

iv) A telephone meeting between MIO and University of Reading (K. Haines) took place in June 2015, and further collaboration for the method development on the "concept of cages" had been agreed (K. Haines, M. Valdivieso). In particular, this discussion was a big support in terms of scientific value for this concept idea. No agreement could be currently established for the evaluation of iv) from ocean reanalysis.

Karina stress out that getting the lateral heat flux is dependent on best effort by the University of Reading and depending on availability of resources. JFP suggested that we could process them within the project starting from ocean model data, with the advantage of being more flexible in the future to dynamically select and process a new area.

Action: Karina to investigate how we could process the lateral HF in the project

Rick (NERSC) presented the method aiming at the characterization of wind stress, latent, and sensible heat fluxes errors. It is based on the use of quite known triple collocation method. Rick showed some flux distribution results derived from buoy data provided by IFREMER. He also discussed the approach aiming at the collocation of buoy, satellite, and NWP data. In particular, he pointed out the issue dealing with data independency required by the trip method. About 5 million moored buoy observations have been identified for 1999-2009 that include all basic variables (slp, wdir, wspd, at, dpt, sst, but without wave information). The COARE-3 algorithm has been applied (effectively, this is COARE-2.6, as we are currently excluding all cool skin, wave, and rain corrections). The pdfs of shf and lhf were shown globally and take on the expected distribution (shf more Gaussian and lhf with a long tail). Distinctions according to proposed cages (regions) are also to be examined and daily averaging of the buoy data required to compare with the standardized flux products. Interpolation of products to mooring locations underway. Initially this will invalidate the independence require- ment (i.e., no interpolation from outside correlation length scale of buoy impact, as could be done by linearly interpolating across a 2-4 day analysis window). Also, three independent datasets are required for an estimate of error in all three: we plan to use 1) buoys, 2) an analysis, and 3) either a pure satellite or a forecast product (with no interpolation) or a good reference analysis, such as ECMWF, but as with the first analysis, employ a temporal interpolation from outside a window.

Rick asked for further information about buoy data quality flag.

Abderrahim suggested to use the quality flag coming with data made available by IFREMER. The latter are provided with fluxes calculated based on the use of two parameterizations COARE3 and COARE4.

6 WP 4 : OHF PORTAL

JFP gave a brief overview of current status of portal : catalogue, access to data and remote access to Nephelae platform for partners. An initial list of tools to be made available to the flux community in open source was also provided.

7 PUBLICATIONS AND CONFERENCES

JFP showed the record of publications and presentations in conferences. Each partner is requested to provide any submitted paper or presentation to JFP to keep a track of these promoting material of OHF project.

8 DELIVERABLES AND AGENDA

- D1.1 (Requirement baseline) has been delivered, with a large overdue delay.
- D2.2 (Reference dataset) is completed
- D3.1 (Flux assessment report) : the intercomparison is still ongoing (AB, Sergey, Karina, Rick) and we suggest to postpone the delivery of this report to October instead of July (resp. Karina).
- D3.2 (Handbook) and D3.3 (Flux dataset) : the production of the improved fluxes started as not yet started as sensitivity studies and analysis of inputs and parameterizations is still ongoing. We suggest to postpone this delivery to December 2015 (instead of June). We can't reasonably provide a complete package before (resp. Abderrahim).
- D4.1 (OHF portal) : the portal was delivered. It is regularly updated (product catalogue, access to OHF platform at Ifremer,...) (resp. JFP)
- D5.1 (Scientific Roadmap) : no progress was made. We suggest to mode the delivery of initial version back to end 2015 (resp. B Chapron)
- D6.1 (Outreach material) : several presentations have been made and two articles have been published in flux related newsletters (resp. Abderrahim).
- D6.6 and D6.7 (brochure and newsletter) : this task is now under the responsibility of NERSC.

This revised plan will be discussed between PPM and JFP

9 PROJECT TEAM MEETING

A new telco needs to be planned for next month.

Action: JFP to organize next telco

The next team meeting was planned originally during the CLIVAR workshop in Exteter (29 Sept-2 Oct.). PPM suggested to move this meeting back to ESA as originally planned during the SOOS week. Tentative date is now 21st September.

10 REVIEW OF ACTIONS

all open actions closed except action 15 (Sergey to provide pdf calculation tool) which is ongoing (planned visit of Sergey to Ifremer).