WORLD OCEAN DATABASE IN USE

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MAKING COMPLEX EASY

Many ocean profile databases to choose from

- NCEI World Ocean Database (2005, 2009, 2013, 2018, ongoing)
  https://www.ncei.noaa.gov/products/world-ocean-database
- CSIRO Atlas of Regional Seas (2009, based on WOD2005)
  http://www.marine.csiro.au/~dunn/cars2009/
- International Quality Controlled Ocean Database (IQuOD v0.1, 2018)
  http://www.iquod.org/
- Others…

Overview of the World Ocean Database

- Database of measured ocean profiles – temp, salinity, density, sound speed, etc
- 15 million profiles, each with up to 5000 data points (average 1500)
- Spanning 250 years – 1772 to 2021 (ongoing)
- Various collection methods and instrument types
- Total records = approx. 85 billion point values
- Interim updates monthly, full releases every 5 years or so

Reducing data volume with QC filters

- Aim is to reduce data volume by discarding bad profiles (eg 1 point)
- Add ranking by data quality and content (e.g. temp + salinity vs temp only)
- Ranking includes instrument type and methodology (implied QA)
- General QC filters but also different QC per instrument type
- Output to NetCDF (full metadata) and PostGIS database (nomalized and indexed)

Types of additional QC

- Remove profiles with less than 2 points
- Remove duplicate profiles from the database
- Remove profiles already QC'ed as bad/suspect/poor (QCflag < 3)
- Use GEBCO 2019 bathymetry to remove profiles 'on land'
- Remove profiles in water depths of <5m
- Remove profiles where depth is decreasing
- Remove profiles without a temperature
- Range-check temperature and salinity against physical limits (e.g. temp < -2C)

Reducing data volume with RDP

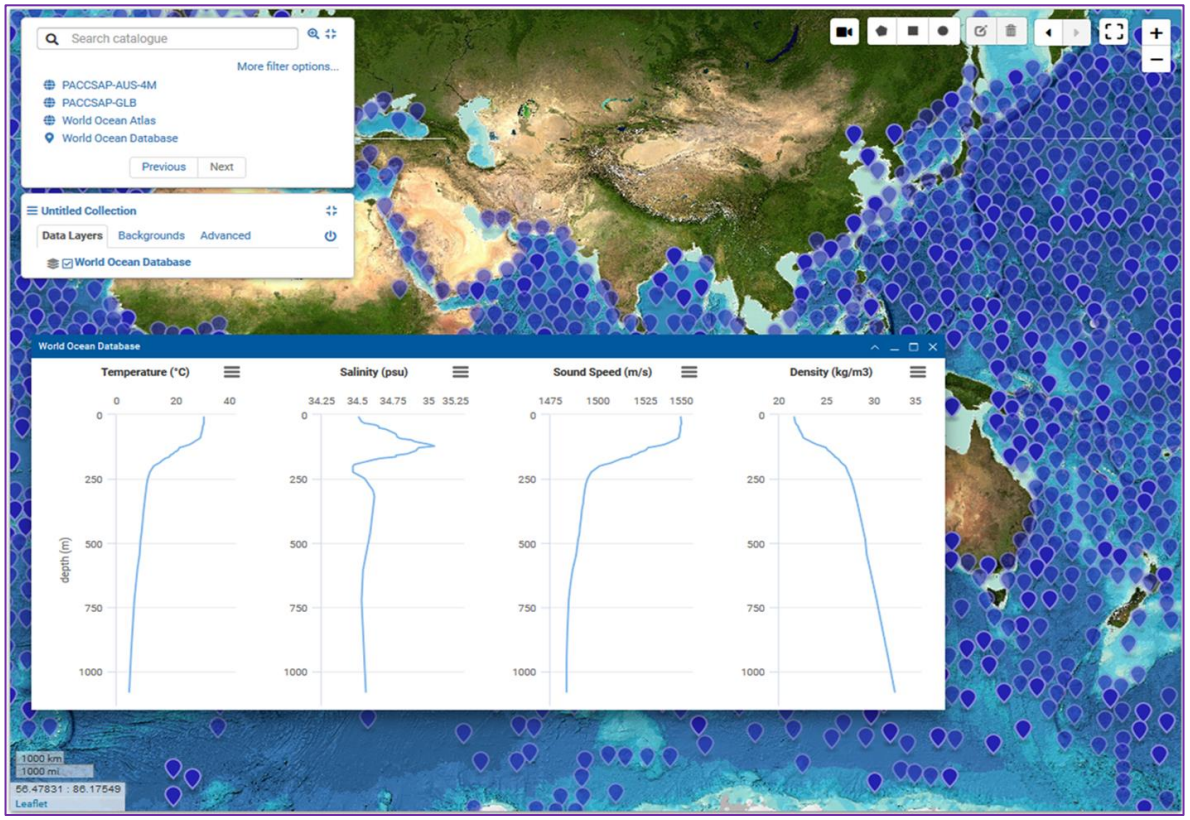
- Aim is to reduce data redundancy (e.g. high density sampling where no change)
- Keep all turning points and profile shape, start and end points
- Do not create new data values that weren't measured
- Do not extrapolate beyond measurement values with spline or curve fits
- Use 'improved' version of Ramer-Douglas-Peucker algorithm
- Only keep profiles with 2 or more points (QC)
- RDP on Temperature, Salinity, Density, Sound speed independently
- Reduce profiles to 50 points or less
- Typical reduction of 30:1 with negligible reduction in quality

RDP Improvements

- Keep measured top and bottom points untouched
- Retain data points in sorted depth-order (allows immediate stop)
- Short-circuit halt at 50 points or less
- Iterative epsilon term refinement

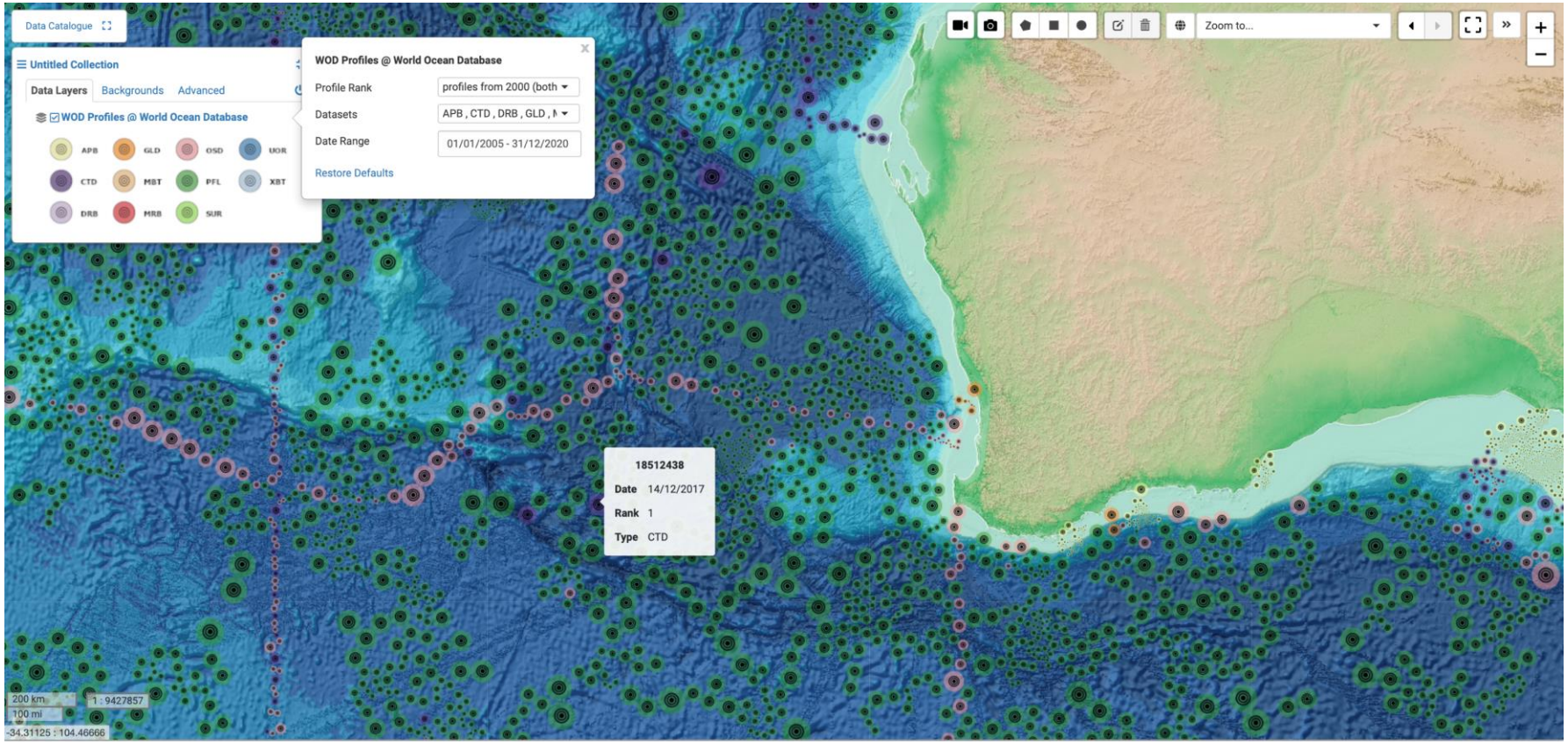
Visualization Challenges

- High density coverage – too many dots/samples for a map
- Need to distinguish different instruments, methods, age, quality, etc



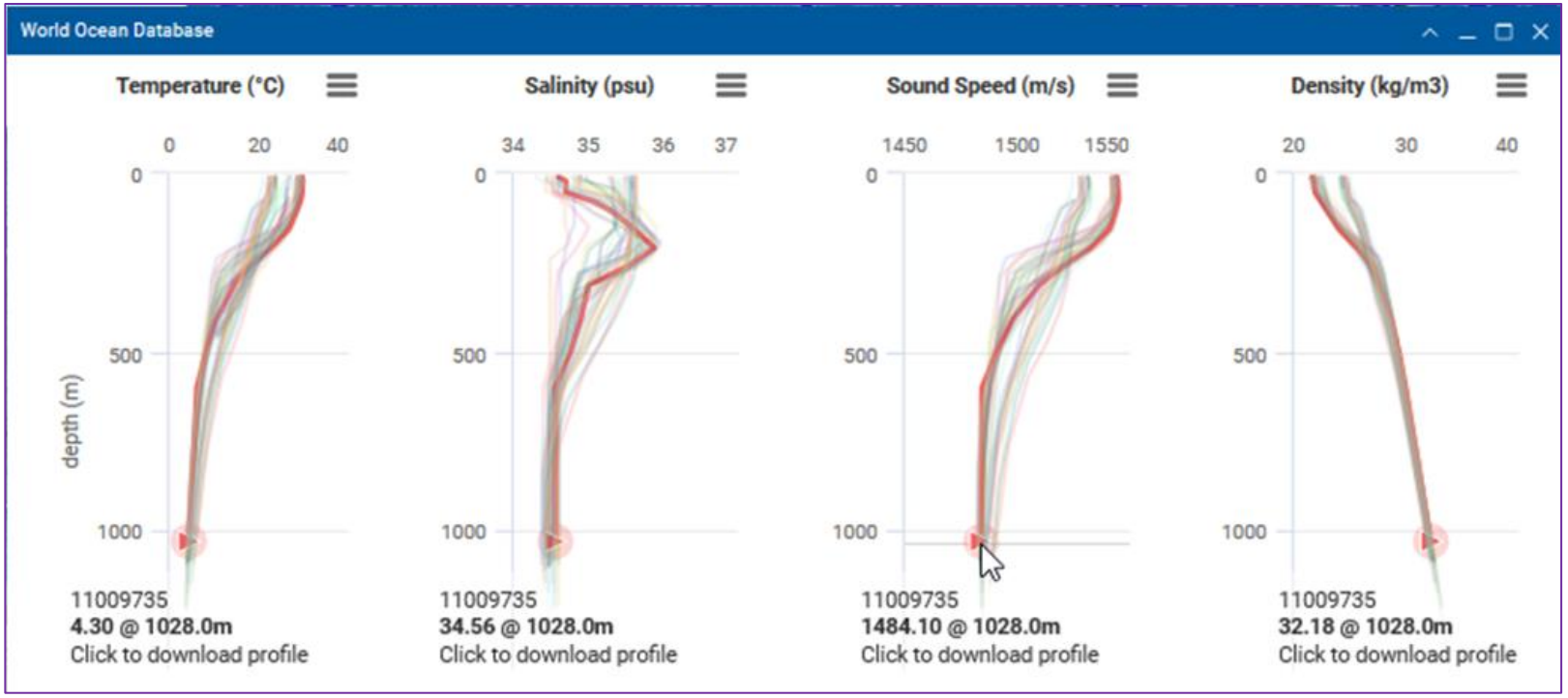
Visualization

- Piximap decluttering – priority profiles are distinct and selectable at any zoom level



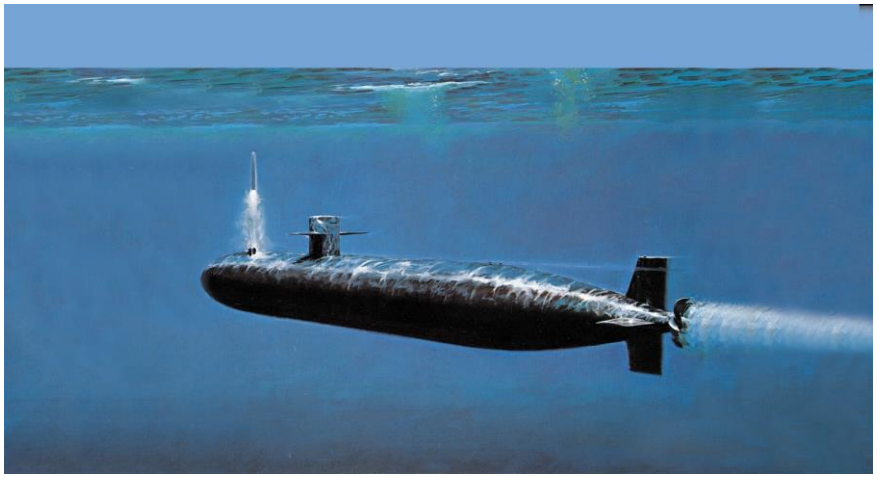
Visualization

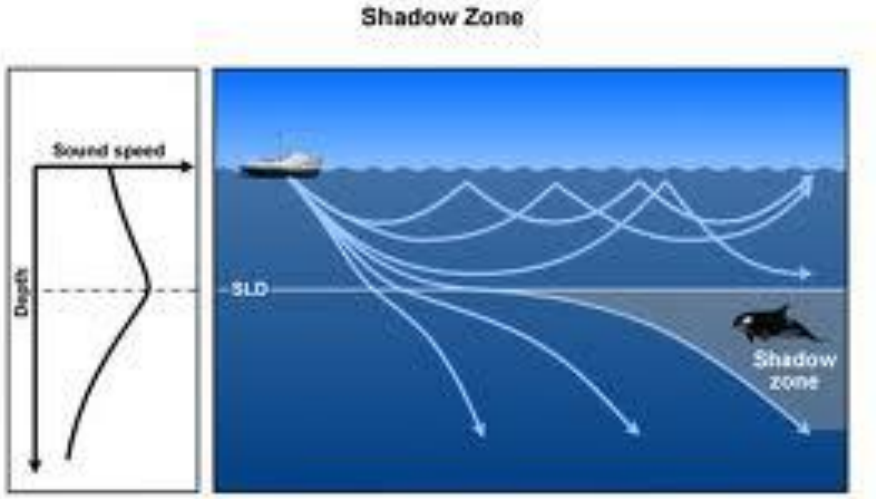
- Classification – distinguishing seasonal patterns, identifying representative profiles
- Zoomable profile plots, highlight individual profiles, download selected profile data



Applications

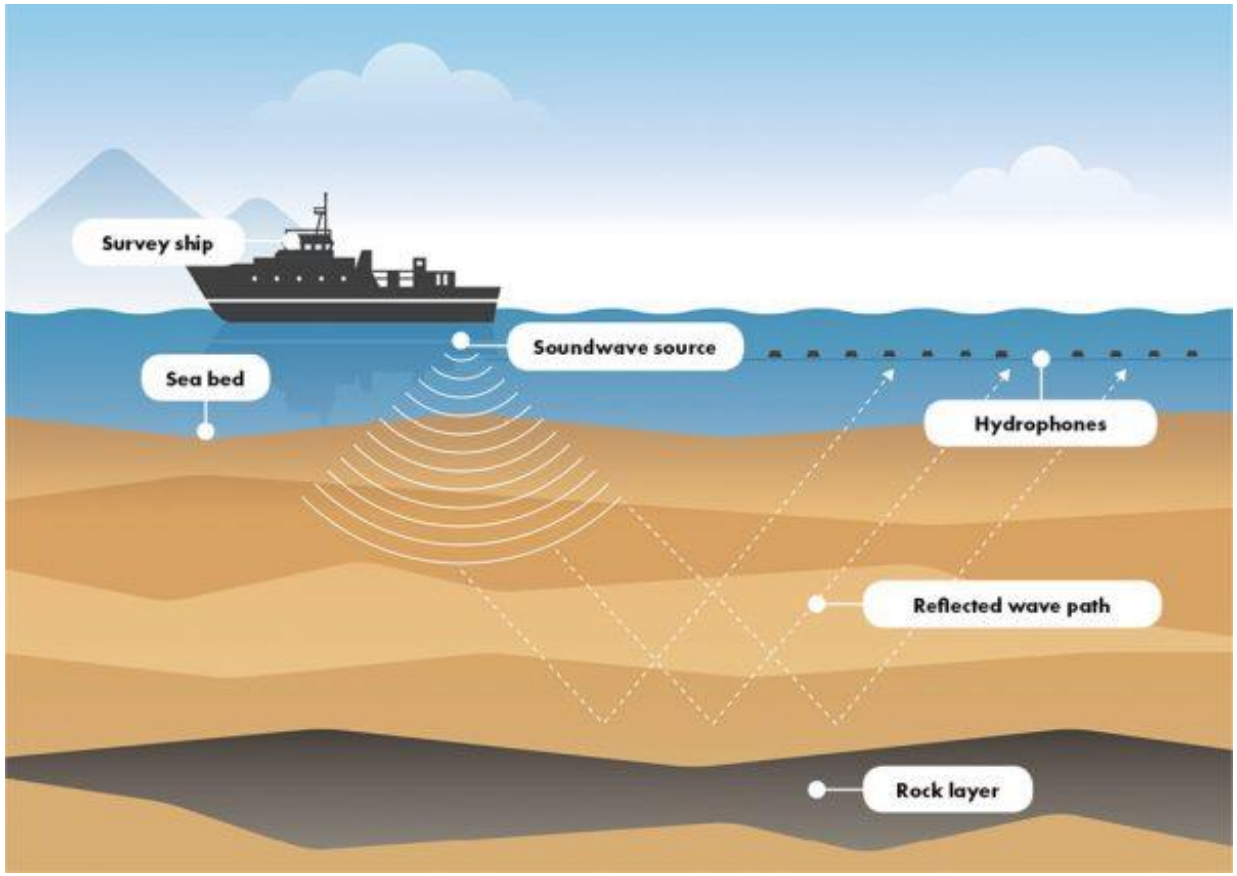
- Defense
  - Submarine stealthiness and comfort





Applications

- Seismic Survey – Accurate density information imperative for accurate measurements



Applications

- Environmental Impact Assessments