TECHNISCHE
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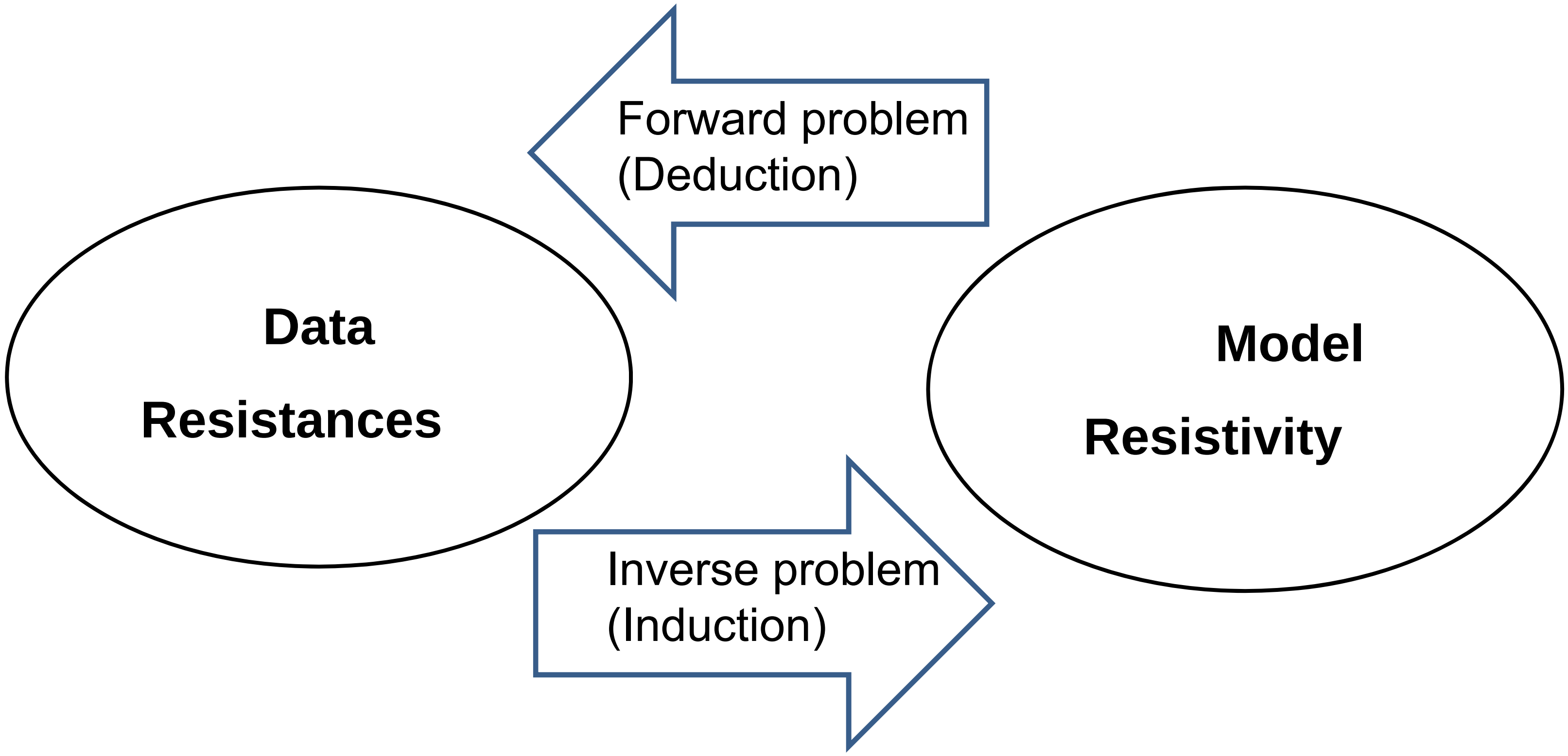
Übung 4
Electrical Resistivity Tomogrpahy

Exercise 4

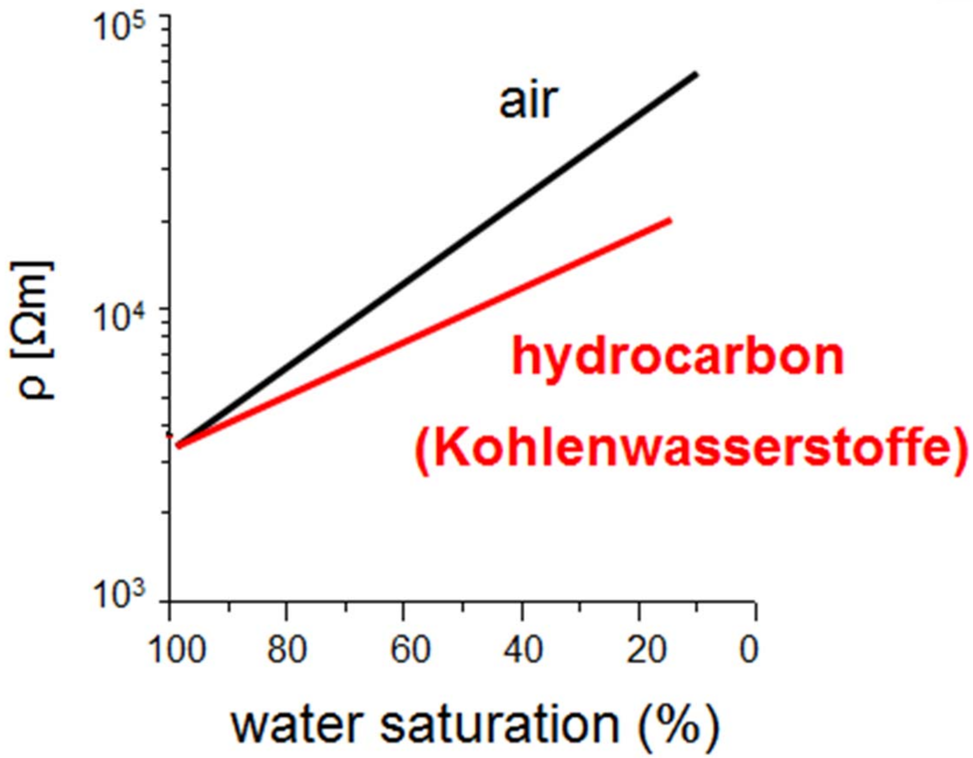
1. Forward modeling of Electrical Resistivity Tomography data
2. Evaluation of different electrode configurations regarding the resolution of the imaging results



Electrical conductivity of hydrocarbons

The electrical resistivity of hydrocarbon (such as gasoline, oil) is very similar to the electrical resistivity of air.

→ Hydrocarbon spills to the subsurface (i.e., leakages) are expected to be identified with resistive anomalies

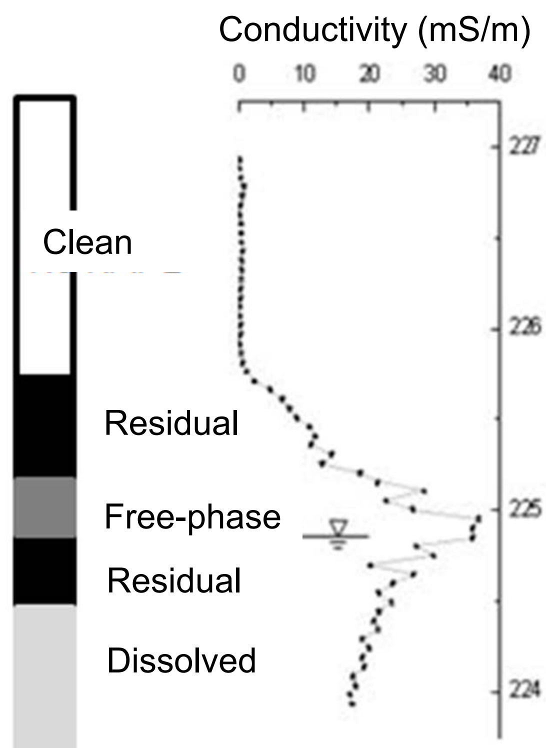


Hydrocarbon plume

Hydrocarbon provide a suitable source of energy (food) for microbial organisms in the subsurface. Microbial activity is enhanced due to the occurence of hydrocarbons, resulting in the release of metabolic products and transformations of the contaminant and sediments → modifications of the electrical response.

Release of carbonic acids, has been proposed as a mechanisms associated to:

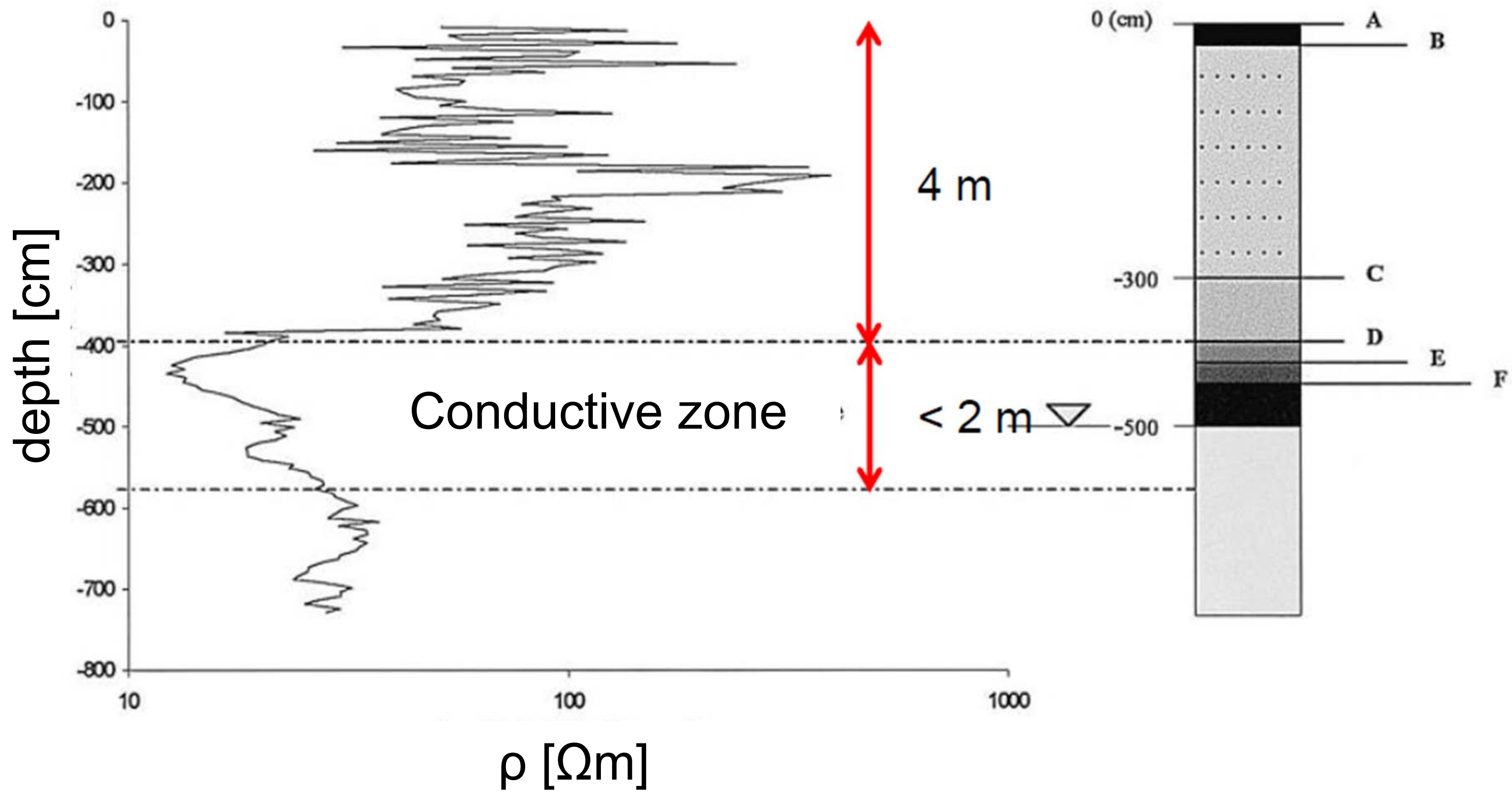
1) An increase in fluid electrical conductivity
2) Weathering and fracturing of grains → increase in porosity
3) Precipitation of metallic minerals
4) Accumulation of biofilms



Modified from Werkema et al., GRL 2003

Aged hydrocarbon plume

Conductive plume due to “aged” hydrocarbon spill



Atekwana, E.A., Sauck, W.A., Werkemma, D.D., 2000: Investigation of geoelectrical signatures at a hydrocarbon contaminated site. J. of Applied Geophysics

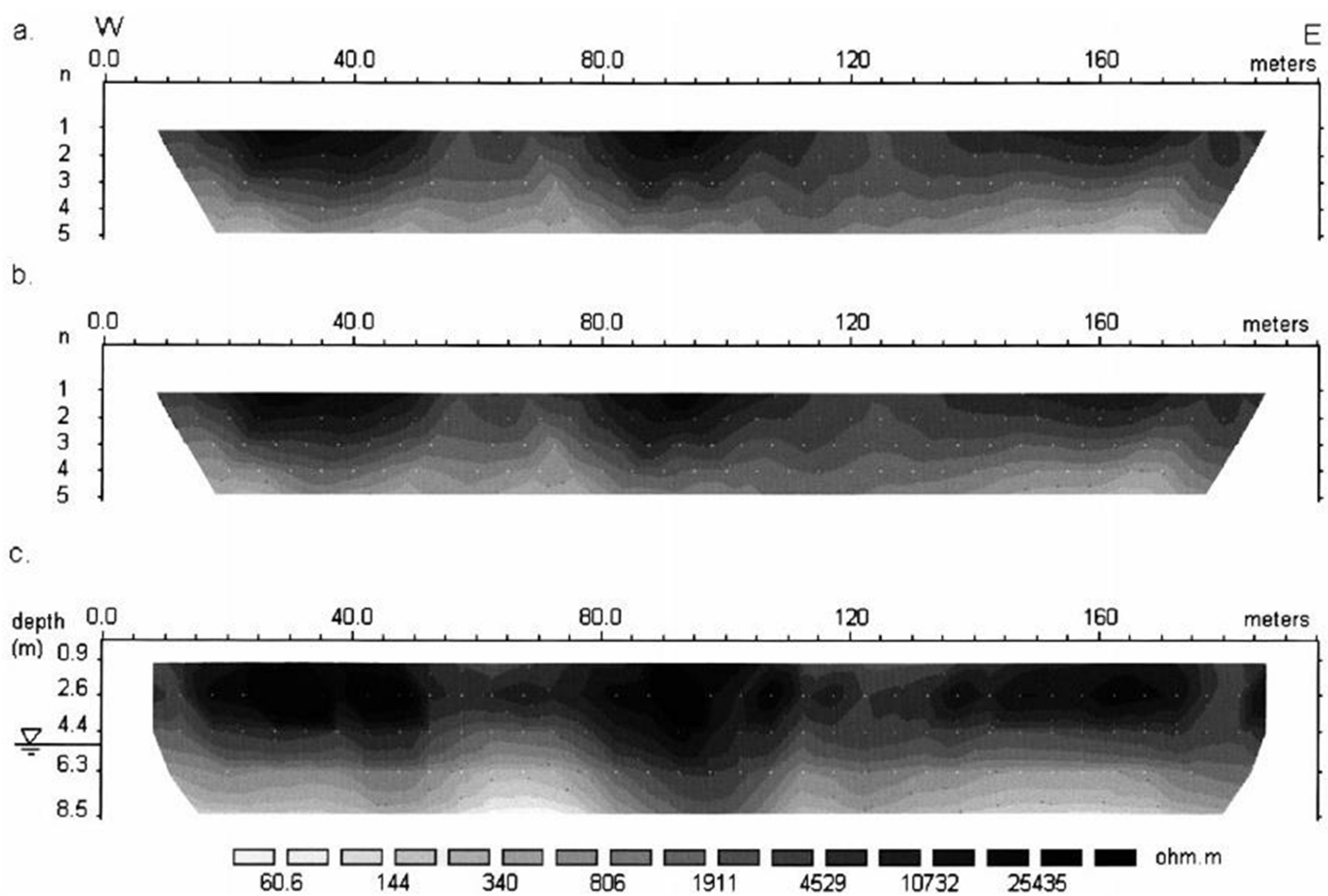
Inversion results

Dipole – dipole with 5m separation between electrodes (a) of 5 m and a separation between current-potential dipoles (n) of 5

Measured Apparent resistivity (seudosection)

Inverted Apparent resistivity (seudosection)

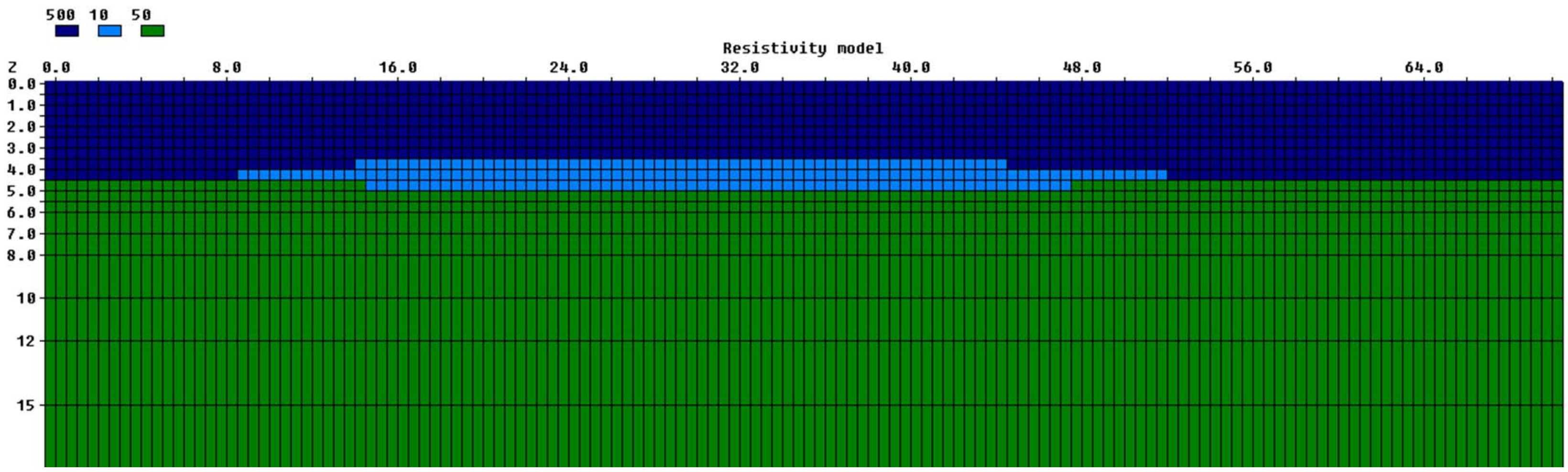
Inverted electrical resistivity model



Task

Based on a numerical model – which represent a contaminant plume characterized by a conductive anomaly (i.e., aged hydrocarbon spill) - we will investigate the advantage using:

→ Larger separations between current and potential dipoles in dipole-dipole configurations
→ Different configurations: Wenner and Schulmberger
→ Shorter separation between electrodes



Electrode arrays

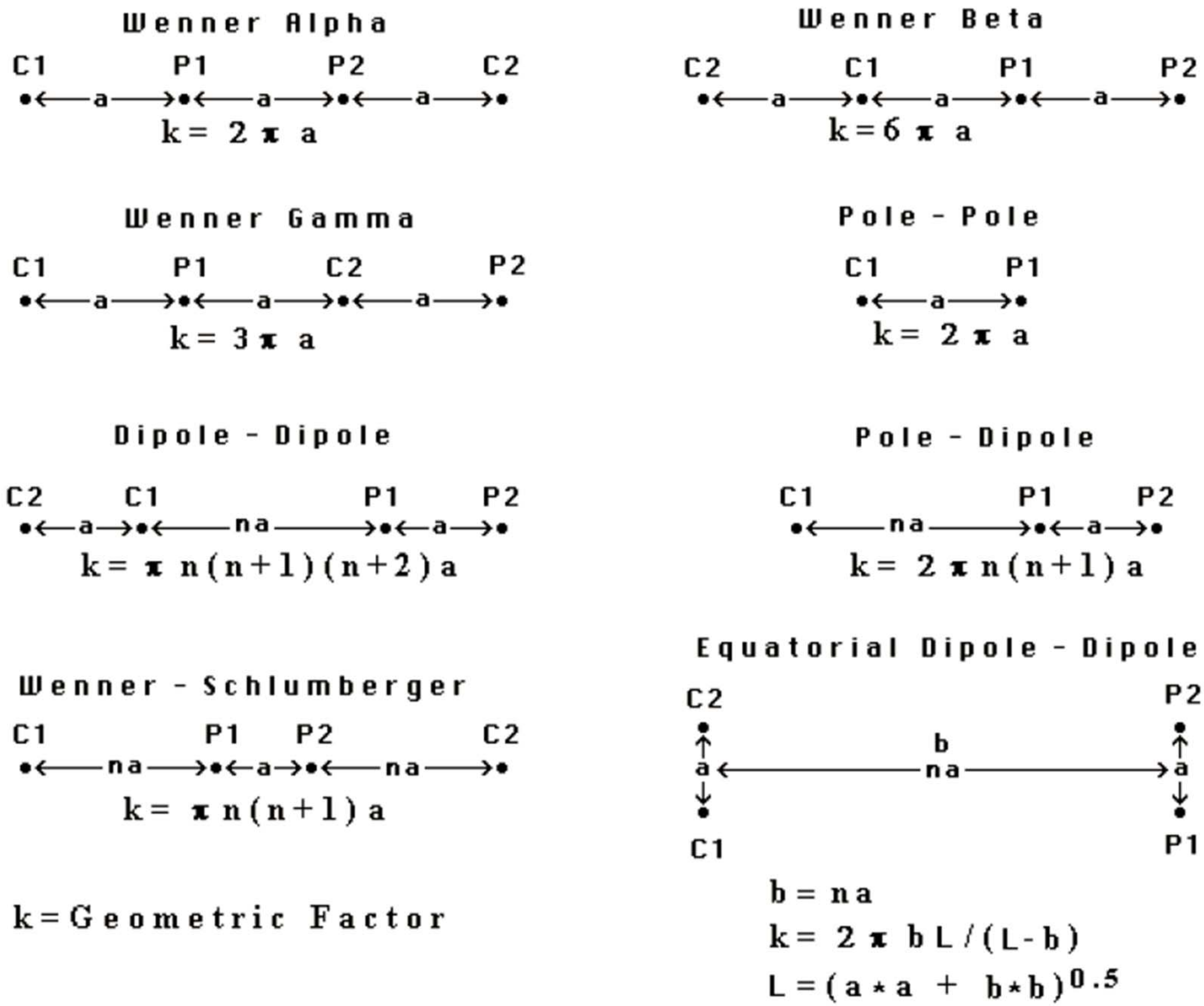


Figure 44. Arrangement of the electrodes for some commonly used arrays.