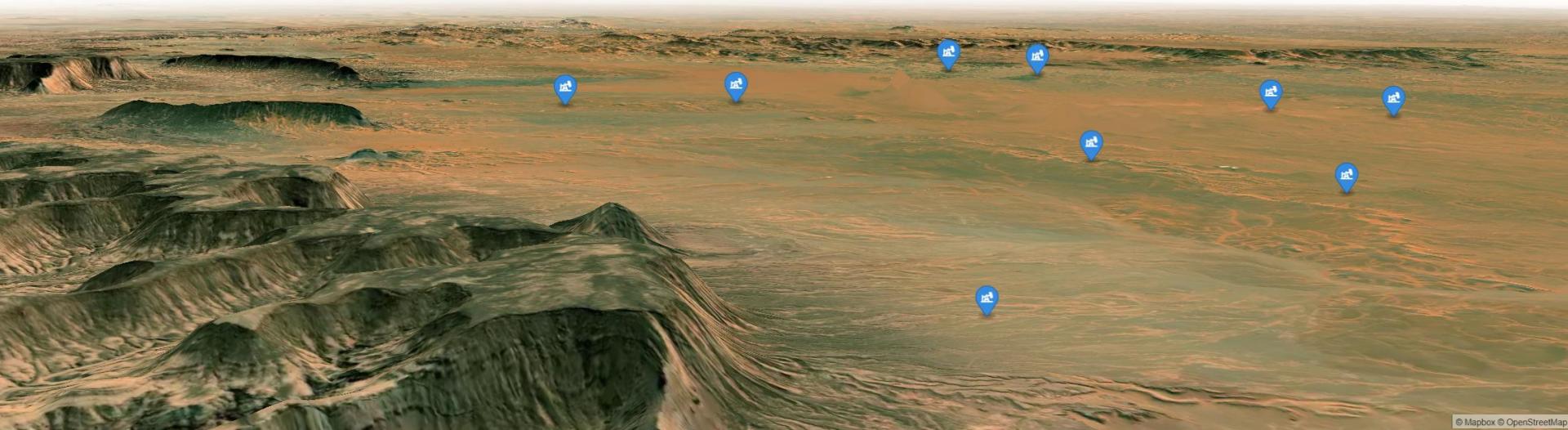
61st General Meeting
6th & 7th of March 2025
Stavanger, Norway

Wellbore Positioning Technical Section

The Industry Steering Committee on Wellbore Survey Accuracy (ISCWSA)

Unpacking coordinate reference systems

Controlling CRS usage in wellbore data exchange



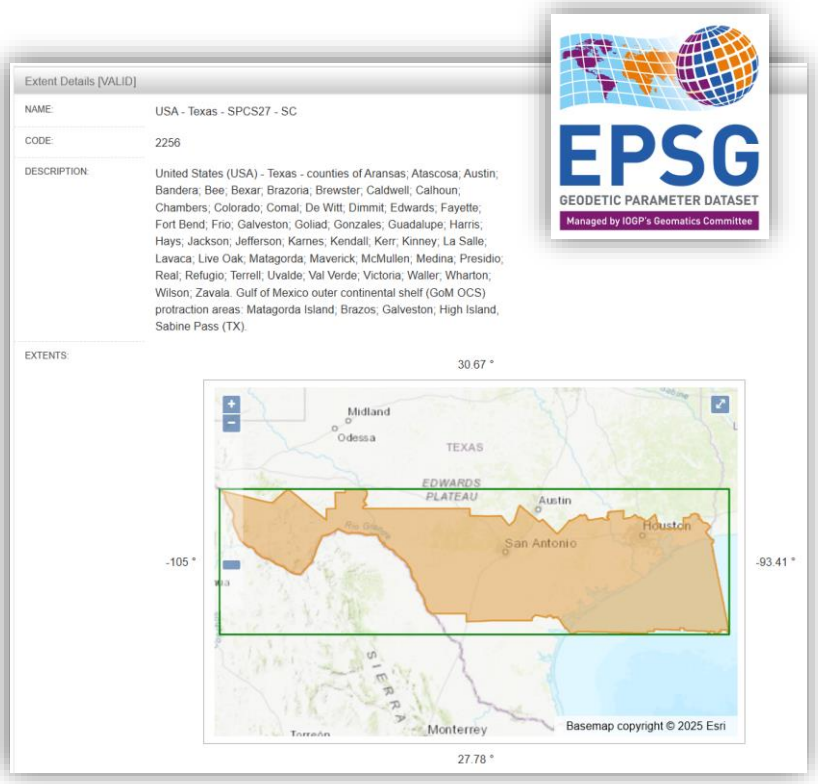
Who we are

- Geodetic software and services company
- Seismic and well positioning data QA/QC
- Ensuring geodetic integrity is not compromised in data management strategies

GEOMATIC SOLUTIONS

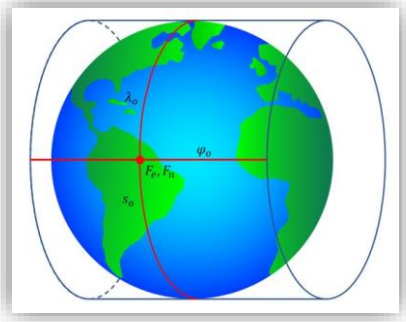
CRSs and geodetic parameters

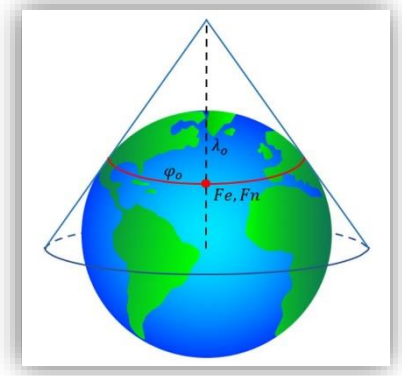
- How we connect local survey data to the Earth
- Global industry necessitates lots of variation in definitions used
- EPSG: set of common geodetic parameters maintained by IOGP
- Limited geographic validity – areas of use are defined



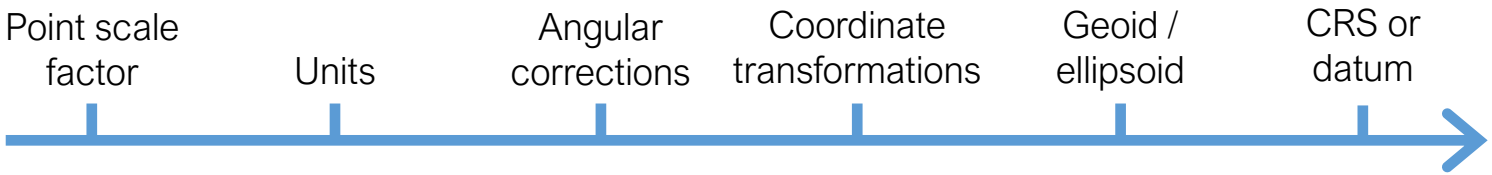
Map projections

- Different methods of mapping the reference ellipsoid of the Earth's gravity field (geoid)
- Common methods involve simple geometric shapes: cones, cylinders
- All introduce distortions:
  - Shape/angle
  - Distance





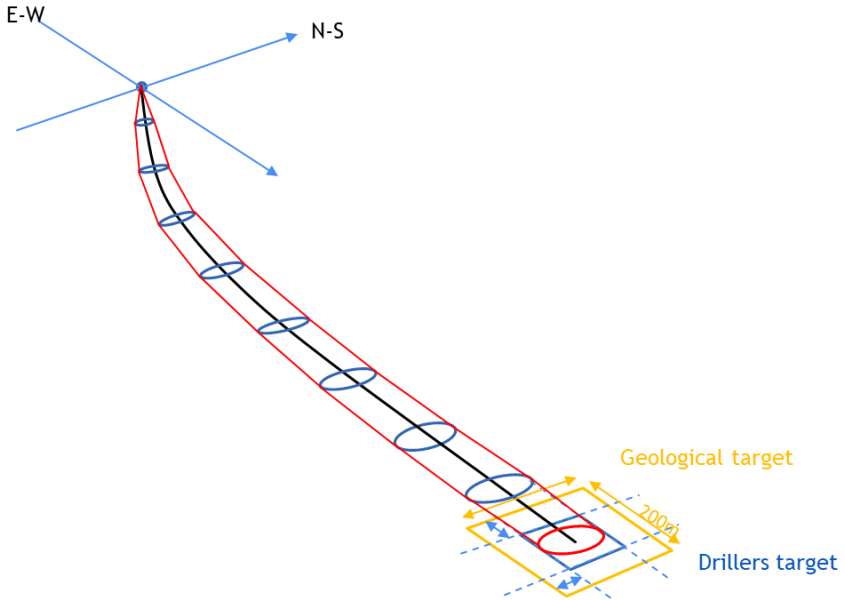
Spectrum of potential error magnitude



- All weaken the link between well data and seismic data
- Errors may be masked due to seismic reflectors increasing in size with depth – mis-ties not identified
- Potentially lead to inefficient and uneconomical interpretation and planning

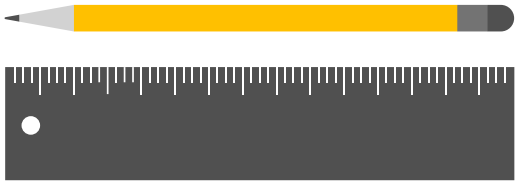
The smallest: point scale factor

- Map distance vs. real-world distance
- Drill pipe has a real-world length – needs to be scaled to the map
- Only affects lateral offsets (along pipe)
- Result: small potential error, a few metres maximum



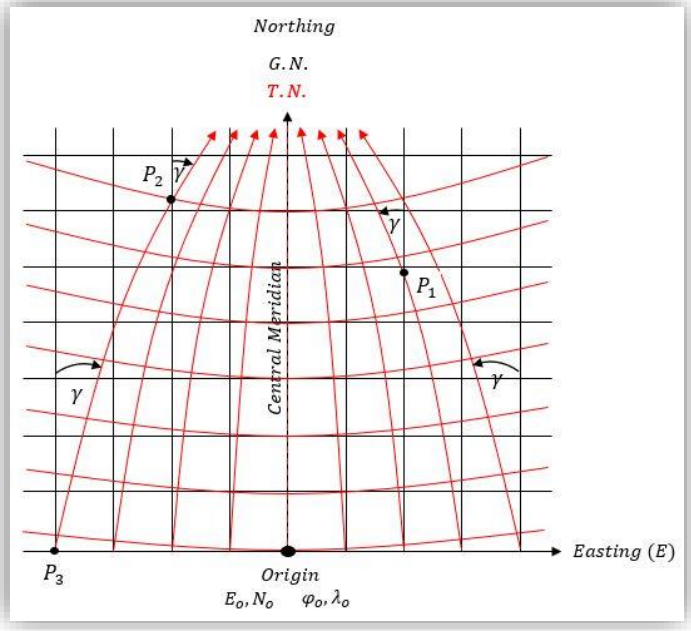
A bit larger: units

- Feet and metres are very different…
- But US survey feet and international feet differ in length
- Coordinates are tens of millions of feet
- **Systematic** error in position: tens of feet



Potentially quite notable: angular corrections

- Convergence and declination
- Different conventions
- Which side of zero?
- 5000ft with a 1.5° error, error will be ~130ft
- Vertical wells are much less affected



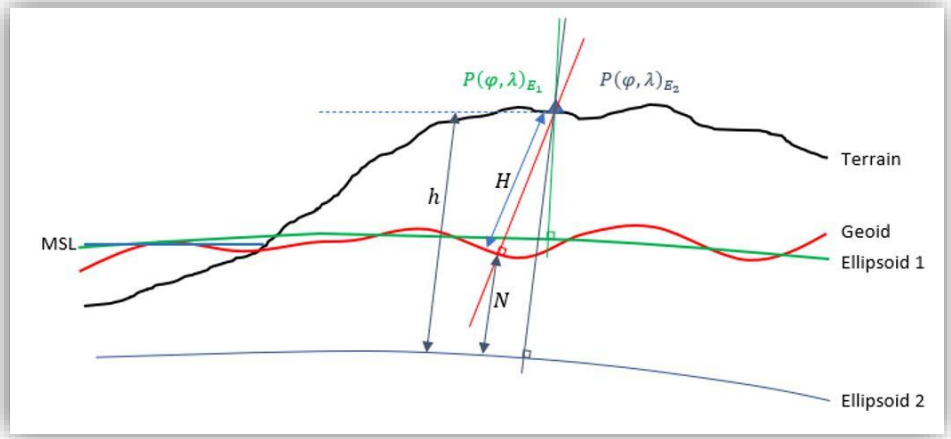
Notable and systematic: coordinate transformations

- Easy to select the wrong option!
- Field- or block-specific, region-specific, or not needed
- Historical vs. newly established
- **Systematically** affects vertical and lateral wells

Imagery from ESRI

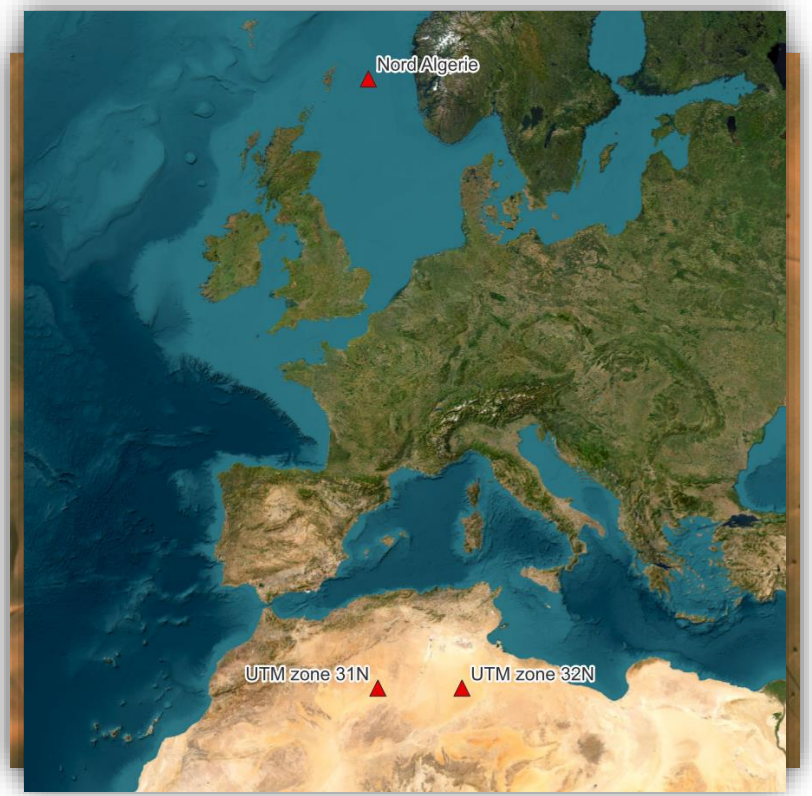
Getting larger, in the vertical: geoid/ellipsoid issues

- Geoid-ellipsoid separation is ±300ft
- Variable globally
- Can **systematically** affect vertical positioning
- Ensure correctly handled wrt seismic datum



The largest: CRSs and datums

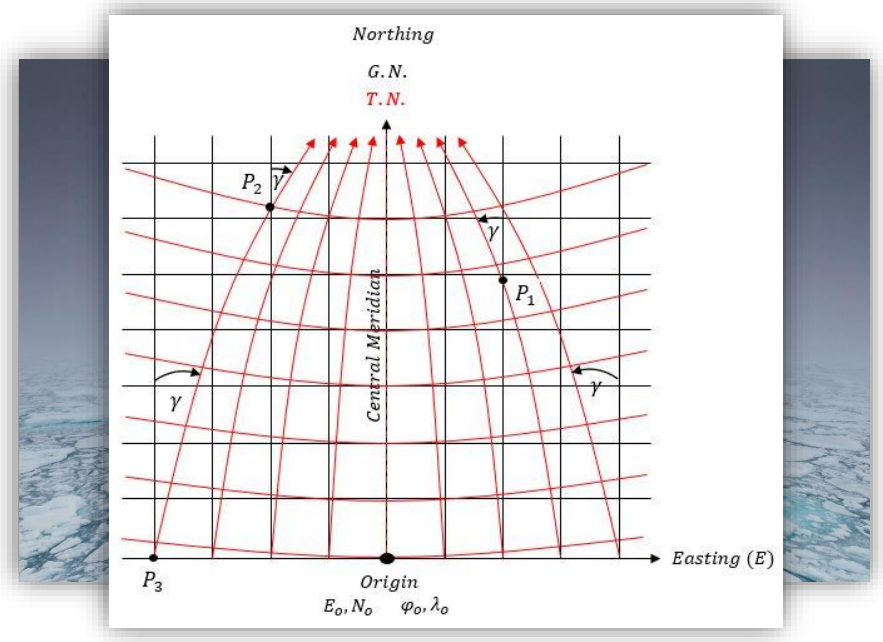
- Incorrect **datum**: hundreds of metres
- Incorrect **map projection**: potentially much more
- Introduced by missing metadata, coordinate mismanagement
- Mis-ties are more obvious
- Gross errors may get masked/lost in data exchange/publishing



Imagery from ESRI

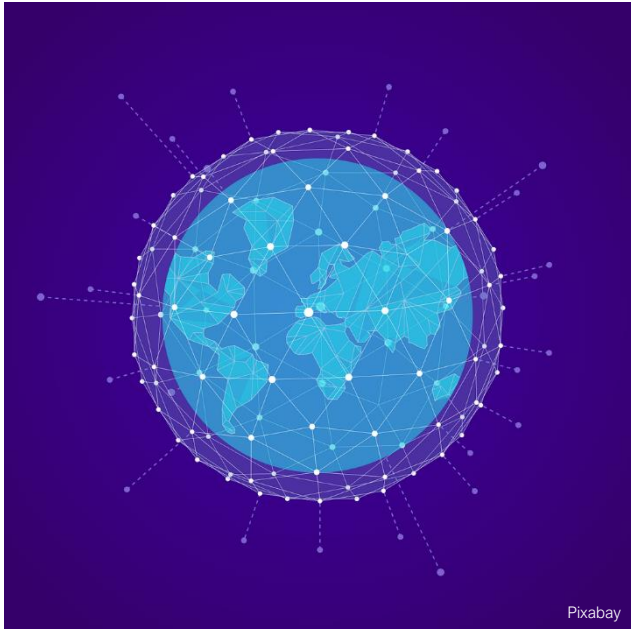
Specific case: northern latitudes

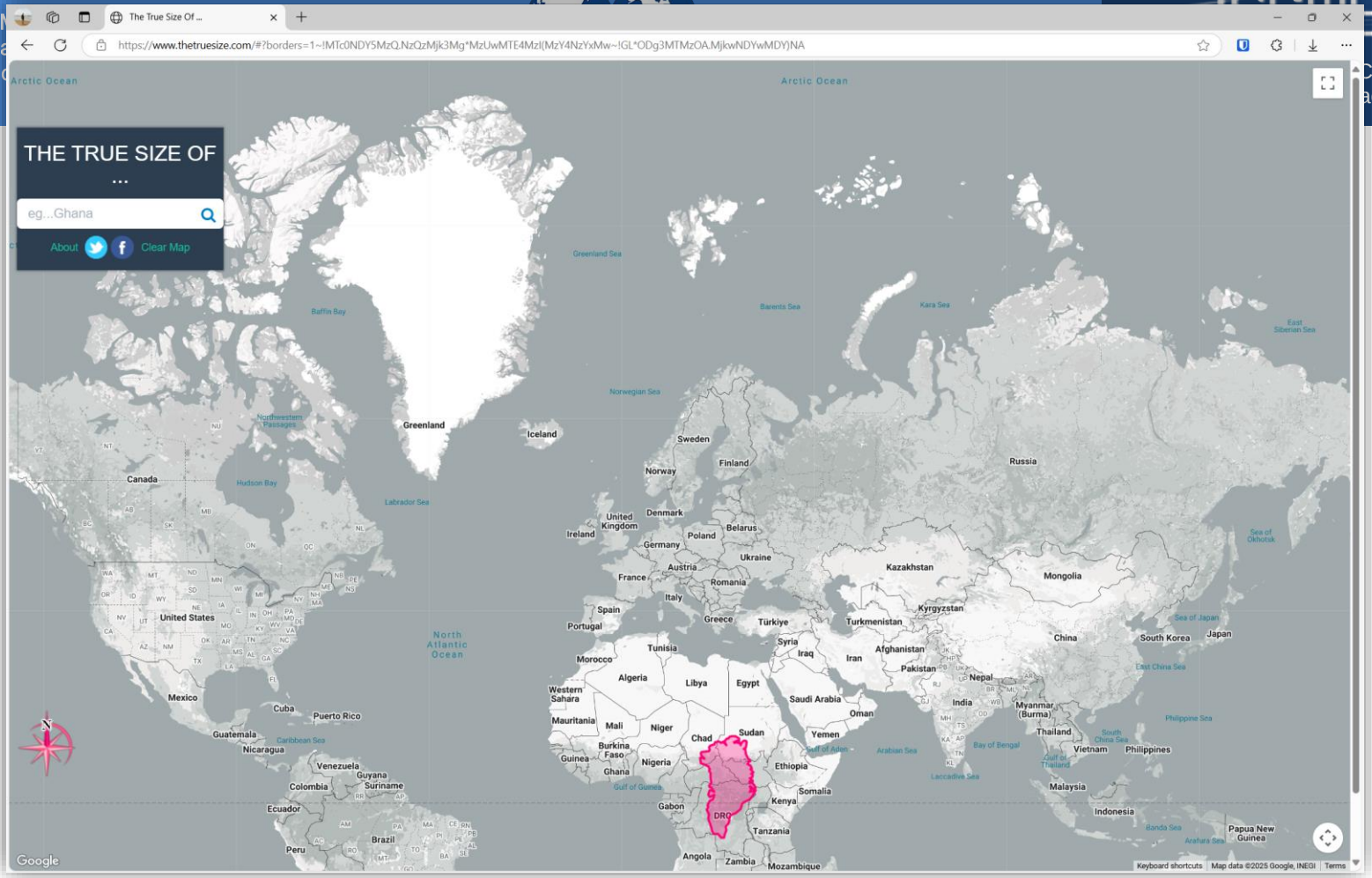
- Barents Sea – north of 70°N
- Convergence: rate of change is much greater
- Nuanced UTM zone usage in Norway
- ED50 to WGS 84 transformation selection



Specific case: publishing to global CRS

- Drive by operators to have data published on enterprise platforms
- Non-specialists working with nuanced datasets
- Coordinate transformations to global CRS (WGS 84)
- Global CRSs are for visualisation, not surveying
- Convergence and PSF do not follow expected rules – these are not local CRSs





https://www.thetruesize.com/

Data management challenges

- No standard reporting format utilised across industry
- Metadata is inconsistently stored and exchanged
- Difficulty in recreating well trajectories with missing positioning metadata
- Any uncertainty reduces confidence in data (and thus value)
- Application variability and settings

DALL-E

Drive towards global publishing and AI-driven data management

- Specifics of geodetic management are easily lost within automated routines
- AI training requires a strong, consistent baseline
- Enables repeatability
- Investing time now ensures future efficiency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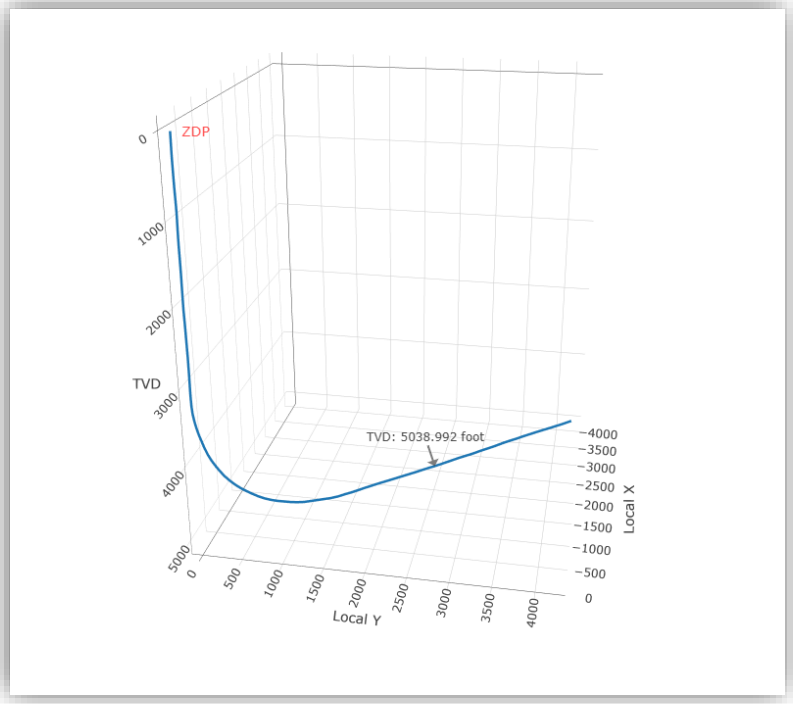
Metadata and audit trails

- Structured metadata
- Ensure accountability in the case of mismanagement
- Tracing back to originally surveyed data
- Geodetic or coordinate operations are recorded, and can be ‘undone’ in the case of errors

Disordered to ordered (DALL-E)

What can we gain?

- High positioning confidence can be assured
- Value is maintained from survey to exchange
- Less time lost by non-specialists trying to solve geodetic issues
- Uniformity allows automated processing, loading, storage, etc.
- **Data exchange no longer compromises data quality**



A potential solution

- IOGP P7/17 format for wellbore positioning
- Cross-industry initiative but low adoption
- Clear and strong geodetics
- Consistent nomenclature
- Storage of multiple wellbores and surveys in one file
- Extendable records – including error details

https://www.iogp.org/bookstore/product/p7-17-wellbore-positioning-data-exchange-format/

In preparation for the future

- Big investment decisions to refocus on oil and gas
  - New ventures, exploration in old blocks
  - Need for maintenance of legacy data will remain, lots of data exchange
- CCS requires analysis into legacy data
  - Old data, both seismic and well, will be revisited in feasibility studies
- AI/automation is here to stay – we should be prepared

In conclusion

- Mishandling of CRSs leads to data management challenges
- Mispositionings can be masked if not identified and reported
- Effective metadata reporting maintains positioning integrity and data value throughout data and project lifecycle

Thank you

GEOMATIC SOLUTIONS