Architecture of the “cloud” thematic software complex for analysis of climatic and environmental changes

Igor Okladnikov, Evgeny Gordov, Anna Ryazanova, Alexander Titov

Institute of Monitoring of Climatic and Ecological Systems SB RAS, Tomsk, Russia
Institute of Computational Technologies SB RAS, Tomsk branch, Tomsk, Russia
Institute of Atmospheric Optics SB RAS, Tomsk, Russia

ENVIROMIS-2018, 5-11 July 2018, Tomsk, Russia

Motivation

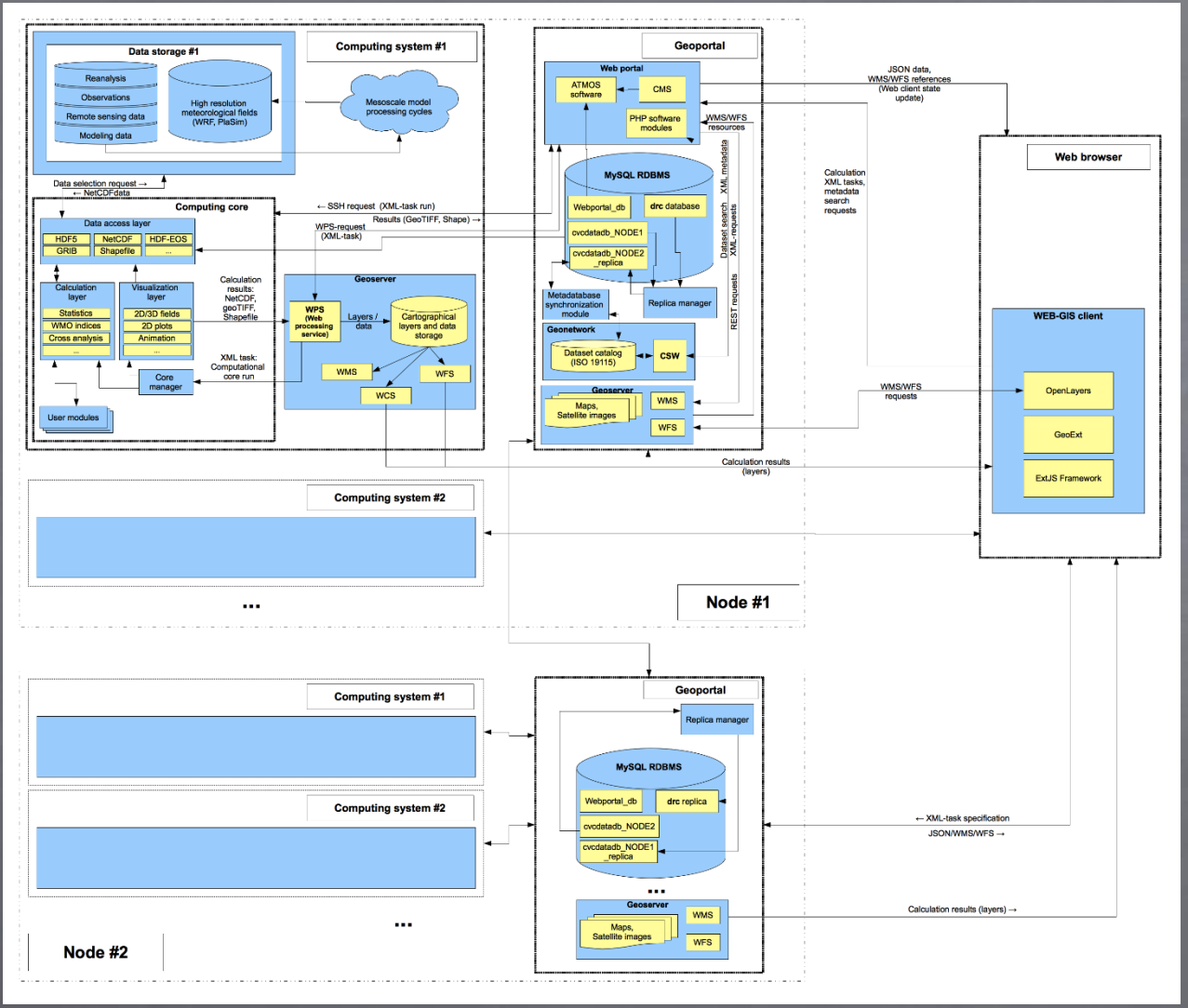
Climate research challenges:

- Multidisciplinary, often spatially distributed research activity
- Spatially distributed datasets of huge size
- Different formats of datasets obtained from different sources
- Specific knowledge is needed to search, extract and process data
- Risk of using unverified algorithms and data

Approach

- Internet accessible web-GIS with user-friendly GUI
- Web portal integrating web services providing search, retrieval, cartographical visualization, and client applications
- “Cloud” data analysis and visualization
- Flexible modular computational engine with verified data processing routines
- Combined usage of Web and GIS technologies
- Access to processing results: images (PNG, JPEG), binary files (NetCDF, float GeoTIFF, ESRI shapefile), web services (WMS ,WFS, WPS)

Architecture



- Data archives + Metadata
- Modular Computational Backend
- Geoportal
- Web-GIS client

Data archives

- NCEP/NCAR Reanalysis II
- JMA/CRIEPI JRA-25 Reanalysis
- ECMWF ERA-40 Reanalysis
- ECMWF ERA Interim Reanalysis
- MRI/JMA APHRODITE's Water Resources Project data
- DWD Global Precipitation Climatology Centre's data
- GMAO Modern Era-Retrospective analysis for Research and Applications (MERRA)
- Reanalysis of Monitoring atmospheric composition and climate (MACC) Collaborated Project
- NOAA-CIRES Twentieth Century Global Reanalysis Version II
- NCEP Climate Forecast System Reanalysis (CFSR)
- Planet Simulator model results
- INM CM4 model results
- Meteorological observational data for the territory of the former USSR for the 20th century
- University of Montana evapotranspiration project data

Datasets storage model

Datasets are stored on dedicated storage systems as collections of netCDF files. Data files are distributed in a hierarchy of specially named directories:

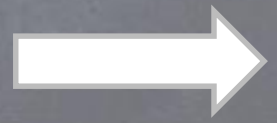
/<data root directory>/

<data collection name>/

<spatial domain resolution>/

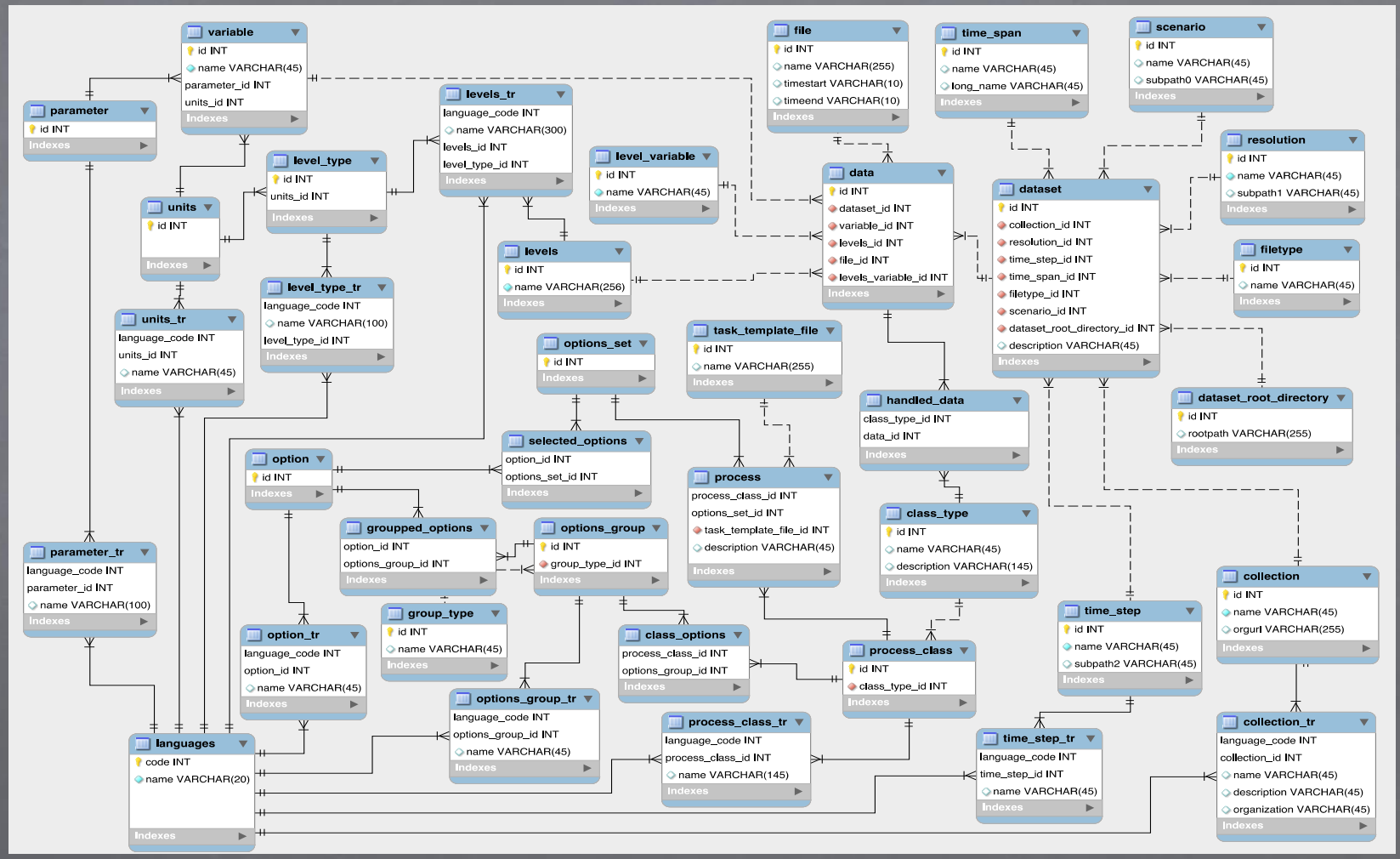
<time domain resolution>/

<files and directories with data>



```
/mnt
 └─ megaraid2
    └─ data
       ├─ APHRODITE
       ├─ DS093
       ├─ DS131
       ├─ ERA40
       ├─ ERAInt
       ├─ GHCND
       ├─ GPCC
       ├─ JRA25
       |  ├─ 1.25x1.25
       |  |  └─ 6h
       |  |     └─ anl_p
       |  |        ├─ 197901
       |  |        ├─ 197902
       |  |        ├─ 197903
```

Metadata database



Thank you for your attention!