

NonPointPollution - Scanner

(based on NQT MONERIS)

Comments on prototypical service reports
for AquaSAGE - testsite Vltava/Ohre CZ

Draft only

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Notes on service-background

GMES background :

- To install and test a service for the analysis and quantification of diffuse nutrient loads into surface waters at different scales , in accordance with requirements of the targets of the Water Framework Directive.

The target of the SAGE-Phase:

- With respect to the above mentioned context the target can be stressed under the headline : „**Service enabling**“ of a suitable nutrient quantification tool (NQT)

Following items had to be considered:

- Out of a couple of models recently active in the european diffuse pollution context the model MONERIS was selected by INFOTERRA for AQUASAGE tests.
- An NQT-related GMES-service has to fulfill additional requirements compared to project-based NQT-modeling.
- A high measure of interregional comparability of service results and a reasonable regional independence of application conditions have to be achieved.

Target of the case studies Moldava (Vltava/Ohre) and Unstrut:

- Analysing the common and differing infrastructure features of the NQT-analysis in both regions an effective and general way of transforming an NQT-model into a GMES-service was to derive and to test.

General preconditions supporting the implementation of an over-regional NQT-service

- WFD : Profits are expected from a lot of unified framework conditions, which create an advantageous scenery to redesign and realize NQT-model applications
- GMES : Getting profit from enhanced LULC-information to be hopefully available within ESA related GMES activities

Specific conditions for implementation of NQT as a GMES-Service

- The service should be compatible in its ‘service-character’ to the *GMES-Core-Services*¹, especially the service-afford should to a considerable degree be proportional to the geographical extent of the service region, in contrary to mainly project related local service concepts.
- Important service components must have a high degree of uniformity if applied to varying regions, at least throughout Europe, as well as if related to
 - methodological concepts as to
 - the character and reliability of the service outcome.
- An NQT-service must be expected to be easily interfaceable to related services
- The service must be flexible enough to be applicable under different conditions of regional data availability, user involvement and organisational infrastructures

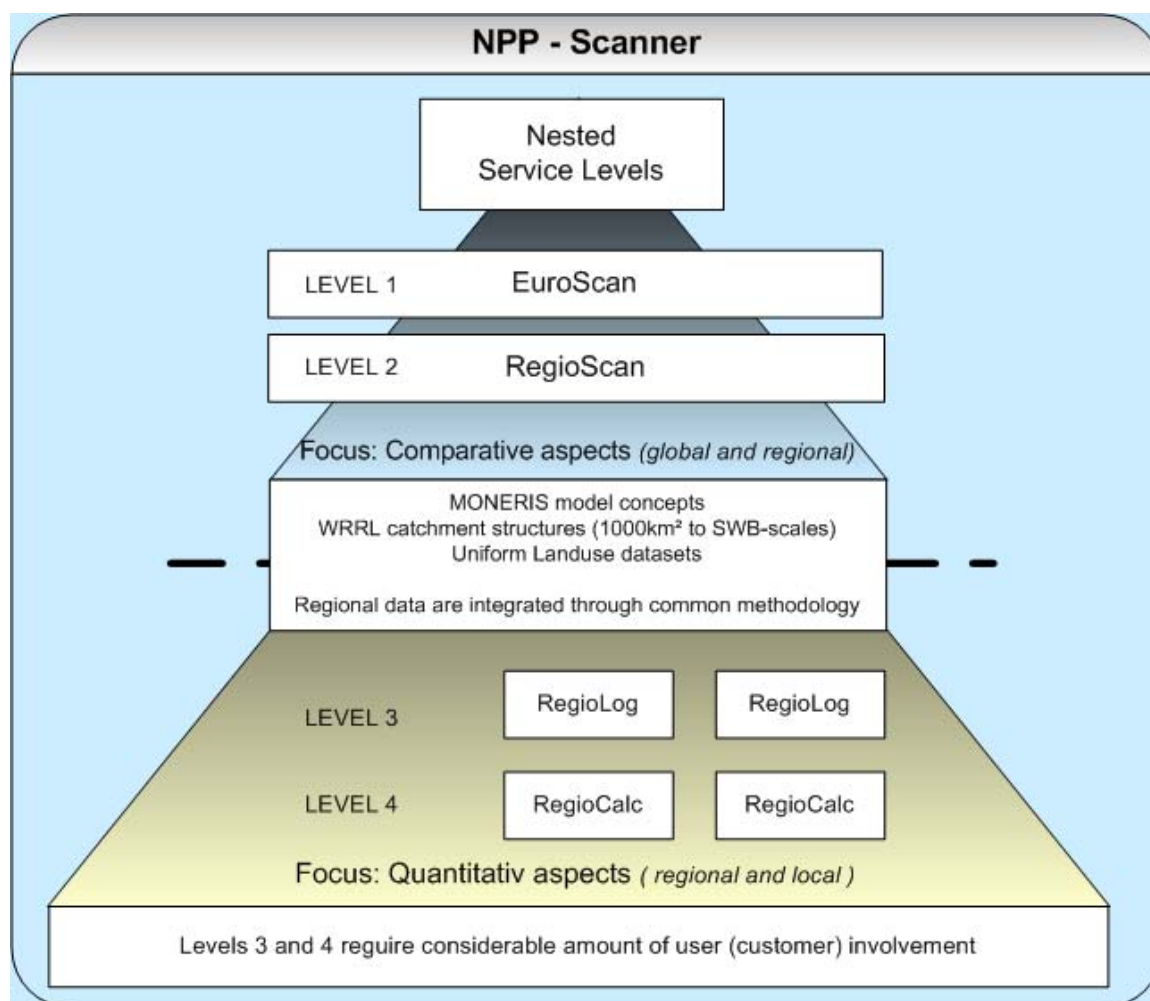
¹ Resulting from cost allocation discussions with INFOTERRA (Kuntz) a cost per km² must be specified

Service framework

Respecting the conditions, mentioned above, the preprocessing layout of NQT MONERIS was extended (“service enabled”) to become an GMES-service directed into differentiated evaluation of diffuse pollution potential for european waterbodies of variable sizes.

The service is named „NonPointPollution(NPP)-Scanner “ for the present, emphasizing the main purpose of the service to be useful for scale independent applications with comparable results. Through the common conceptual modelbase the service is extensible into a quantitative tool for detailed analysis of actual state or the potential development of pollution situation in selected catchments (surface water bodies).

To open a broader range of applicability and flexibility the service is intended to be offered in 4 consecutive levels with different requirements to end-user involvement and service efforts on one hand and degree of detail or veritability of results on the other hand.



Service prototyping at SAGE testsites

The work done during SAGE at the Czech parts of river basins Vltava and Ohre as on the thuringian part of river Unstrut-basin were understood as testing sites for the reasonability of the NPP-service concept.

Moldava (Vltava/Ohre)

The service-runs designed and applied to Vltava and Ohre were restricted to be mainly NPP- (nonpoint pollution) quantification services. It was assumed that information about the nutrient loads from point sources will increasingly be available from appropriate databases and will probably not be a main focus for future NPP-Services in Europe.

Service adaptation during testsite application

The reports of prototype service-applications to Vltava and Ohre basins require some additional explanations:

At the beginning of the service prototyping for Vltava and Ohre especially the necessity and the possible advantages of a multilevel architecture of NPP-services were not clearly realized.

- a. On one hand especially the management and time consuming process of user-data acquisition prior to any visible outcome for the service-user induced the necessity for modification (alteration) of the service concept. From the experiences in the Vltava test site it was concluded (by the service provider) that a long-lasting unidirectional process of service preparation from scratch would be a considerable obstacle for a hopeful installation of a GMES-Service for a broader audience throughout Europe.
- b. On the other hand the suitability of the NQT MONERIS had not to be reproved especially in the Czech Elbe(Labe) sub catchments, since both catchments were included in small scale modelling with MONERIS during GLOWA and EUROCAT-projects and a representative Vltava-sub basin (Zelivka) was successfully modelled at a spatial resolution comparable to typical sizes of WFD-surface water bodies.

In consequence of the mentioned reasons the focus of the SAGE-work shifted from the pure model application to the integration of the NQT into a broader and enhanced (potentially more suitable) service-architecture with following principles:

- a. Being based on a conceptual NQT , the NPP- services (for evaluations of diffuse pollutions at catchment levels) can be offered for selected purposes with “black box” character (from the view of customers), **but** generally at survey level **only** - either in space **or** in time.
- b. Selected results of the Vltava – wide calculations should be evaluated with respect to its suitability for long-term risk assessment with high degree of comparability through large space regions and with comparatively high spatial resolutions (SWB-scale).
- c. To maximize the possible (and expected) outcome of an NPP-service at higher spatial resolution **and** with regard to specific periods of time or scenario constraints it depends on the willingness and ability of the customers/users to contribute necessary regional or local expertise. These conditions however cannot be expected to be equally guaranteed by all potential customers, so the service has to be further differentiated with respect to the expected degree of customer involvement.
- d. From entry level ‘Euroscan’ (Overview- or Risk-analysis-level) to most advanced regional (‘scenario’) level services , the degree of customer involvement, necessary to define service constraints and subsequently to comply with, naturally rises and must hence be freely eligible by the customers (users).

Following this approach it was possible to extract a maximum of immediate benefit from the large amount of data supplied from the Vltava and Ohre authorities for NPP-service prototyping.

Especially valuable was the availability of differentially scaled catchment structures applied in Czech Republic for WFD. The specific coding (strongly differing from principles used in Germany) pointed out the strong need of and enabled the testing of ‘generalization procedures’ for the services catchment coding approach so far restricted to the principles applied to catchment structures in FRG.

The availability of the Europe-wide unified catchment structure at least at medium scales (‘Betrachtungsräume’) appeared to be a necessary condition for the planning and provision of comparable NPP analyses, especially if across national boundaries. Any national SWB-structures can be embedded, applying suitable GIS-operations.

For the claim of service-prototyping the advantages of the available Vltava-datasets more than balance the gaps, the actual dataset has, if it were to be used exclusively as basis for fully qualified service constraints for a **higher-level** NPP service at the SWB-spatial resolution. To fulfill the latter requirements further intensive involvement of regional specialists and data

owners will be required. In some cases this relates to the conceptional transformation of raw data into service compatible catchment-variables as well as to some pre-processing normally falling outside the scope of MONERIS for other variables.

The general conclusion is that a further detailed specification of service constraints (model variables) must be elaborated and communicated to service customers for NPP-modelling to become a service with maximum overall efficiency.

Preliminary service-outcomes

The service-reports generated during prototyping should be considered as conceptual examples (so far immature) of service-outcome at scanning (overview) levels.

Forced by the intent to include as much as possible of the supplied user input into the service the reports represent an **intermediate level between** “Euroscan” and “Regioscan ” service modes.

The spatial resolution applied for these reports bases on te dataset “**cz_upvhlgp**” and falls into the order of 100 km² subcatchments (characteristic size). The dataset is identical to the dataset supplied as geocoding carrier for the soil-loss information in the service region.

The considerably smaller catchments of the base-structure “**cz_pcorr**” (totally more than 3000 subcatchments in the service region) were tested as maximum resolution of the NPP-service (conceptual size-threshold of the underlying model) as well. The test indicated a high potential for spatially highly differentiated NPP-estimates at SWB-scale and SWB-subscale in the future.

Service outcome formats

The primary results of the NPP-Services are produced as numerical information about different aspects of diffuse pollution, geographically referenced to the areas of underlying catchment structures from the modelling scale (minimum) up to any larger aggregates, derived by hydrologically or otherwise motivated catchment aggregation.

Primary service results can/will be delivered in different formats:

- raw or aggregated data as GIS-data layers in vector or raster formats,
- as attribute tables for preset GIS-data structures or
- as dynamic content for WebGIS - services.

Aggregated results are to be delivered (or publicised) as service-reports shaped into standardized office- or PDF-documents. The layouting of service-reports is to be updated continuously throughout the service life-cycle.

From the wide variety of primary service results an even wider spectrum of possible presentations arises, e.g.:

- distribution maps for total emissions,
- subtotals of emission processes or single processes,
- comparative diagrams of emission intensities or
- tabular presentations, ...

will be combined dependent on the customers service target.

Prototype reports for Czech area of Vltava and Ohre

The main contents of the prototype reports concentrate on the visualization of absolute or relative differences of pollution intensities between different spatial units (subcatchments, RBDs) in the service region under consideration.

Exemplary resulting maps are combined with a primary statistics of the emission status, integrated into the legend of the distribution map. In accordance with the service target the results (here emission maps) will be delivered for total emissions of an analysed substance (nutrients N and P, heavy metals) or for emissions through a singular emission mechanism identified by the models underlying the service (e.g. P-emissions by erosive processes). To support the evaluation of the relative importance of selected emission mechanisms additionally “service-region-summaries”, shaped as diagrams or distribution maps of overall emissions, are included into thematic service reports.

Contrary to the underlying service analysis which in most cases necessarily has to be carried out in the hydrologic context of a separable runoff system the service outcome can be reported in other geographical extents, e.g. for all SWBs intersecting at least partially a given administrative unit (see report for ‘Ceske-Budejovicky kraj’).

As many service results will significantly depend on the amount and quality of information fed into the service (the underlying model) a standardized service-log, reporting the most important of them, is generally attached.

Service configuration for prototype reports

As mentioned above for the prototyped services a configuration was selected lying between the unified European and regional scanning levels.

The database presently available for first level services ('Euroscan') was extended by following regional data:

1. **High Resolution - LULC mapping** delivered by GISAT for a reliable landuse statistics in small subcatchments (SWB-level)
2. Hydrologic / hydrometeorologic regime: To achieve a possibly homogenous coverage of the hydrologic situation the use of runoff and precipitation was restricted to the subset for the year 2000, because the density of stations and the mean hydrological conditions seemed to best suited for a representative specific runoff guess.
3. Catchment level-4 ("cz_pcorr") referenced map **of tile drained areas**
4. The **soil loss data**, mapped to subcatchments at "cz_upvhlgp"-level, were calculated. Because of uncertainties in the interpretation of comparatively high soil loss values these results are replaced for now by results calculated with data from a significantly coarser grid of soil loss data, compiled for Europe.
5. The statistical data of urbansystems connected to county-level geometries and redistributed into model catchments through population density at municipality level

Availability and suitability of regional model input

The regional data-situation of model-parameters and variables has varying importance for the service-effectiveness and the quality of service results at different service levels. The present situation for services within Moldava- and Ohre basins is sketched primarily with respect to general model adoption and suitability for use at scanning level 2.

1. **catchments structures:** The supplied data were very well suited for service application in its scale diversity. The coding logic allowed for a very differentiated but systematic derivation of model-catchments. Based on the smallest node based structure a hierarchic configuration of 33 subbasins was derived for specific runoff interpolation from runoff estimates and precipitation.
2. **runoff data :** From 94 water quality stations with attached runoff data 24 were selected for a first raw guess of mean yearly runoff. For fully qualified higher level NPP-service the corrected mean yearly runoff has to be assessed from pre-processed data of national hydrometeorological services.
3. **water quality data:** delivered as data-pairs for days of quality-measurements. Mean yearly load data would be preferred or at least a combination with daily runoff data.
4. **nutrient surpluses:** not supplied in compiled mode for reasonable spatial units (counties, better municipalities). For most catchments with considerable agricultural uses a very important quantitative landuse variable .
5. **soil-loss data :** Were supplied connected to specific subcatchment structure. Not yet sufficient metadata to properly apply in model context properly .
6. **soil parameters :** delivered with specific Czech, FAO-derived classification. From included metadata no quantitative information could be directly derived related to N- and Clay-contents in topsoil resp. subsoil – substrate classes. Formerly provided point data for topsoil parameters cannot (but by regional specialists) be interpolated into catchment areas.
7. **drainage areas :** supplied with very high spatial resolution . Very important for reliable separation of catchment runoff and N-emissions between fast drained emissions and slow groundwater driven emissions
8. **urban system data :** partly available at county level. Information about fractions of sewage system types not available.
9. **point src data :** delivered as mean yearly discharges for most and mean nutrient concentrations for selected WWTPs (best situation with regard to P_{tot}). The completion or

modelling from secondary data is required in the context of quantitative levels of NPP-services (level 3 and 4).