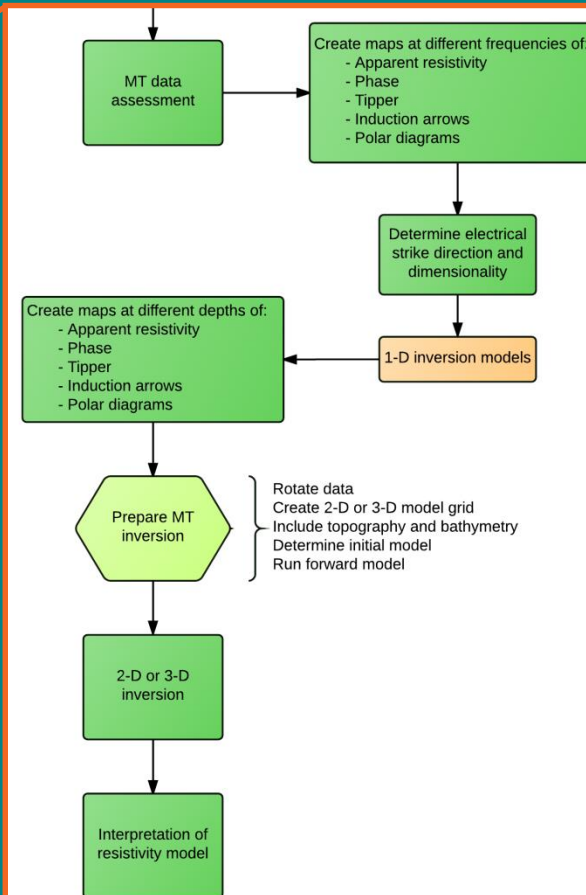
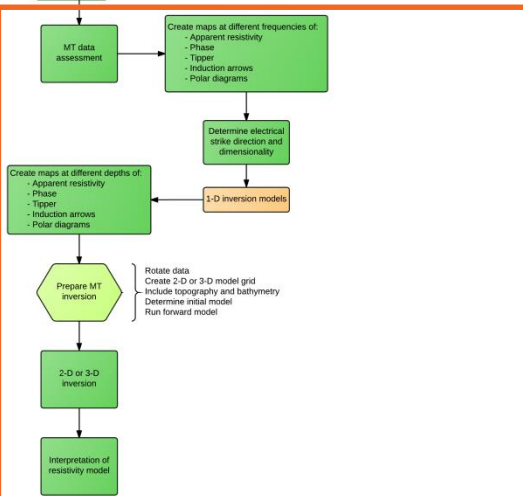
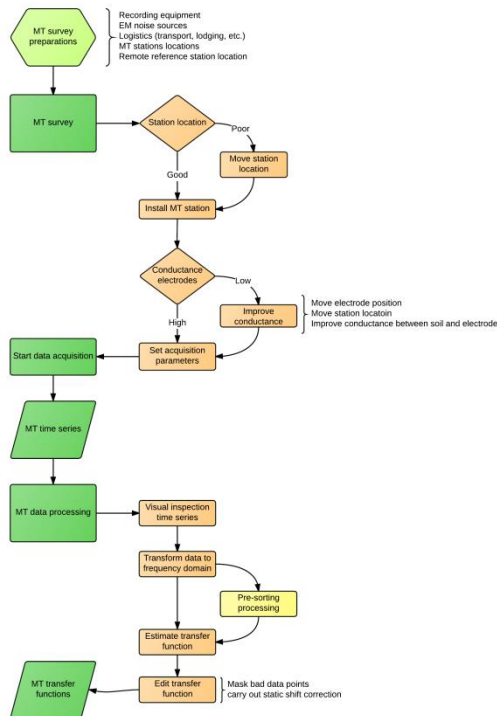


## 09\_Data processing

# The MT process



Sections:

1.2, 1.3, 1.4  
1.5, 1.6, **1.12**,  
1.13

# The magnetotelluric transfer function ( $Z$ )

$$\mathbf{E}_h = \overline{\mathbf{Z}} \cdot \mathbf{B}_h$$

$\Leftrightarrow$

$$\begin{pmatrix} E_x \\ E_y \end{pmatrix} = \begin{pmatrix} Z_{xx} & Z_{xy} \\ Z_{yx} & Z_{yy} \end{pmatrix} \cdot \begin{pmatrix} B_x \\ B_y \end{pmatrix}.$$

- Relates the measured horizontal electric ( $E$ ) and horizontal magnetic ( $B$ ) fields
- Also known as:
  - Impedance tensor
  - MT response function
  - ...

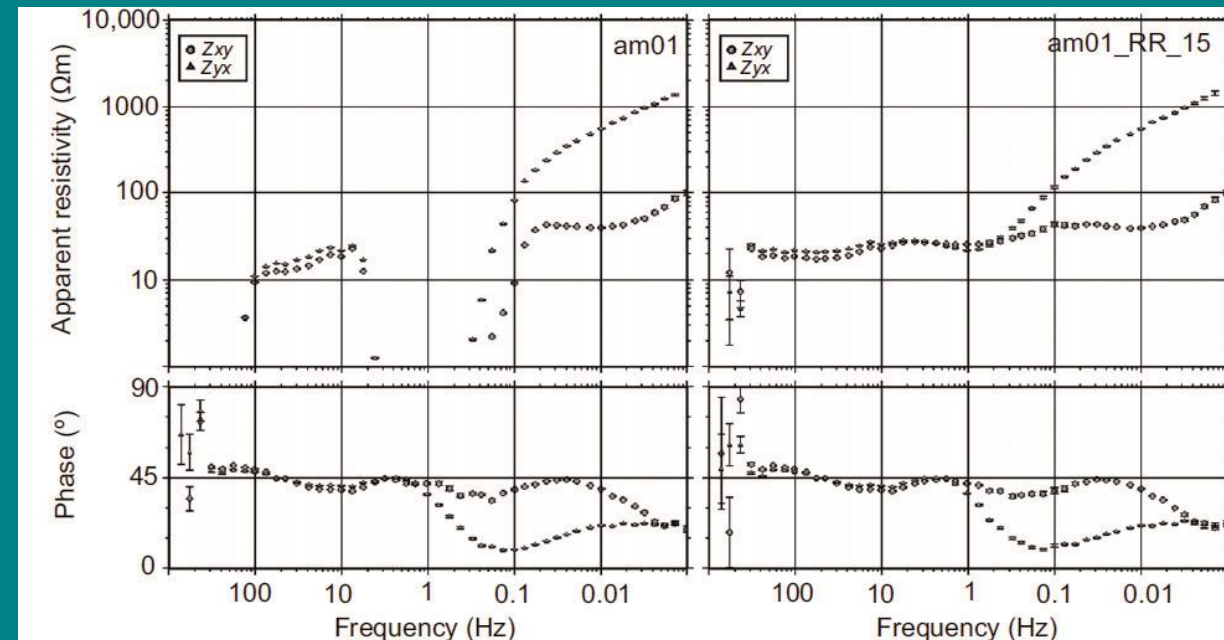
# MT processing theory - basics

- MT transfer function can be estimated following:

$$\bar{Z} = (E \otimes B^*) \cdot (B \otimes B^*)^{-1}$$

- To eliminate (uncorrelated) magnetic noise remote reference processing can be utilized.

$$\bar{Z} = (E \otimes B_R^*) \cdot (B \otimes B_R^*)^{-1}$$



# MT processing theory - basics

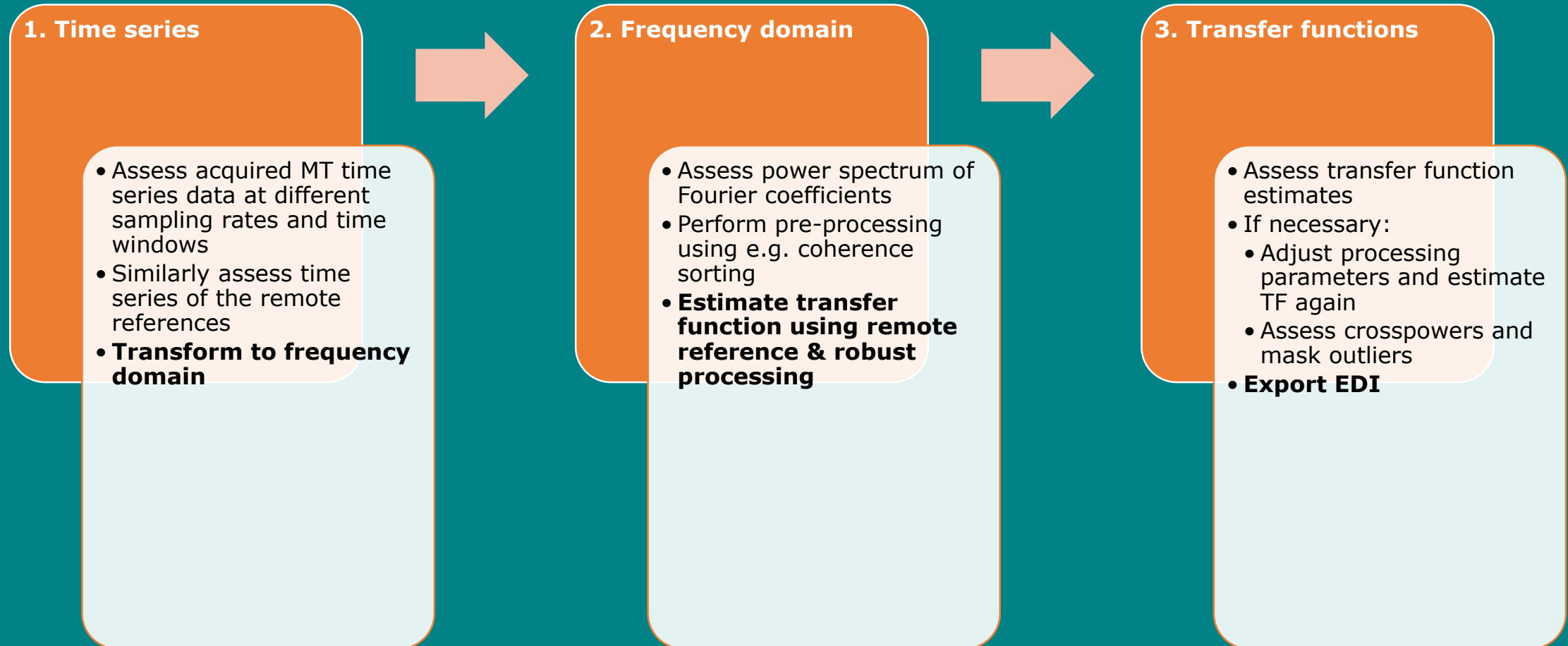
- In case EM noise is measured:

$$Z = \frac{(Y_0 + n_Y)}{(X_0 + n_X)}$$

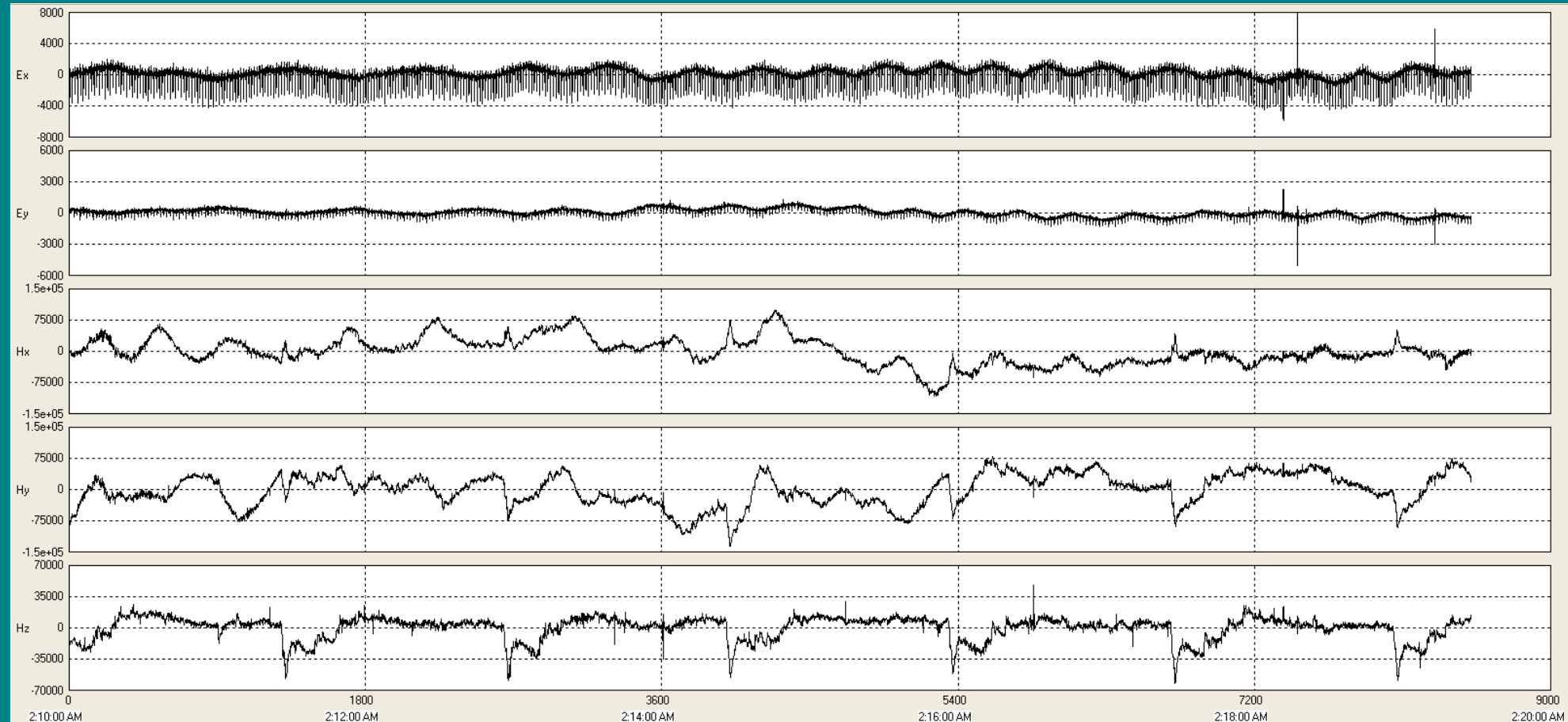
- Commonly, robust processing approaches are used to process MT data and eliminate the EM noise from the data.

$$X = (Z_1 \cdot Y_1 + Z_2 \cdot Y_2) + \varepsilon$$

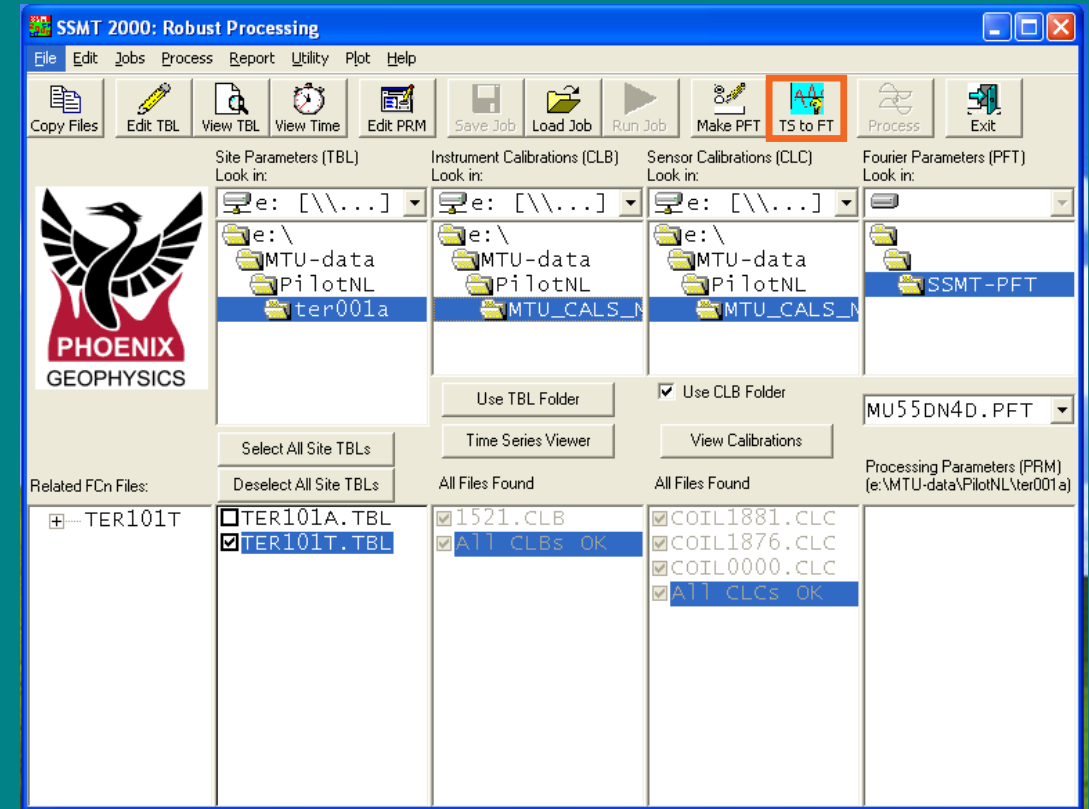
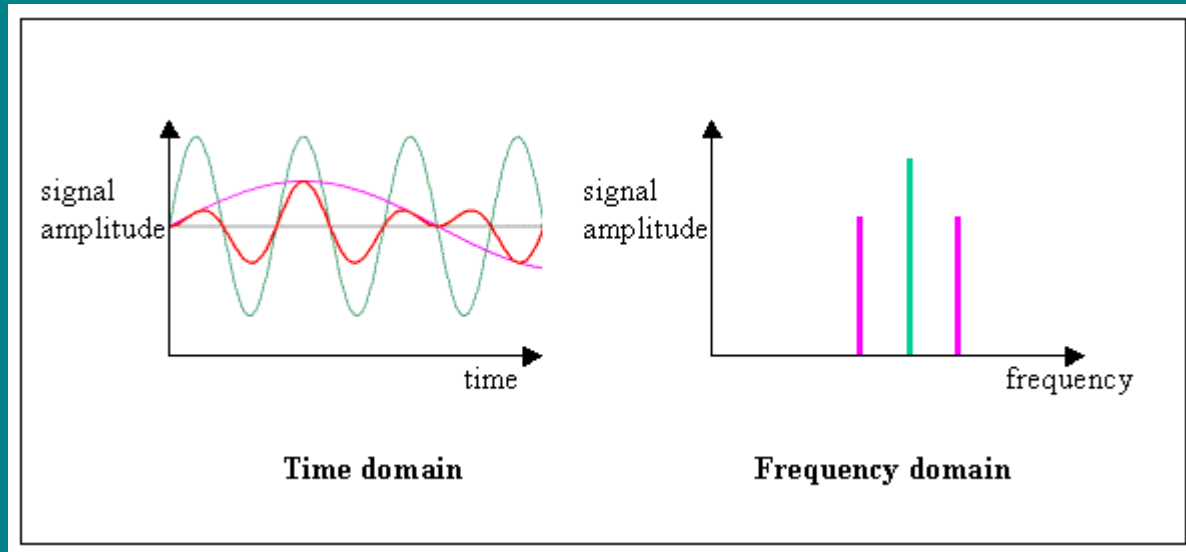
# Time series to MT transfer function



# 1. MT Time Series

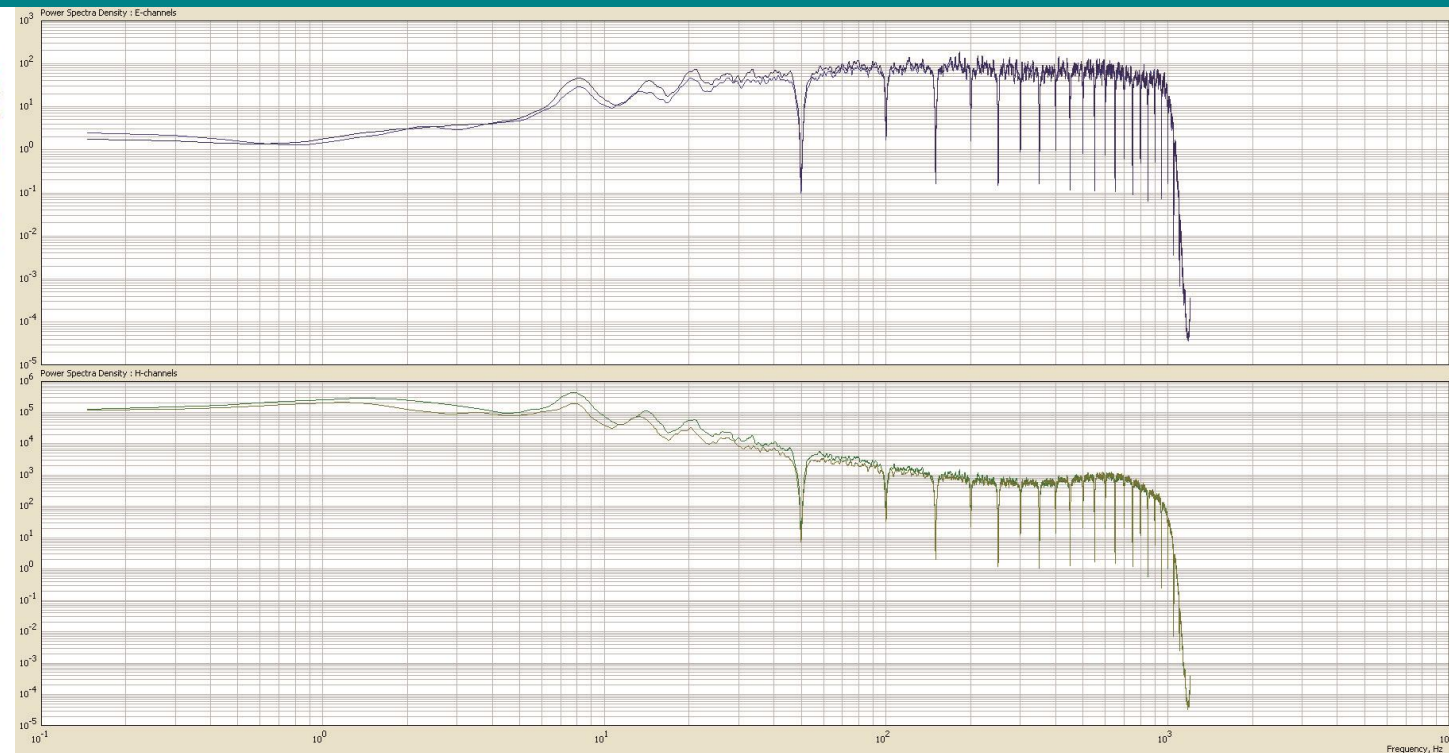
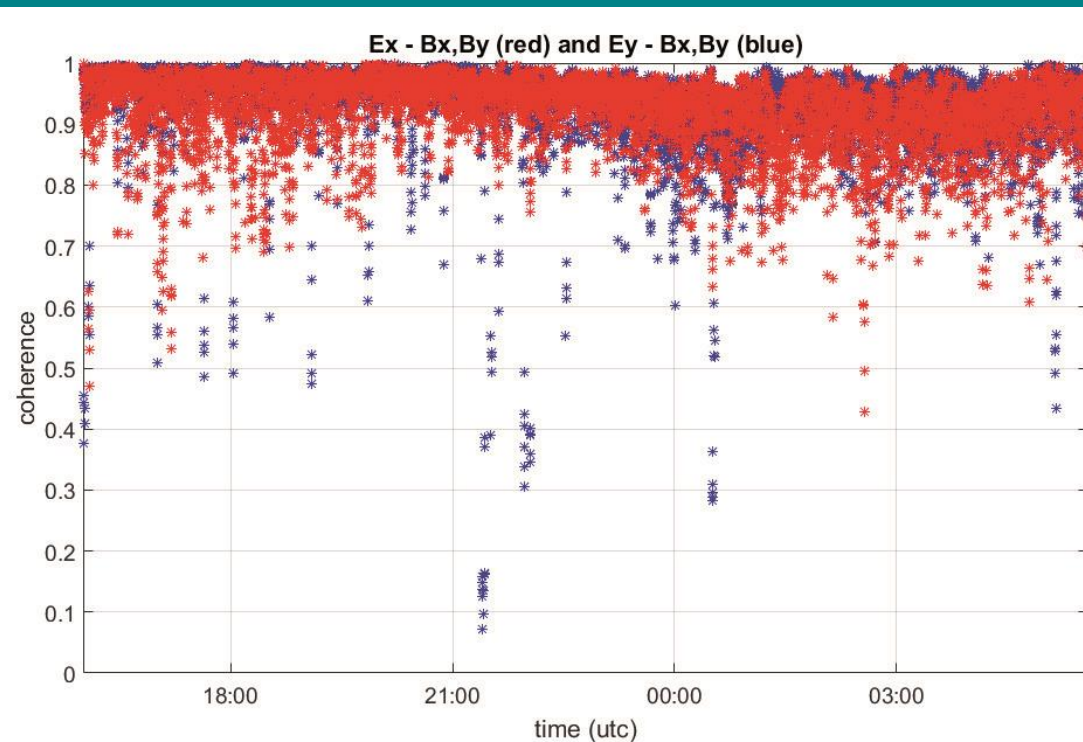


# From time-domain to frequency domain



# 2. Frequency domain

- Power spectrum
- "Pre-"processing



# Estimating the MT transfer function

1. Remote reference processing
2. Crosspowers
3. Settings such as coherency type and cut-off values.

- This is the Phoenix SSMT2000 processing routine, other processing software offers other approaches.

The screenshot shows the 'Magnetotelluric Processing Setup' dialog box with several sections highlighted by red boxes:

- Select Reference Type:** Includes radio buttons for 'Local E', 'Local H' (selected), 'Remote E', and 'Remote H'.
- Select Site(s) for Channels:** Includes dropdown menus for 'Ex and Ey', 'Hx and Hy', 'Hz', and 'RHx and RHy', all set to 'TER101A. TBL'. Checkboxes for 'Same as Ex and Ey' and 'Same as Hx and Hy' are checked. A status bar indicates '1 site(s), 5 channels selected'.
- Select Folders:** Includes text boxes for 'Save results in:' (E:\MTU-data\LAUW15\Processed\056aRR3H) and 'Store temporary files in:' (C:\EMT-SW\MTU-RBF), each with a 'Browse' button.
- Select Frequencies:** Includes a section for 'Frequency ranges to process:' with radio buttons for 'All applicable frequency ranges' (selected) and 'Only one range:'. It also has a 'View Ranges' button.
- Set Crosspower Parameters:** Includes a 'Maximum crosspowers (1-100):' spinner set to 20, radio buttons for 'No weight', 'Rho variance' (selected), and 'Ordinary coherency', and a 'Weight cutoff value:' spinner set to 0. An 'Advanced' button is also present.
- Set Robust Processing Parameters:** Includes a 'Use coherency processing' checkbox (checked) with a 'Coherency type:' dropdown set to '1' and a formula  $M(Ex,H) * M(Ey,H)$ . It also has a 'Move to next frequency if coherency reaches:' spinner set to 0.85 and a 'Maximum fraction of estimates to reject:' spinner set to 0.35. Below this is a 'Use Rho variance processing' checkbox (checked) with a 'Move to next frequency if variance reaches:' spinner set to 0.75 and a 'Maximum fraction of estimates to reject:' spinner set to 0.25.
- Parameters Files Loaded:** Includes a list box showing '(e:\MTU-data\PilotNL\ter001a)'.
- Save Robust Parameter (PRM) Files:** Includes a 'Save Parameter File' button, a text box with 'TER101A.PRM', and a 'Close' button.

# 3. Transfer functions

