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Customised search and comparison of in situ, satellite and model data for ocean modellers

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For the ocean modelling community, the amount of available data from historical and upcoming in situ sensor networks and satellite missions, provides an rich opportunity to validate and improve their simulation models. However, the problem of making the different data interoperable and intercomparable remains, due to, among others, differences in terminology and format used by different data providers and the different granularity provided by e.g. in situ data and ocean models.

The GreenSeas project (Development of global plankton data base and model system for eco-climate early warning) aims to advance the knowledge and predictive capacities of how marine ecosystems will respond to global change. In the project, one specific objective has been to improve the technology for accessing historical plankton and associated environmental data sets, along with earth observation data and simulation outputs. To this end, we have developed a web portal enabling ocean modellers to easily search for in situ or satellite data overlapping in space and time, and compare the retrieved data with their model results. The in situ data are retrieved from a geo-spatial repository containing both historical and new physical, biological and chemical parameters for the Southern Ocean, Atlantic, Nordic Seas and the Arctic. The satellite-derived quantities of similar parameters from the same areas are retrieved from another geo-spatial repository established in the project. Both repositories are accessed through standard interfaces, using the Open Geospatial Consortium (OGC) Web Map Service (WMS) and Web Feature Service (WFS), and OPeNDAP protocols, respectively.

While the developed data repositories use standard terminology to describe the parameters, especially the measured in situ biological parameters are too fine grained to be immediately useful for modelling purposes. Therefore, the plankton parameters were grouped according to category, size and if available by element. This grouping was reflected in the web portal's graphical user interface, where the groups and subgroups were organized in a tree structure, enabling the modeller to quickly get an overview of available data, going into more detail (subgroups) if needed or staying at a higher level of abstraction (merging the parameters below) if this provided a better base for comparison with the model parameters. Once a suitable level of detail, as determined by the modeller, was decided, the system would retrieve available in situ parameters. The modellers could then select among the pre-defined models or upload his own model forecast file (in NetCDF/CF format), for comparison with the retrieved in situ data. The comparison can be shown in different kinds of plots (e.g. scatter plots), through simple statistical measures or near-coincident values of in situ of model points can be exported for further analysis in the modeller's own tools. During data search and presentation, the modeller can determine both query criteria and what associated metadata to include in the display and export of the retrieved data. Satellite-derived parameters can be queried and compared with model results in the same manner.

With the developed prototype system, we have demonstrated that a customised tool for searching, presenting, comparing and exporting ocean data from multiple platforms (in situ, satellite, model), makes it easy to compare model results with independent observations. With further enhancement of functionality and inclusion of more data, we believe the resulting system can greatly benefit the wider community of ocean modellers looking for data and tools to validate their models.