OSPAR EMORID riverine database:

a description of differences between the 2024 and 2025 versions

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1 CONTENTS

1 Introduction

This document lists the additional data submitted to ICG-EMO by OSPAR contracting parties and the decisions the new data (or lack thereof) necessitated. The EMORID guide still provides the main overview of the process followed and issues encountered in generating the EMORID riverine database for ecosystem modelling. Some additional rules were implemented which are listed in red in section 2.

2 Procedure

The following rules have been applied in general to fill gaps within the used databases

Actions to complete the OSPAR RID and HELCOM PLC databases

1. Missing annual flow values (blanks, NI, 0 entries) in the RID database are replaced with the mean of the reported values between 1990 and 2020 (per river, per country). Not using the whole RID time span 1989-2022 is due to suspected errors in some of the 2022 data (FR) and the low amount of data available for 1989.
2. Missing annual nutrient values (blanks, NI, 0 or not included years) are replaced with the mean of the reported values between 1990 and 2020 (per river, per country, per nutrient) for Table 6a (riverine) and Table 6b (unmonitored areas). Missing nutrient values in Table 5e (total direct discharges) are not filled, as the sources of these discharges (sewage, industrial, aquaculture, other) is not assumed to be continuous.
3. If a nutrient has no mean annual value but only a lower and an upper annual value, then the mean is calculated as (lower + upper)/2.0, due to lack of information. If only a lower or upper value is included in the database then the mean is taken as that value.
4. If no mean is available and the average of the lower and upper value is used for Total N, this value is compared with the associated reported values for NO_3 and NH_4. When the averaged value for Total N is found to be lower than the combined value of NO_3 and NH_4 only the upper value is used for Total N.
5. If no mean is available and the average of the lower and upper value is used for Total P, this value is compared with the associated reported value for PO_4. When the averaged value for Total P is found to be lower than the reported value for PO_4, then only the upper value is used for Total P.
6. Per aggregated area (direct discharges, unmonitored areas) per year a residual flow is calculated by taking the original area flow and subtracting all original riverine flow in that area from it. Any remaining flow is listed as the area flow for that unmonitored area. If the residual flow is ≤ 0 then 5% of all riverine flow in that area is selected for the unmonitored area flow for that year. The discharge values for the rivers in that area are reset to 95% of their original flow for that year. Whether this fall back option is invoked or not can change between years for any given area. Here original data refers to the data as it is in the RID database, without filling in any missing data.
7. If there are no rivers in an aggregated area (used for direct discharges and unmonitored areas) then the average of the years with positive residual flow data is used.
8. If no silicate data are available for a river/area/country, then a background concentration of 5.6 mg SiO2/l (2.6 mg Si/l) is used (European rivers dissolved mean concentration, Dürr et al, 2011).
9. Negative discharge data (inflow for sluices) have been reset to 0 to avoid issues distributing the annual load over the year as well as the seasonal signal for unmonitored areas.

Table 1. Average dissolved and particulate silica fluxes, concentrations (runoff weighted averages) and yields (area weighted averages) for the exorheic parts of the continents. Catchment surface area, discharge and runoff are given as well as % of volcanic rocks from Dürr et al. (2005). The fraction of PSi that possibly dissolves and becomes biologically available might be <1% (see discussion).

	Catchment area 10^6 km^2	Discharge km^3 y^{-1}	Runoff mm y^{-1}	Volcanic rocks (Vb+Va+1/2 Cl)[b] %	DSi mean concentration mg l^{-1} SiO_2	DSi flux Mt y^{-1} SiO_2	DSi yield t km^{-2} y^{-1} SiO_2	PSi flux Mt y^{-1} SiO_2	PSi yield t km^{-2} y^{-1} SiO_2
Africa	26.2	4130	157	4.2	12.6	52.1	2.0	528	20.1
Europe[a]	8.4	2410	285	6.9	5.6	13.5	1.6	367	43.5
North America	21.9	5880	268	11.3	8.0	47.2	2.2	1713	78.2
South America	17.4	11 850	681	10.0	9.0	106.5	6.1	1633	93.9
Asia	34.0	12 900	379	12.8	10.0	129.4	3.8	3951	116.2
Australasia	6.7	1920	284	8.4	11.8	22.6	3.3	643	95.3
Total Exorheic	114.7	39080	341	9.3	9.5	371	3.3	8835	77.0

[a] Including a small non-glaciated fraction of Greenland.
[b] Vb – Basic volcanic rocks, Va – Acid volcanic rocks, Cl – Complex lithology (consisting 1/2 of volcanic rocks, see Dürr et al., 2005).

Figure 2.1: from Dürr et al (2011).

3 HELCOM DATABASE

Data was downloaded from the HELCOM PLC database via the web portal (https://apps.nest.su.se/helcom_plc/). This data comprised rivers and unmonitored areas for the compounds NO_2, NO_3, TOxN, NH_4, TotalN, PO_4, TotalP, SPM, TOC and fresh water discharge. HELCOM countries were not asked to resubmit data, and data issues with the HELCOM PLC database were minor in any case. Sweden did submit monthly load data for their entire country so effectively Swedish HELCOM PLC loads were not used.

4 COUNTRY SPECIFIC ISSUES

4.1 BELGIUM

Belgium did not resubmit loads but responded to the improvement document. In it, Belgium supplied corrected values for Cadmium in 1993 for areas 79, 238 and 239. For the one occurrence of TotalN < NO3+NH4 and one occurrence of TotalP < PO4 it accepted the rules as proposed by ICG-EMO. Belgium also requested that for aggregated areas only the overall Coastal Area (238) was used, instead of its subdivision Western Coastal Area (239), Middle Coastal Area (241) and Eastern Coastal area (242) which occur at the usual aggregated area level. As the RID database only holds data for subarea 239 and then only for Direct Discharges (Table 5e), the RID entry for 239 was re-assigned to area 238, resulting in a spread of the reported loads over the three different E-HYPE areas that make up the Belgium North Sea coast.

4.2 DENMARK

Denmark provided no new data as it had already provided daily discharge and load values for the entire period. Hence the only addition was the use of the Silicate filler value.

4.3 FRANCE

France provided corrected loads in the original excel sheet format used for reporting (separate tables per year, compounds in columns) , prompting additional coding to bring the information in the shape of the final RID excel sheets provided for corrections. The resubmitted data for France comprised tables 6 (a, b, c), 7 and 9, so that no corrected data was submitted for direct discharges (table 5). France direct discharge loads were therefore copied from the original 5e tables and cover the years 2003, 2004, 2005 and 2009. It remains to be checked with France whether they want to report at all on direct discharges, but as direct discharges are not assumed continuous in time the inclusion of French Table 5e data will not affect the simulation period of 2014-2020 much. The resubmitted data for table 6 contained more entries than the original French data for table 6.

Additionally, Martin Plus (ICG-EMO) provided SiO2 observational data from the Naiades database for all OSPAR stations. These loads were in mmol/l, and it was unclear whether this was mmol Si/l or mmol SiO2/l. As a result the original Naiades data were downloaded for all missing, available nutrients (here Fe, Si and TOC, with Naiades nutrient IDs 1393, 1342 and 1841, respectively) for all OSPAR stations. As reconstruction of the supplied Si data from the downloaded data failed the newly downloaded Naiades data was used for the French rivers (Si, Fe, TOC) and not the previously provided Si data.

4.4 Germany

Germany provided corrected RID data. Before processing German RID data in tables 5c (aquaculture discharges) and 5d (other discharges) were removed because Germany does not report on these tables. The actual RID data however contains 0 values for 2016 for area 99 (whole country) for these tables. Germany has always reported on unmonitored areas.

4.5 Great Britain

Great Britain submitted corrected loads for all tables. The submitted data covered unmonitored areas for the compounds Cd, Pb, Hg, Cu, Zn, NH4, NO3, PO4, TotalN, TotalP and SPM.

4.6 Iceland

Iceland has not been in contact with ICG-EMO and has not submitted any corrected loads. As Iceland is not in any of the model domains for the current ICG-EMO ensemble modelling exercise this was not deemed an issue. Additionally, there were very few issues with the Icelandic RID data. The addition of a third river in the reporting in 2023 has not been taken into account in the new EMORID version. Iceland only reports on 2 (recently 3) rivers and not on any direct discharges or unmonitored areas.

4.7 Ireland

Ireland supplied corrected data but indicated that more changes were needed which could not be incorporated due to the resubmission deadline. It is therefore expected that future Irish load data may be different from that used here. Ireland has always reported on unmonitored areas.

4.8 The Netherlands

The Netherlands measures nearly 100% of their landmass, but stopped reporting for 22 entry points/rivers in 2010. Instead they focussed on the main rivers (Rhine, Meuse, North Sea Canal, Lake IJssel) that make up more than 95% of the total loads. The Netherlands has so far not reported for unmonitored areas as virtually the whole country is measured, but the decision to limit reporting to the 4 major rivers means the unreported areas now form a substantial percentage of the total land mass, though not of the total load. To account for the land area that is currently not being reported on it was decided to reinstate the smaller rivers for the purpose of this exercise while not including any unmonitored areas (as there are basically none when the 26 rivers are included) (NL HASEC HoD, Benjamin Ebbers, pers. comm.). The smaller rivers, which have almost no data after 2010, will be filled in by the usual procedure. The Gent-Terneuzen Canal (area ID 289) was not re-activated for the EMORID database as Belgium reports on this river from 2011 onwards and that timeseries is automatically extended into the past. Dutch areas Polder Effluents Oosterschelde and Polder Effluents Westerschelde (area ID 283 and 290 respectively) are reported on the river level by the Netherlands (only entries in Tables 6a and 6c) and as such are included here as rivers. The river listed as Wieringermeer was not included as no location could be found for it that did not drain into Lake Amstel (Oostoever) or Lake IJssel (Den Oever). For Texel there was no one location available and the (now discontinued) location of Zandkes was used. Monitored outflow points for Texel include Prins Hendrik, De Schans, Zandkes (discontinued), Dijkmanshuizen, Krassekeet and Eierland (ICG-EMO database), while the RID data simply reports on “Texel”.

The newly re-instated rivers have varying levels of daily flow data available to them. Some effort was put into sourcing new discharge data but as this proved very time consuming it was usually left to existing data for these points and the normal gap filling rules. This means that in the worst case (no daily flow data) the annual values are spread evenly over the year and there is no seasonal signal. The table below lists where data was sought and the results.

Data holder	Rivers	Source
Hunze & Aa	Nieuw Statenzijl Rozema Duurswold Oude zeesluis	https://meetreeksen.hunzeenaas.nl/KiWIS/
Noorderzijlvest	Damsterdiep Lake Lauwers/Cleveringsluizen	https://wamportaal.noorderzijlvest.nl/wam
Wetterskip Fryslân	Zwarte Haan Roptazijl Harlingen	https://www.wetterskipfryslan.nl/kaarten/debietenkaart
Hoogheem-raadschap Hollands Noorder kwartier (HHNK)	Texel Oostoever Helsdeur Wieringermeer	https://live.aquadesk.nl/viewer/1
Rijnland	Katwijk	https://rijnland.maps.arcgis.com/apps/instant/portfolio/index.html?appid=04473876a9fa44e4a80acb78f883ee61
Delfland	Vlotwatering Scheveningen	https://hhdelfland.maps.arcgis.com/apps/webappviewer/index.html?id=ba5a7e862b0b496a9832c0babb3c6161
Hollandse Delta	Grevelingenmeer (Bruinisse) Zuiderdiep	https://wshd.maps.arcgis.com/apps/instant/sidebar/index.html?appid=61319de0488a4559a58ed8a4853bb510
Scheldestromen	Spuikanaal Bath Gent-Terneuzen kanaal Oosterschelde (Krammersluizen) Polder Effluents Oosterschelde Polder Effluents Westerschelde	https://webviewer.hkvfewsscheldestromen.nl/
Rijkswaterstaat	Rhine, Meuse North Sea canal Lake IJssel	https://waterinfo.rws.nl

Issues:

- **Hunze & Aa**: no issues, responded to data requests but there was no time to work up the data to daily means.
- **Noorderzijlvest**: no issues, data downloadable from the webpage.
- **Wetterskip Fryslân**: have only managed to find a map, no downloadable data found yet.
- **HHNK**: claim their flow data is on Aquadesk, but there is no data there for HHNK stations. Aquadesk have confirmed they do not have flow or volume data for HHNK stations. HHNK has so far not responded to requests for discharge or volume data.
- **Rijnland**: no historic data found yet.
- **Delfland**: no historic data found yet.
- **Hollandse Delta**: no historic data found yet.
- **Scheldestromen**: have a good portal with data for Spuikanaal Bath, but hold no other stations reported to OSPAR. Rijkswaterstaat also reports on Spuikanaal Bath on WaterInfo.

- **Rijkswaterstaat** probably hold data for the Krammersluizen (Oosterschelde), Damsterdiep and Zuiderdiep, but this is not listed on the publicly available data pages (Waterinfo), requiring additional action.

It is remarkable that Dutch discharge data is so hard to find, particularly as the nutrient data has been brought together in one portal (Informatiehuis Water, https://www.waterkwaliteitsportaal.nl/). This is one of the reasons the Netherlands has limited RID reporting to their 4 major rivers, which all fall under the national governmental institute Rijkswaterstaat.

4.9 Norway

Norway implemented model changes which led to different levels of nutrient inputs as presented at the INPUT meeting in January 2025. Because of these changes they originally requested extra time to back calculate the previously RID reported loads. Ultimately, Norway could not deliver these and the reported RID loads were used. Norway has always reported on unmonitored areas.

4.10 Portugal

Portugal did not resubmit any data as the work involved was too much given the short time frame for response. Therefore, Portuguese entries from tables 5, 6 and 9 were copied from the original RID database of 2025 Jan 06. Portugal dos not report on unmonitored areas, and no attempt was made for now to address this as the country is not covered by any of the MAI ensemble participants' model domains.

4.11 Spain

Spain did not resubmit any data due to time constraints and the many corrections required. To account for ungauged areas the catchment information from the RID report 2022 was used. Catchment information in the 2022 RID report covered 45 of the 50 reported rivers. Information is missing for the Asua, Cadagua and Galindo (which are all tributaries to the estuarine part of the Nervión river) and the rivers Ason and Urola. For 41 of the reported rivers the station catchment was listed as being 100% of the total catchment in the RID report. Only 4 rivers reported a less than 100% station coverage: Eo, Pas, Guadiana and Miño, while the remaining 5 rivers are those with no catchment data at all. Total catchment sizes were found for the Asua, Ason, Cadagua, Galindo and Urola, and flow station catchment sizes were found for the Ason and Urola, but without knowledge of the nutrient station catchment size a correction could not be applied and the 100% coverage was used. Hence, Spanish unmonitored area correction was limited to the Eo, Pas, Guadiana and Miño rivers.

4.12 Sweden

Sweden has submitted monthly loads for the period 1969-2022 for monitored rivers and unmonitored areas, as well as daily flow values for all reported OSPAR and HELCOM rivers. These have been used instead of the reported riverine and unmonitored area loads from the RID and PLC databases. Sweden also submitted direct discharge loads for the OSPAR area only for the period 2003-2023. These direct discharge loads are in annual values but spatially resolved. They have not been used for EMORID, due to 1. Time issues and 2. Conformity issues. Instead, the direct discharge information from RID and PLC were used.

5 Data storage

The OSPAR ICG-EMO riverine database is kept by Sonja van Leeuwen (sonja.van.leeuwen@nioz.nl) at the NIOZ institute (Royal Netherlands Institute for Sea Research), Coastal systems (COS) department. The data is available at https://doi.org/10.25850/nioz/7b.b.th . Note that the current document describes the EMORID_v1 database on NIOZ Dataverse, The version v0 is kept there because some people have downloaded and used the data, but is not recommended for use due to the many errors found in the underlying RID data (which prompted the current resubmission exercise). The v0 version includes the error in French loads where riverine loads were repeated for unmonitored areas, effectively doubling French loads.

6 REFERENCES

Dürr, H. H., Meybeck, M., Hartmann, J., Laruelle, G. G., & Roubeix, V. (2011). Global spatial distribution of natural riverine silica inputs to the coastal zone. *Biogeosciences*, *8*(3), 597-620.