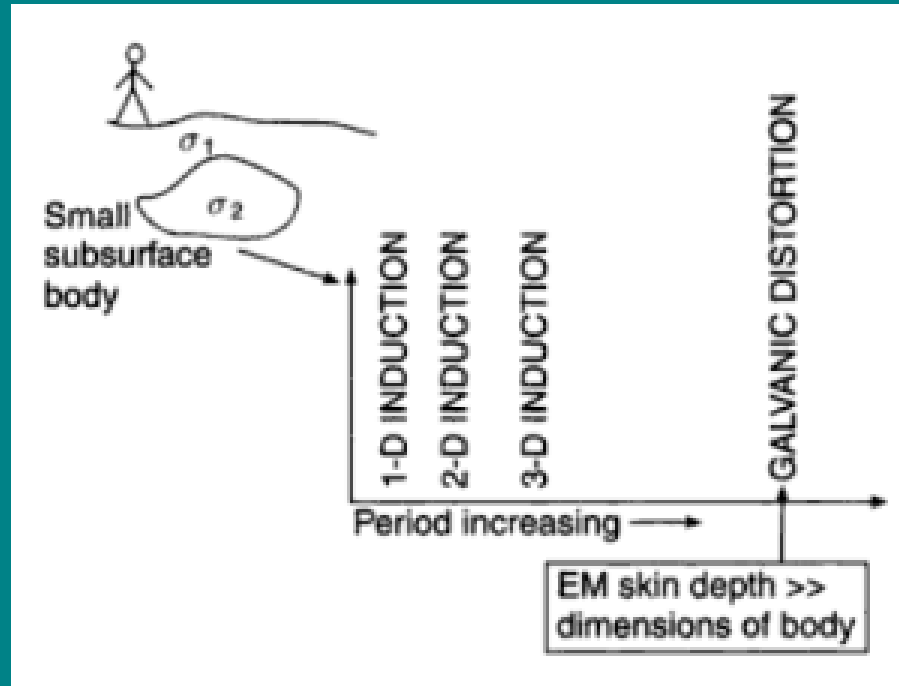


07_Distortion, dimensionality and noise

Distortion of the MT signal

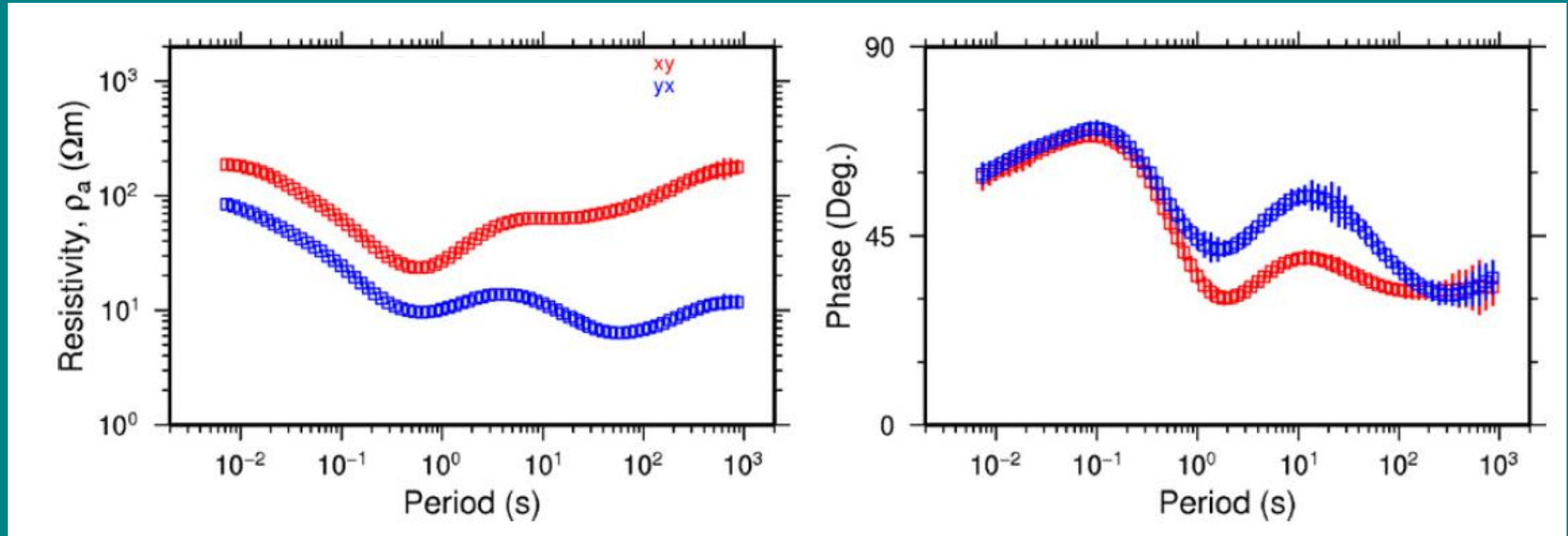
- Galvanic distortion (or *static shift*):
 - Small near-surface conductive inhomogeneities
 - Local topography
- Other distortions caused by large scale regional structures, such as:
 - coastline
 - mountain range
 - geological structures

The static shift effect (1)



- Skin depth \gg shortest dimensions of the 3-D body.
- Result of assumption that no current sources exist within the Earth.
- But: electric charges built up along a discontinuity $>$ apparent resistivity **'shifts'**.
- **'Static'** as the effect is frequency independent

The static shift effect (2)



- Shift xy upwards, or yx downwards?

The static shift effect (3)

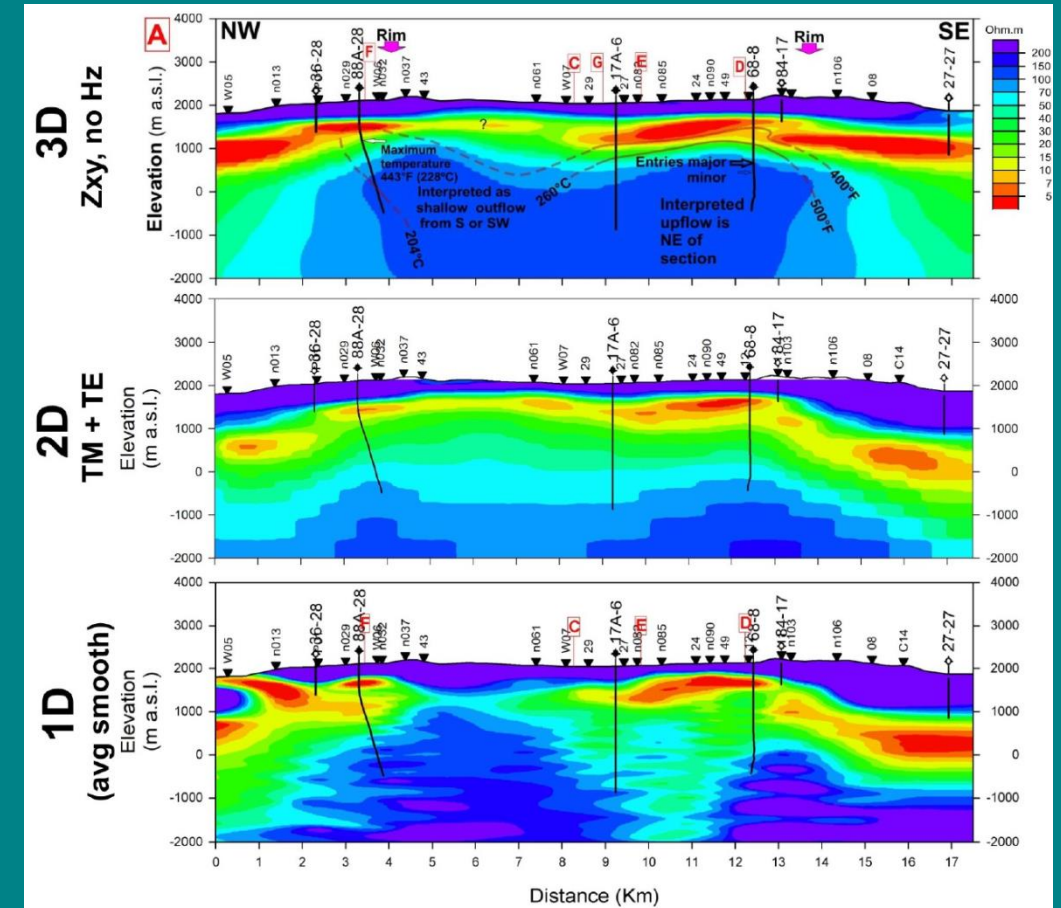
- Correction methods (pick one):
 - TEM-MT survey with iterative shift of the invariant
 - TEM-MT survey with mapping TEM vs time onto MT vs period
 - Joint inversion of static shift with MT data.
 - Carry out 3-D inversion including topography, bathymetry and a sufficiently high resolution
- Much debate (especially in geothermal industry) on the 'best' correction method. Choice often depends on the circumstances of the MT survey.

Dimensionality (1)

- Dimensionality distortions are caused by 2-D or 3-D structures:
 - Survey design should match dimensionality
 - Modelling strategy should match dimensionality
- Assess the dimensionality of MT data and rotate if necessary prior to 2-D or 3-D inversion.

Dimensionality (2)

- Example from glass mountain geothermal field (*Cumming and Mackie, 2010*).
- Consider targeting a well.
- Carry out at least 1-D and 3-D inversions to assess the resistivity models for accurate well targeting.



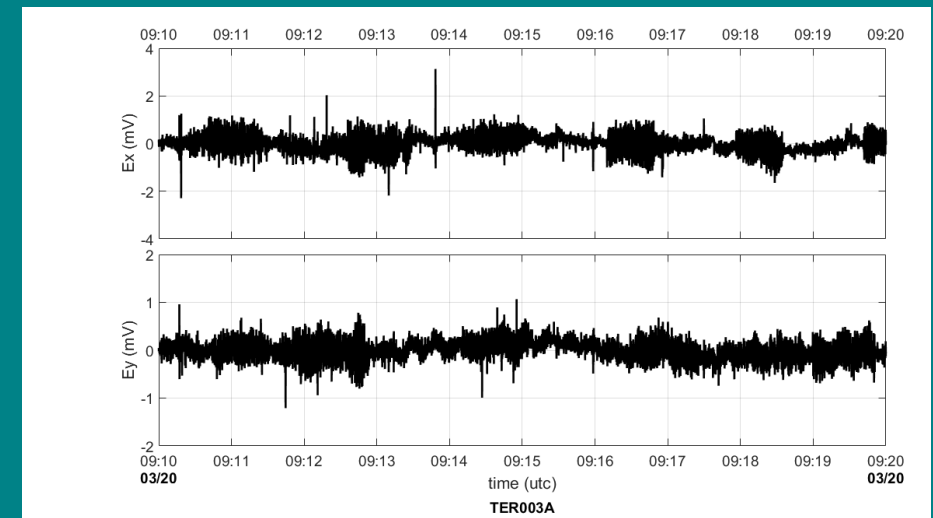
Cultural electromagnetic noise (1)

- Cultural EM noise (or 'man-made' noise) distorts an MT sounding.
- Examples of cultural EM noise sources:
 - Power lines
 - Subsurface pumps
 - Anti-corrosion systems in buried pipelines
 - Wind turbines
 - Electric trains
 - Electric fences
 - Mining areas
 - ...

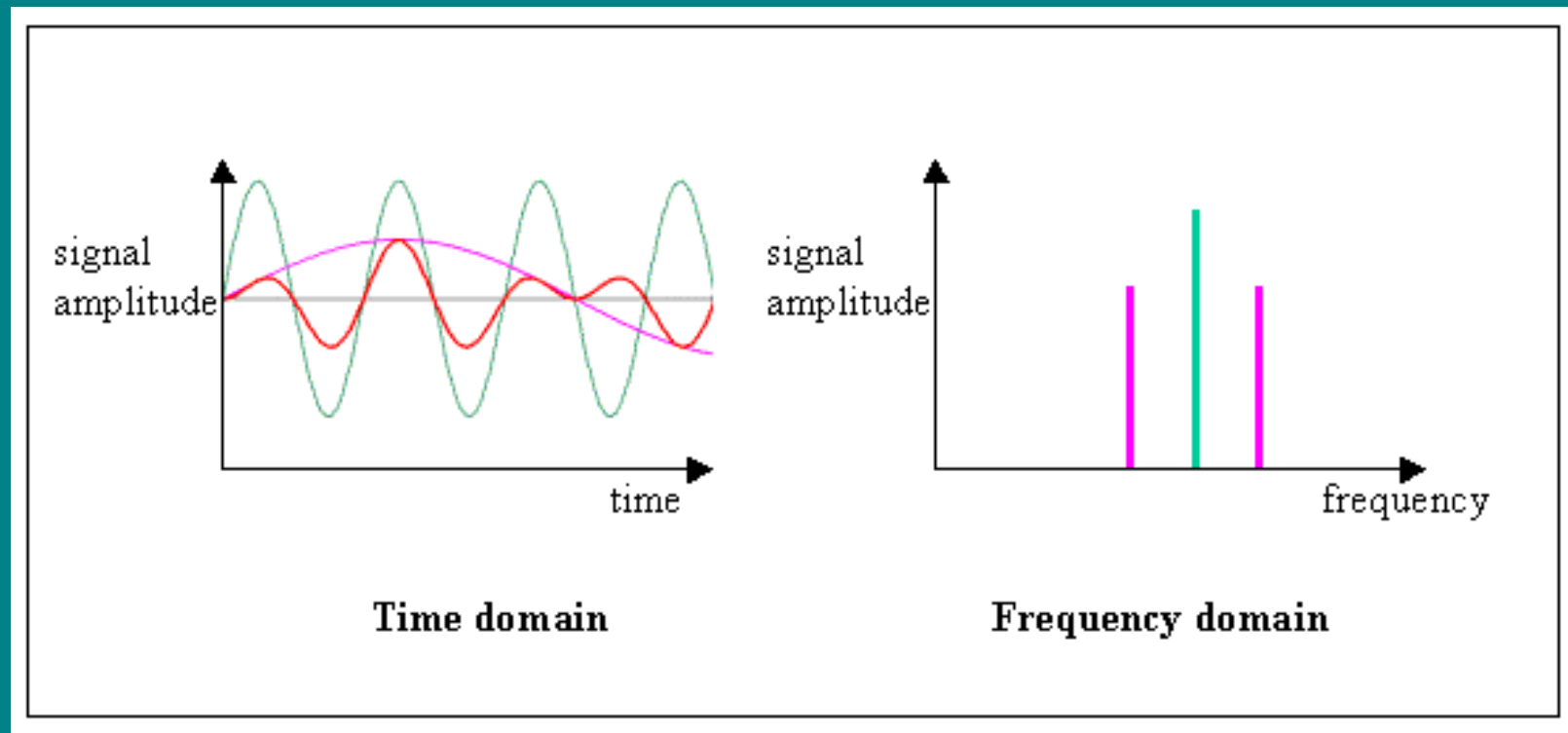


Cultural electromagnetic noise (2)

- Active EM noise: Structures redistributing the EM field (ditches, power line structure, roads, pipes and cables)
- Passive EM noise: All power consuming devices
- Motional EM noise: Artificial vibrations of the Earth (e.g. passing cars)



Intermezzo: From time-domain to frequency domain



Cultural electromagnetic noise (3)

- Power spectrum of two locations from (*Junge, 1996*).

