

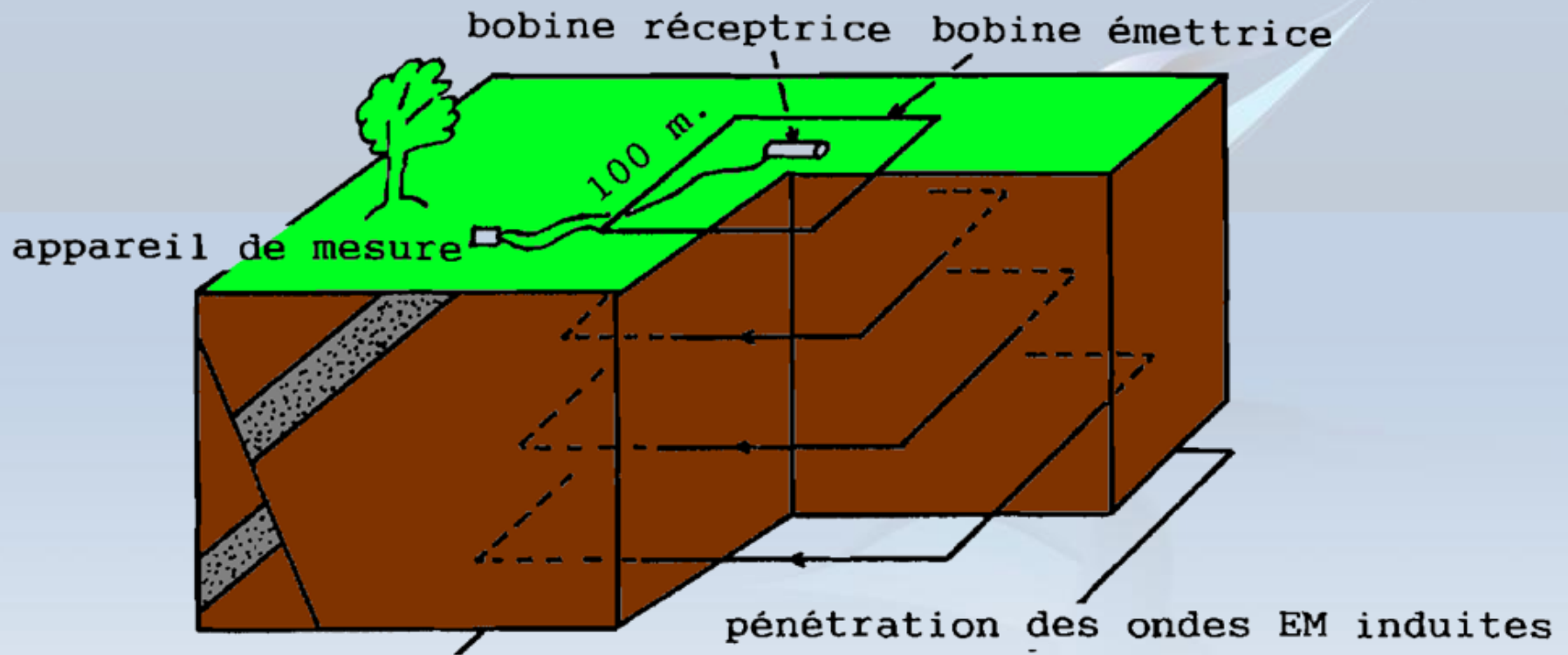
# 1D and 3D sensitivity analysis of an airborne VCP TDEM system

Authors :

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and Tabbagh A.

# Introduction

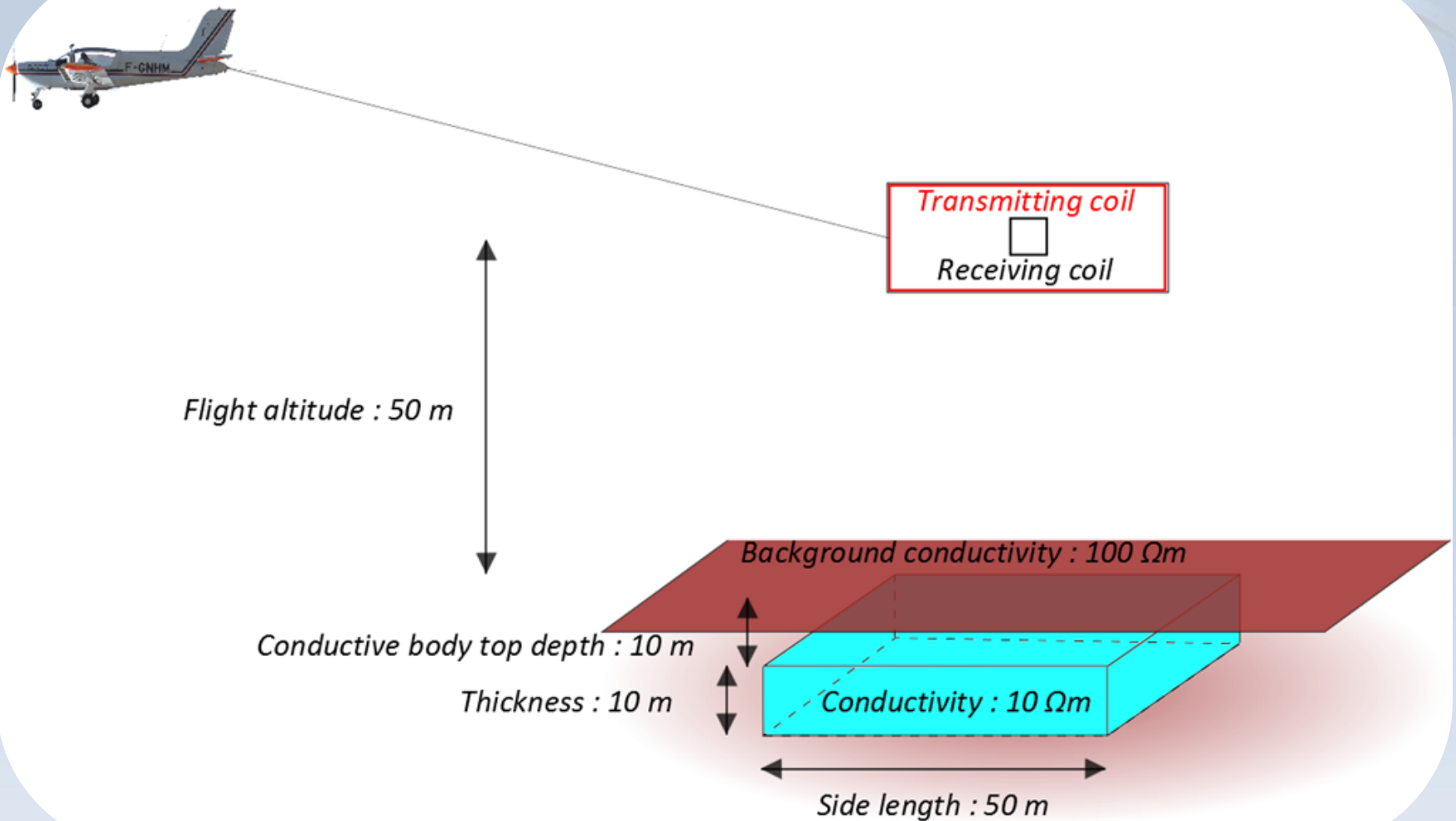
- Principe du TDEM



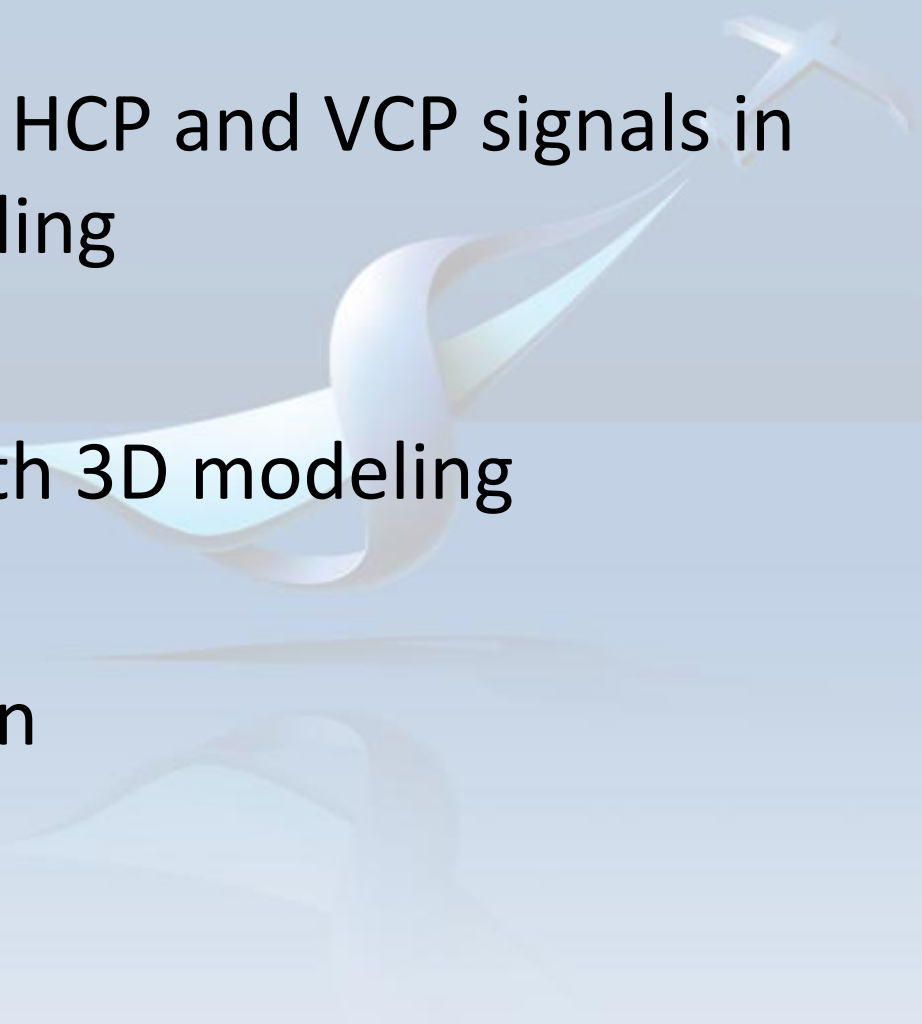
# Introduction

- New TDEM system towed by light plane
- TDEM → No large VCP, ground or airborne
- Could be used for 3D mapping improvement

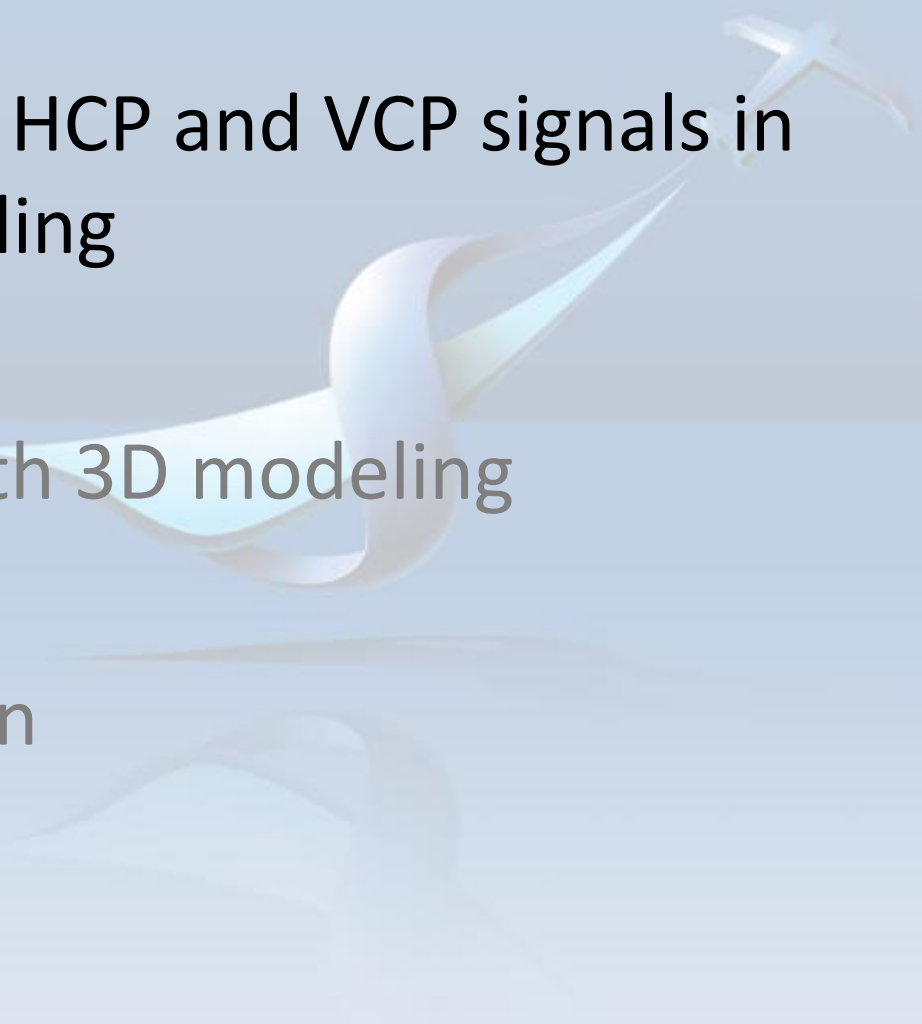
# Introduction



# Plan

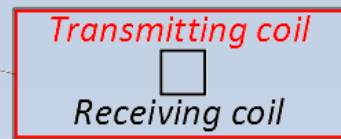
- I. Differences between HCP and VCP signals in TDEM with 1D modeling
  - II. Lateral resolution with 3D modeling
  - III. Depth of investigation
- 

# Plan

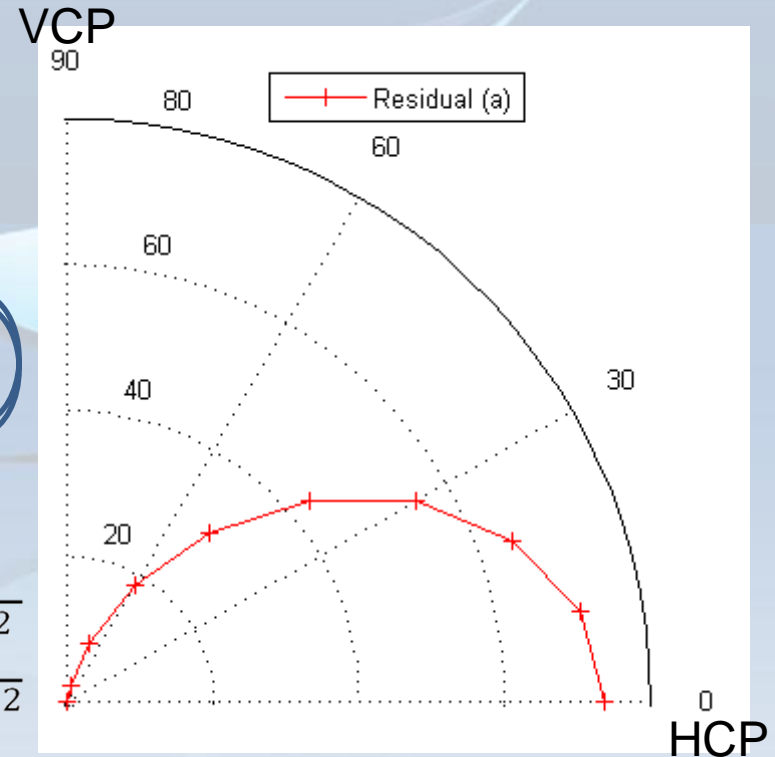
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# I. Differences between HCP and VCP

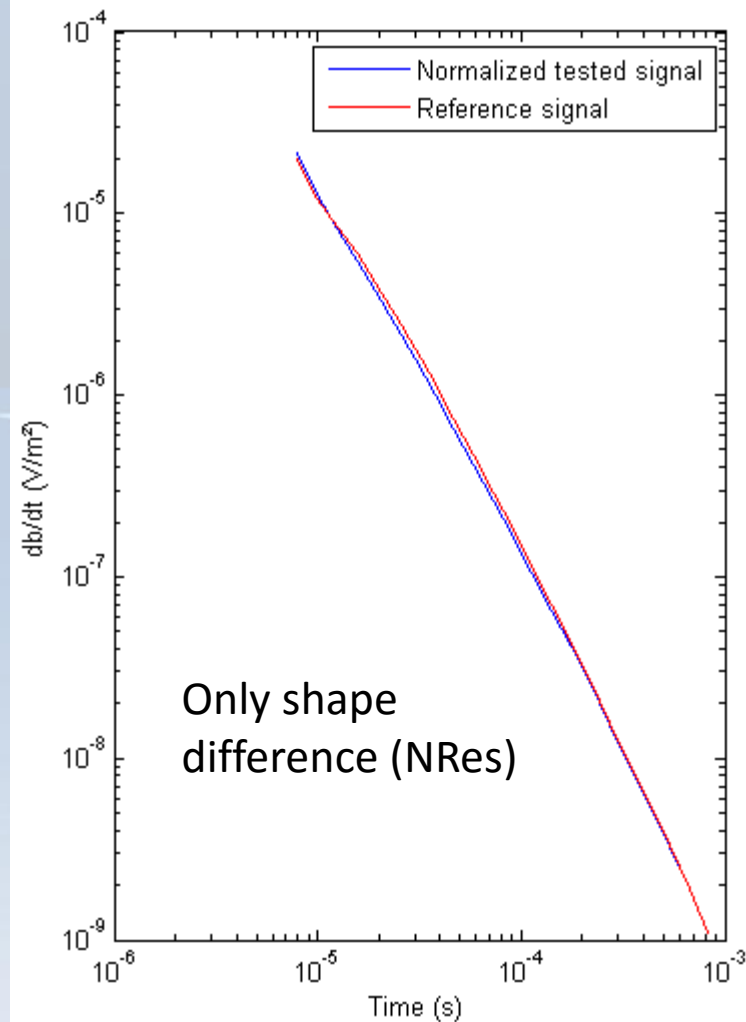
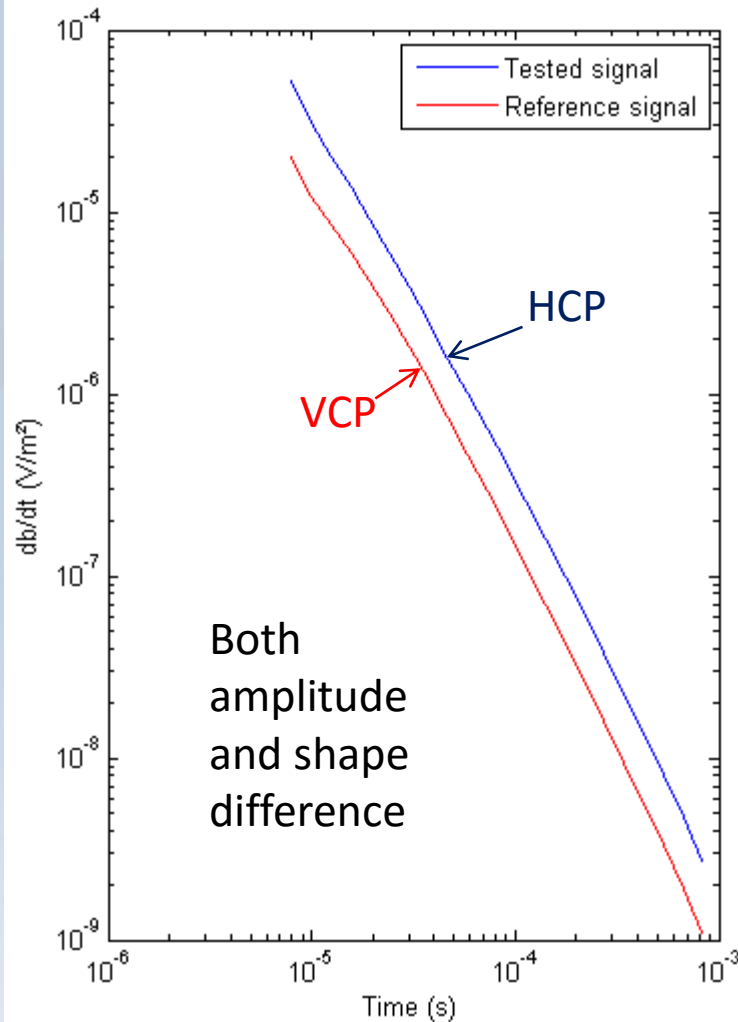
- 10  $\Omega\text{m}$ , 10 m deep, 10 m thick layer
- 100  $\Omega\text{m}$  background



$$\text{Data residual} = \sqrt{\sum_{\text{time gates}} \frac{(M_s - M_r)^2}{(M_r * STD_f)^2}}$$



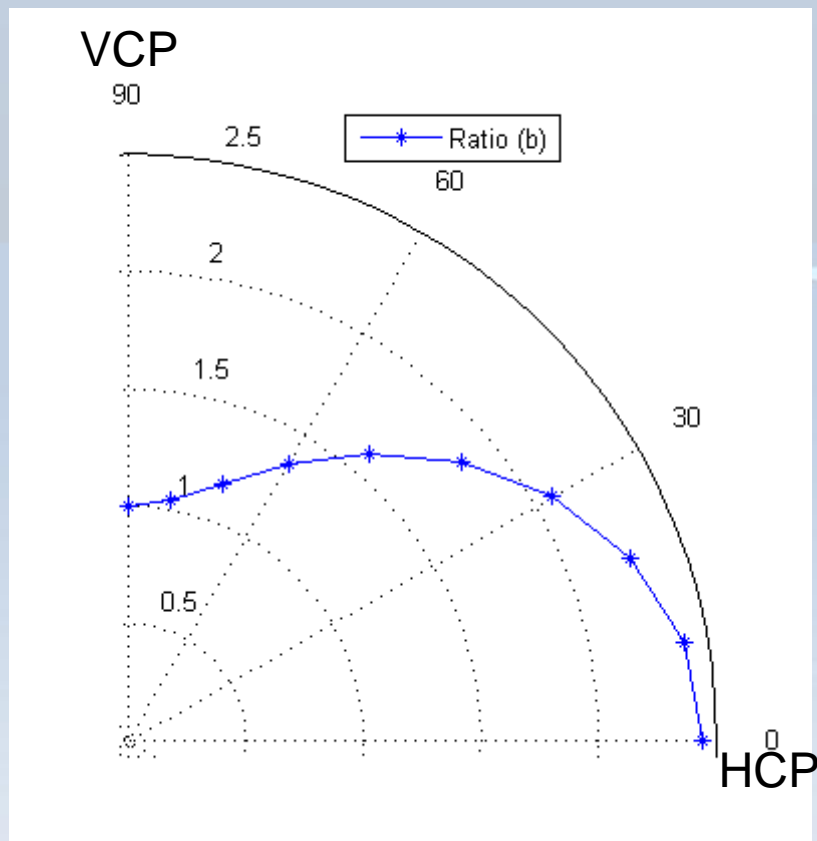
# I. Differences between HCP and VCP



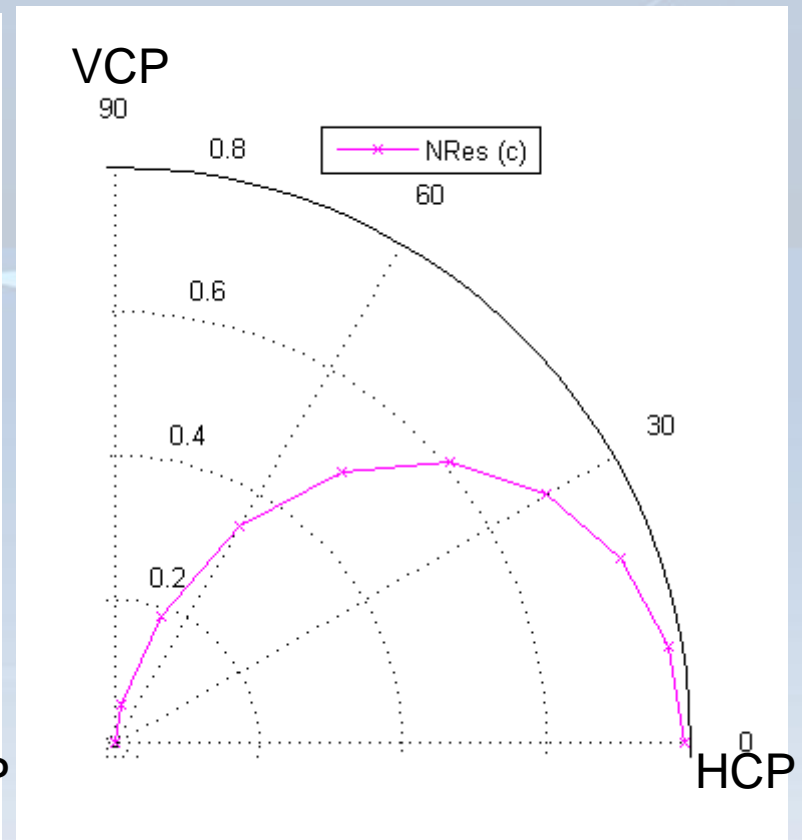


# I. Differences between HCP and VCP

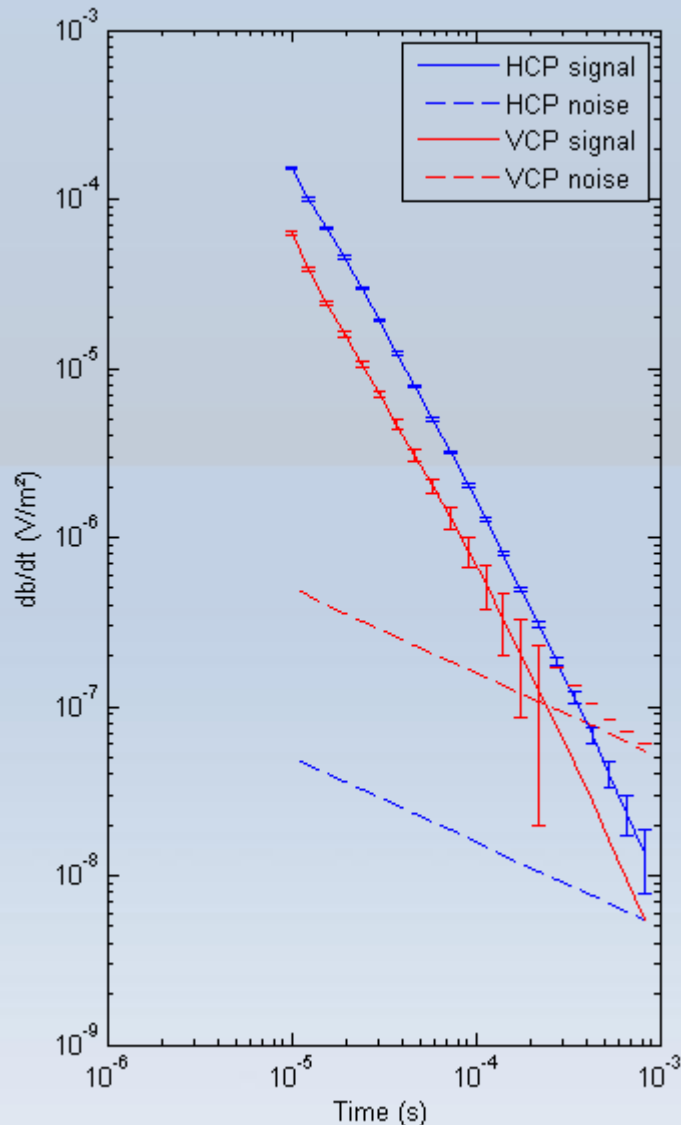
Amplitude difference evaluation



Shape difference evaluation



# I. Differences between HCP and VCP



Alt. : 50 m

Moment : 30,000 A.m<sup>2</sup>

HCP noise level :  
 $5 \cdot 10^{-9} V/m^2$  at 1 ms

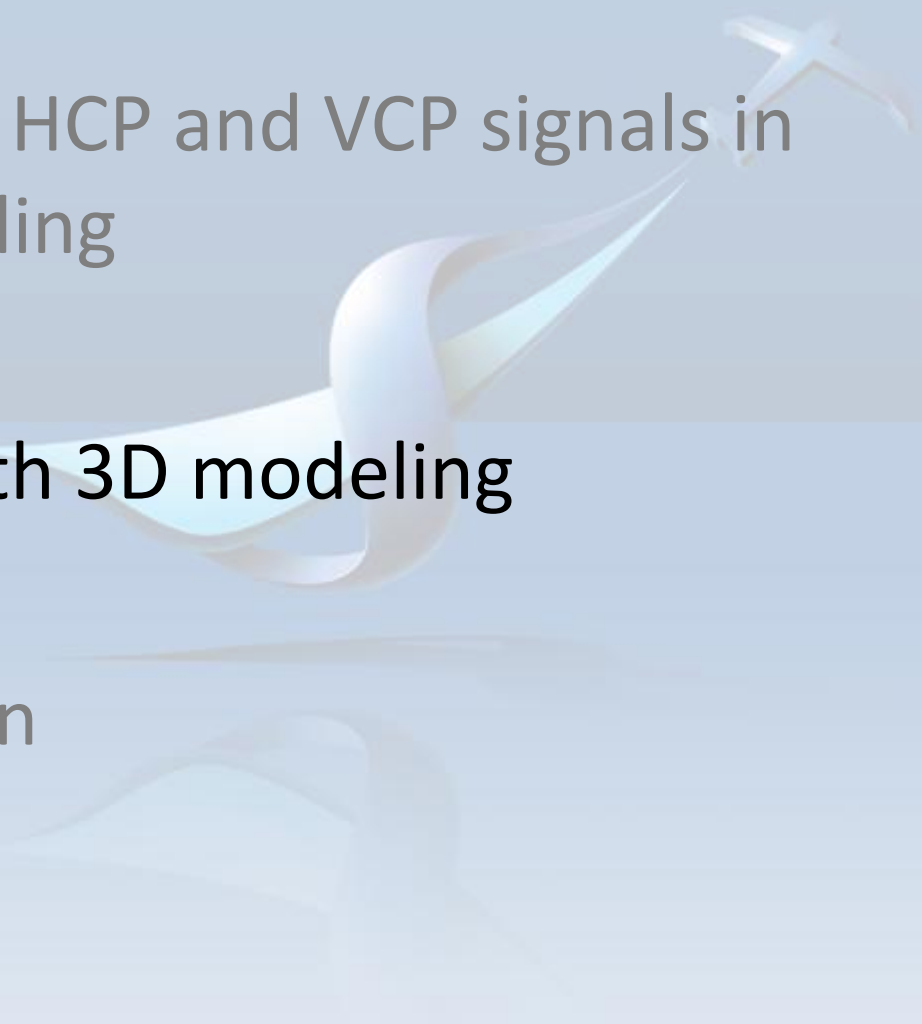
VCP noise level :  
 $5 \cdot 10^{-8} V/m^2$  at 1 ms

Homogeneous ground  
resistivity : 100  $\Omega m$

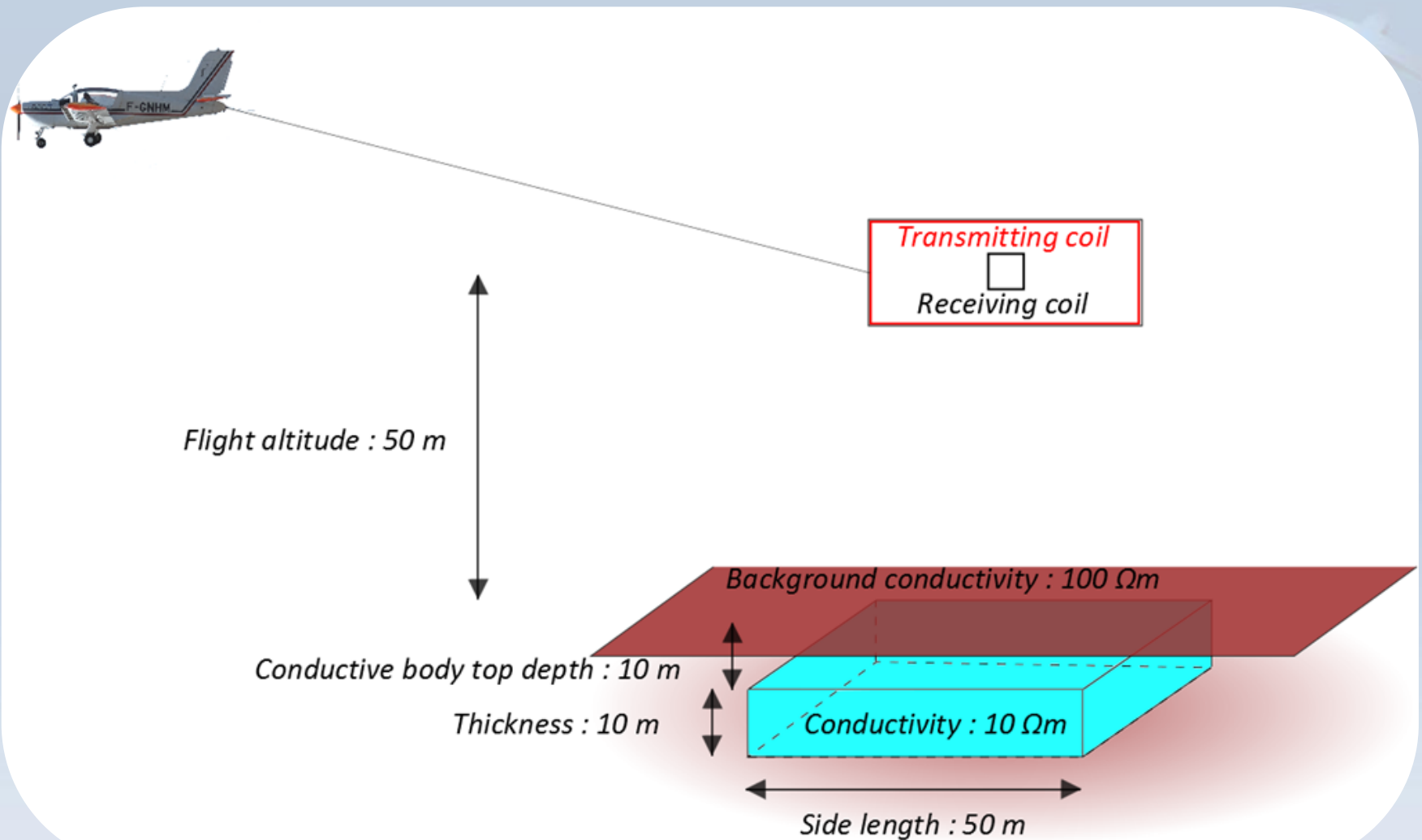
# I. Differences between HCP and VCP

- Important signal difference between HCP and VCP (residual)
- Correctable rotation above quasi 1D grounds
- Noise level difference → how much does it affect sensitivity (part 3)

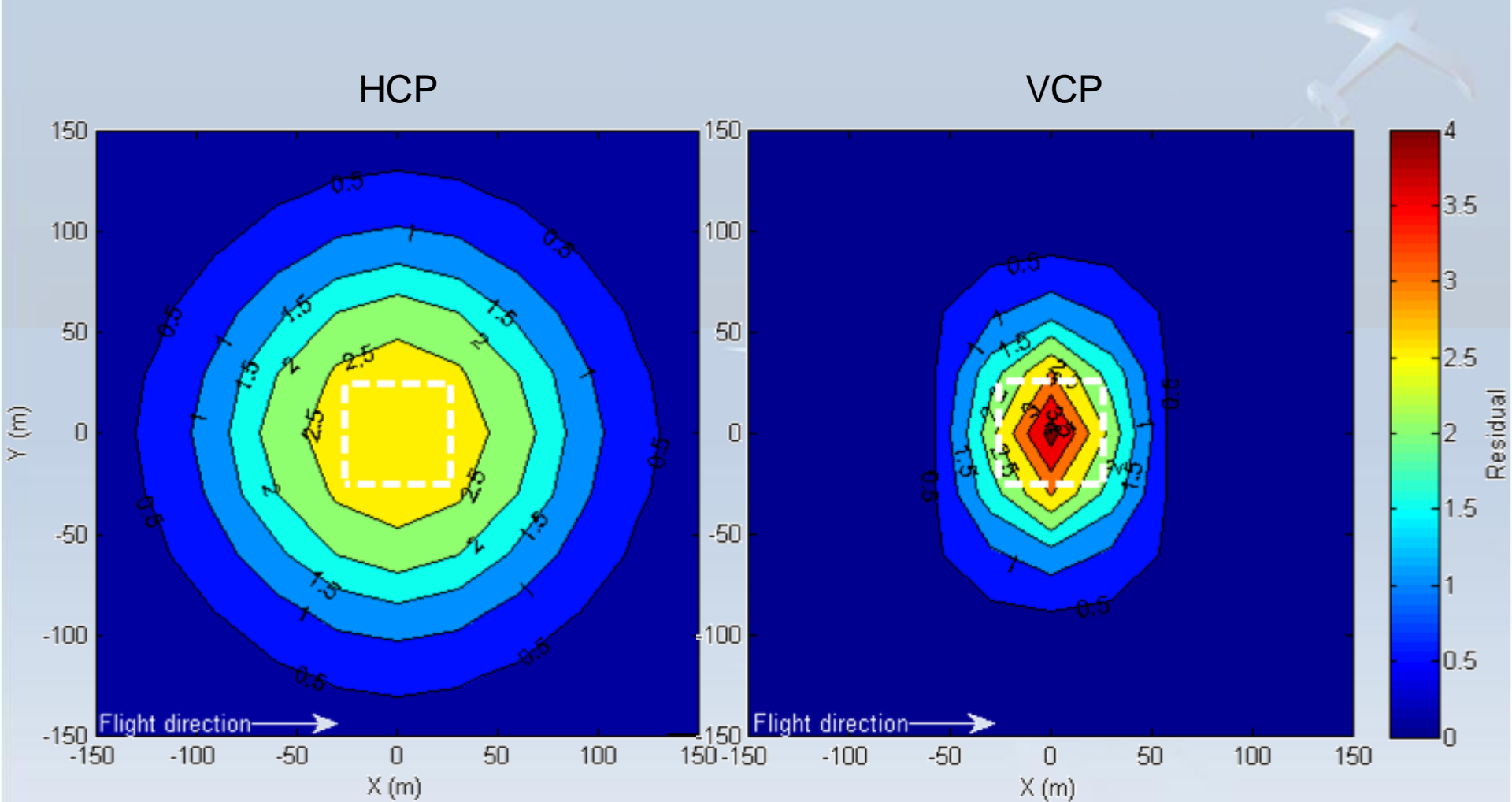
# Plan

- I. Differences between HCP and VCP signals in TDEM with 1D modeling
  - II. Lateral resolution with 3D modeling**
  - III. Depth of investigation
- 

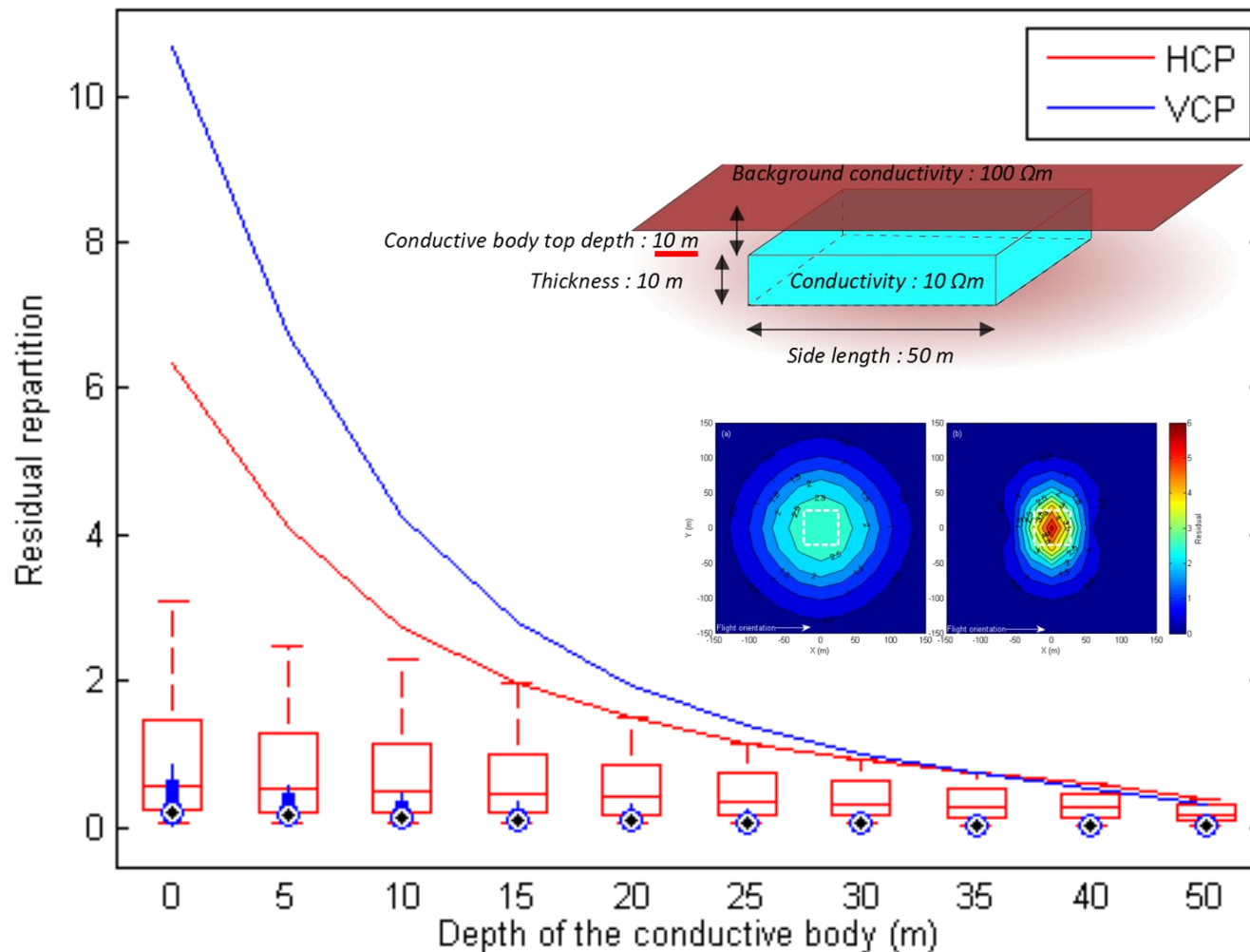
## II. Lateral resolution & 3D modeling



## II. Lateral resolution & 3D modeling



## II. Lateral resolution & 3D modeling



## II. Lateral resolution & 3D modeling

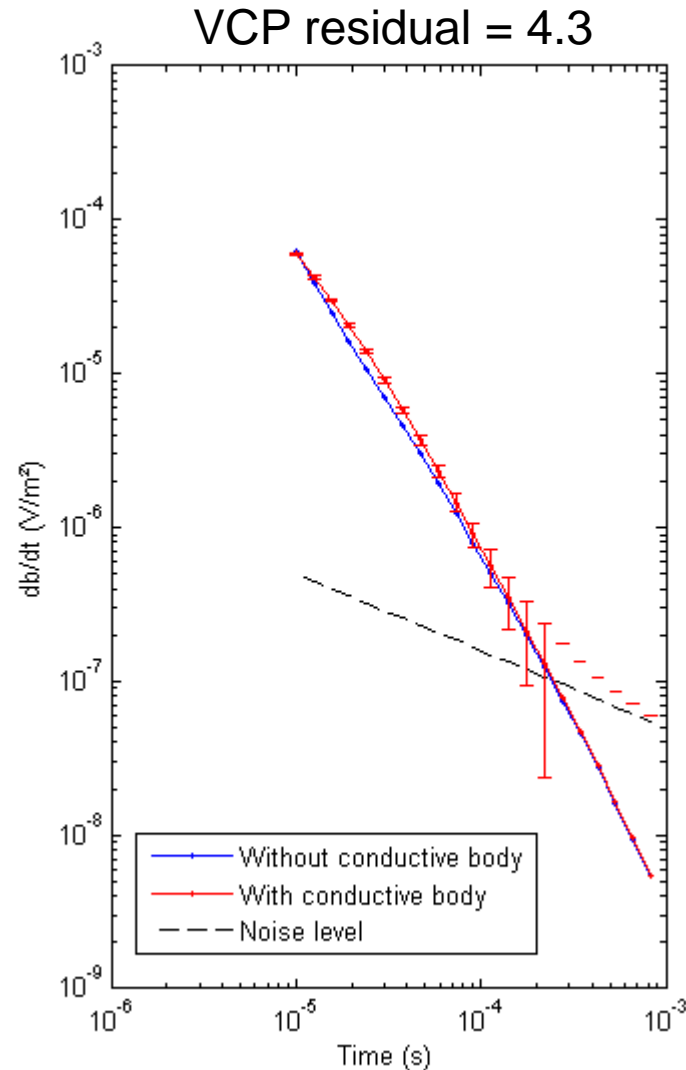
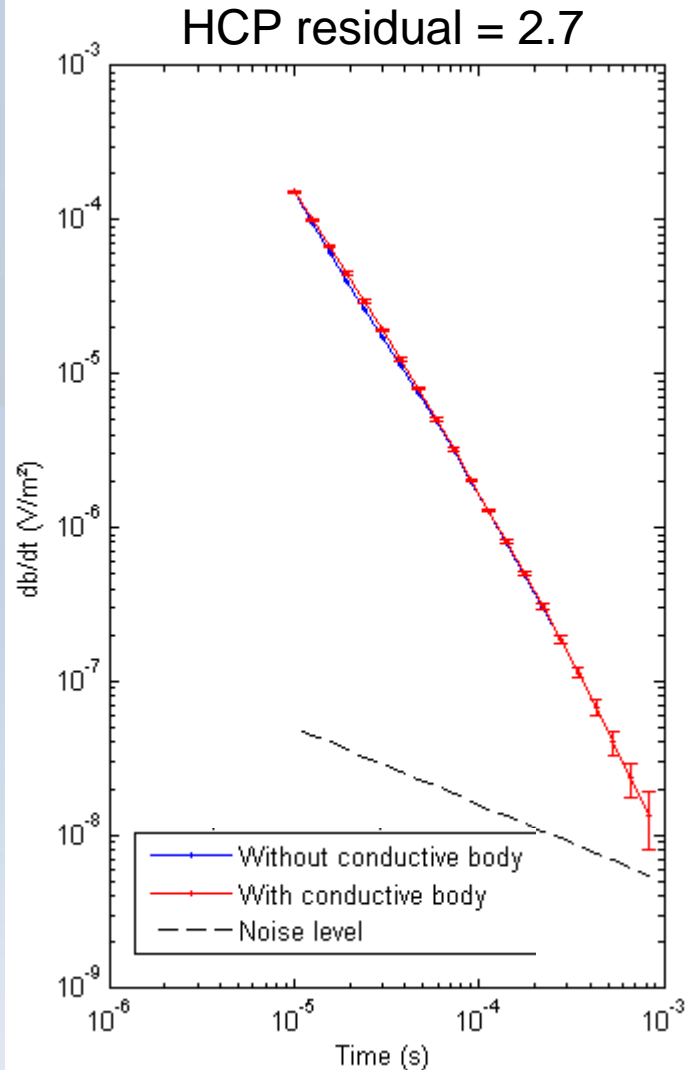
- Better delimitation of near-surface 3D body for VCP
- VCP needs higher measure sampling (small FL spacing)
- VCP seems to lose advantage with depth



# Plan

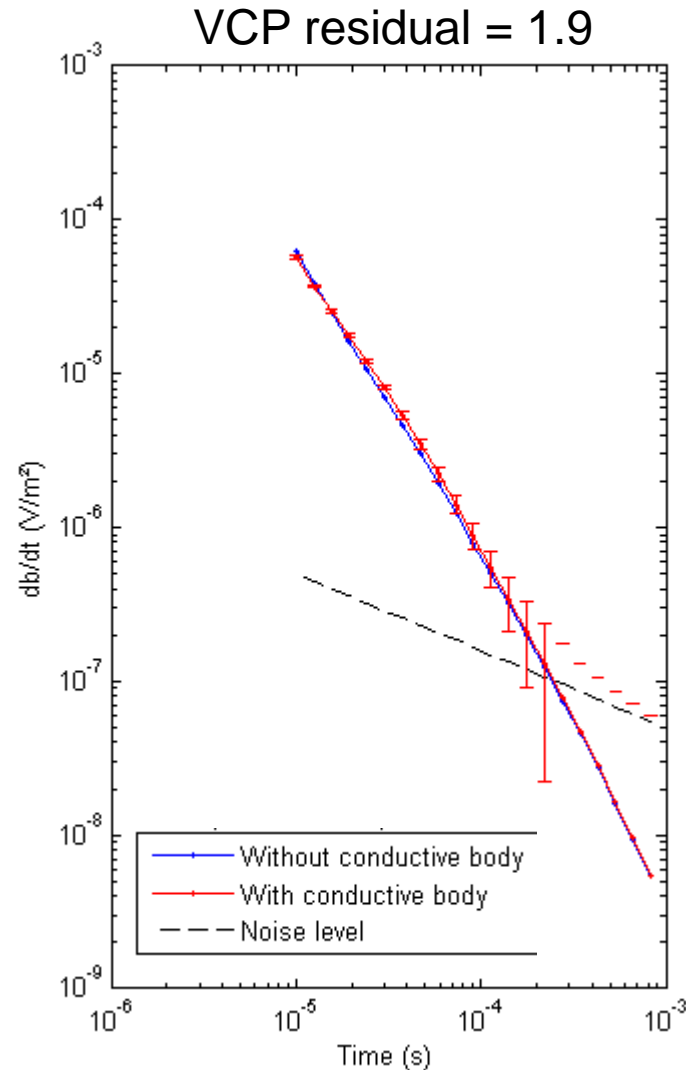
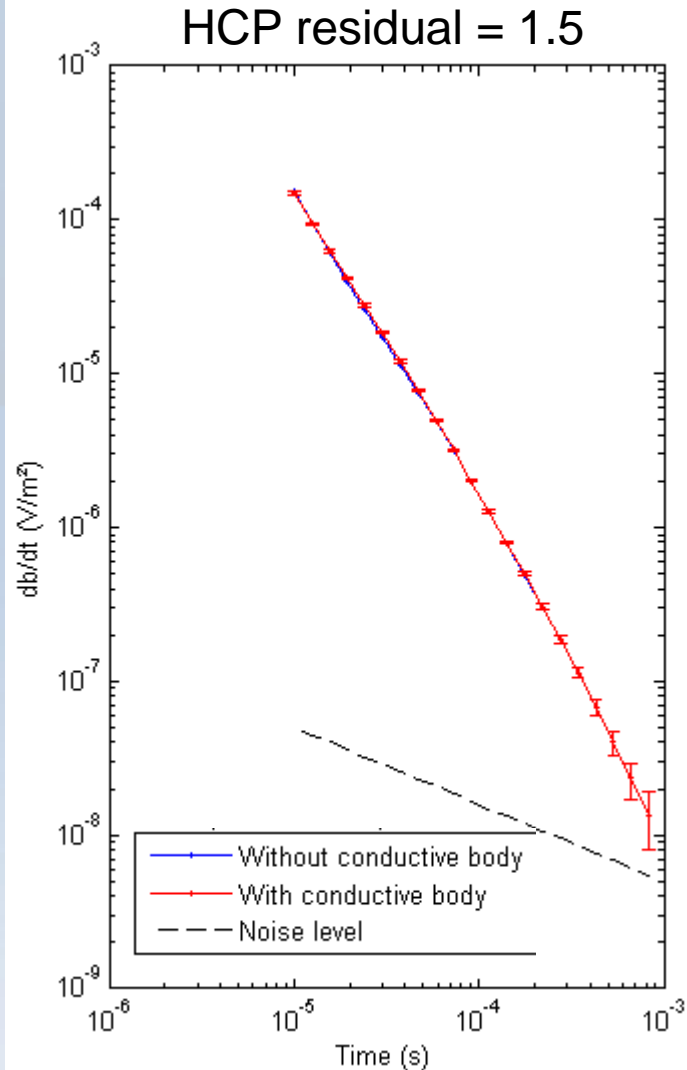
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# III. Depth of investigation



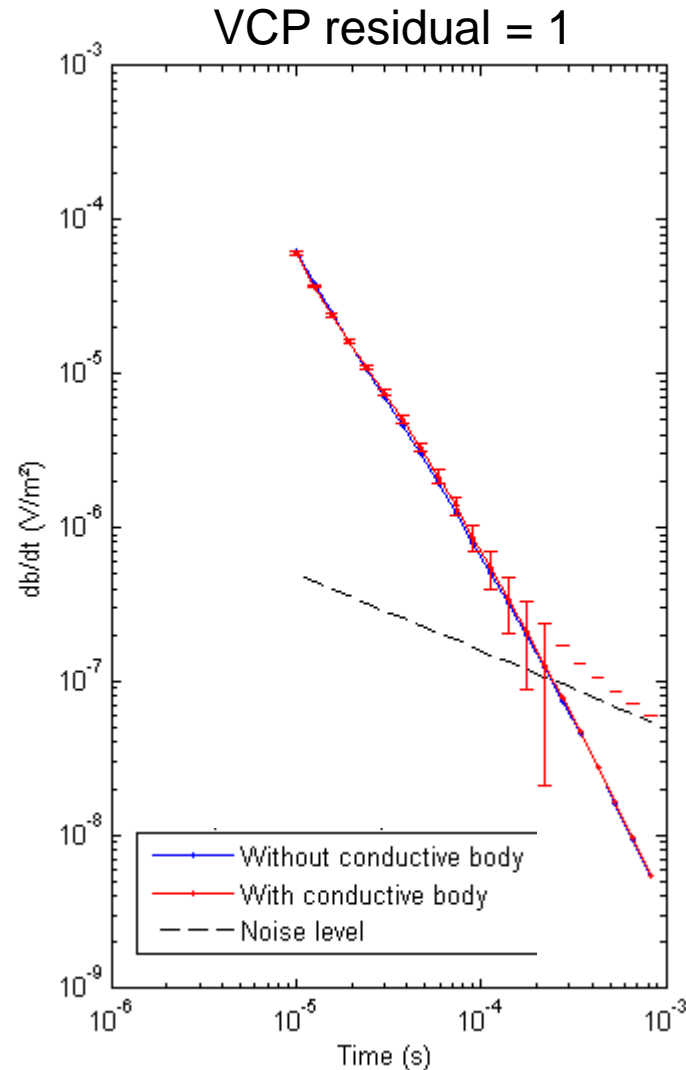
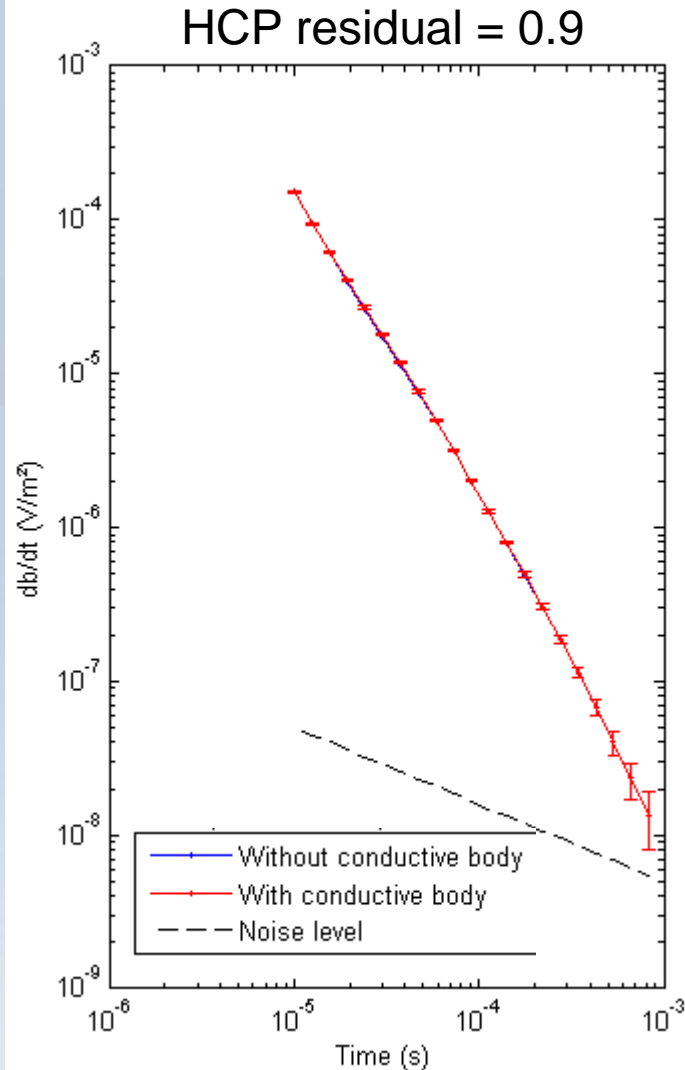
Depth = 10 m

# III. Depth of investigation



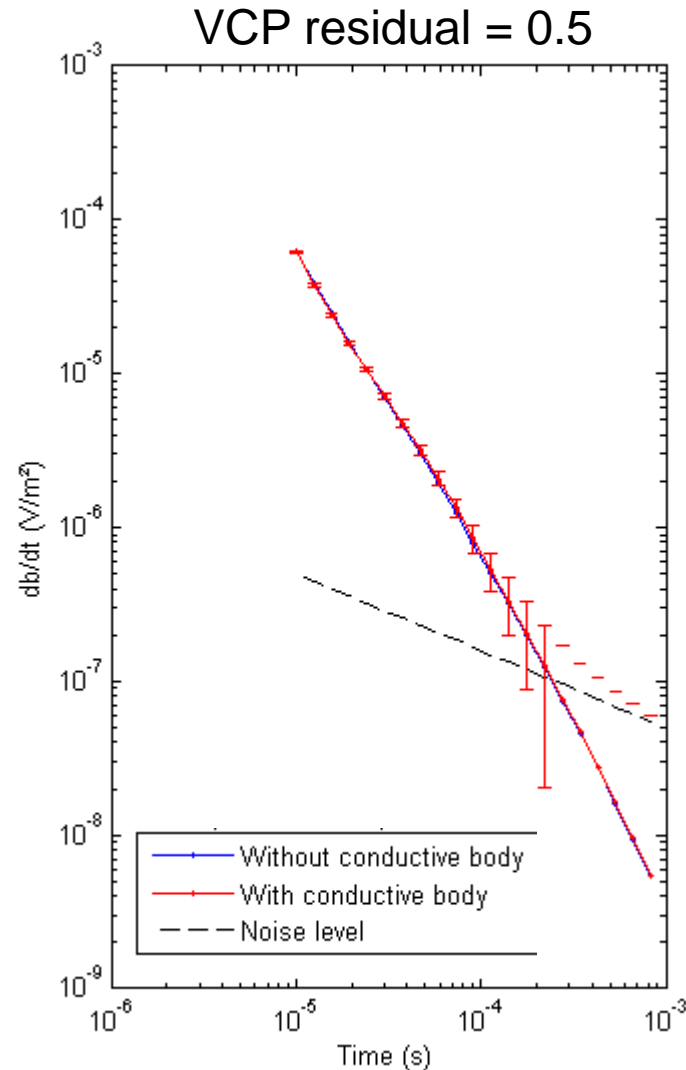
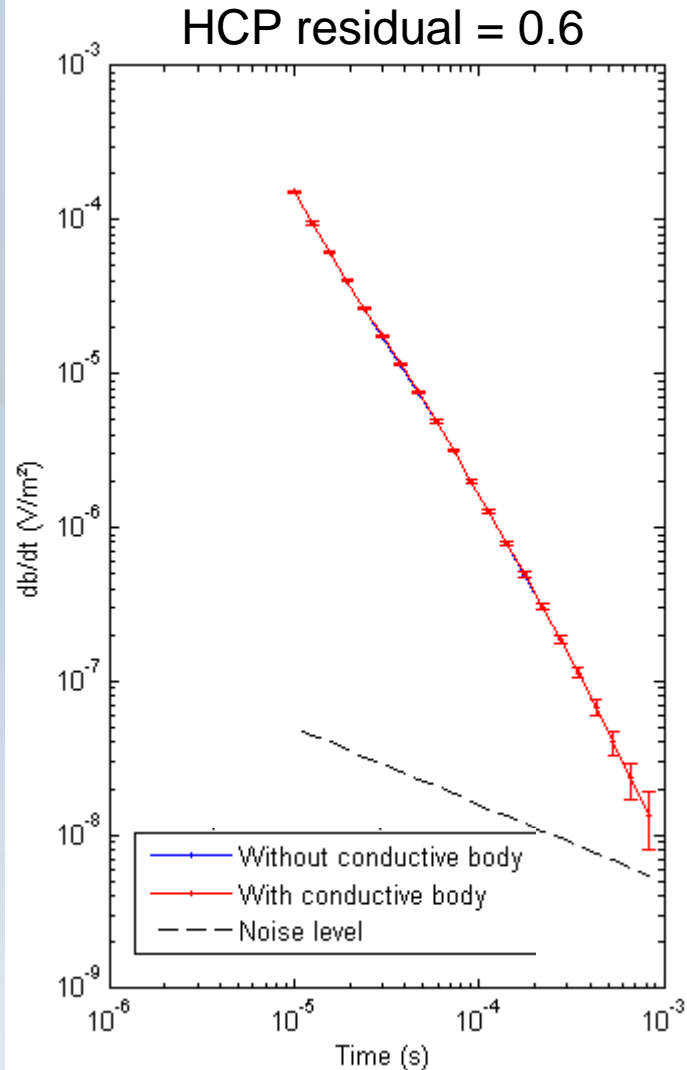
Depth = 20 m

# III. Depth of investigation



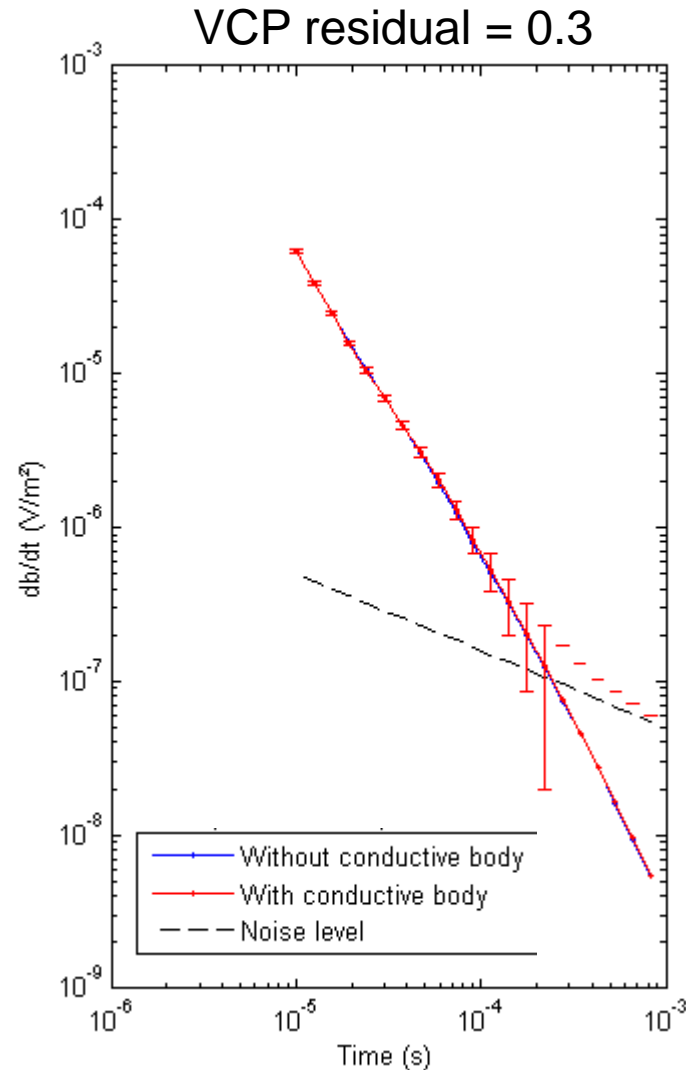
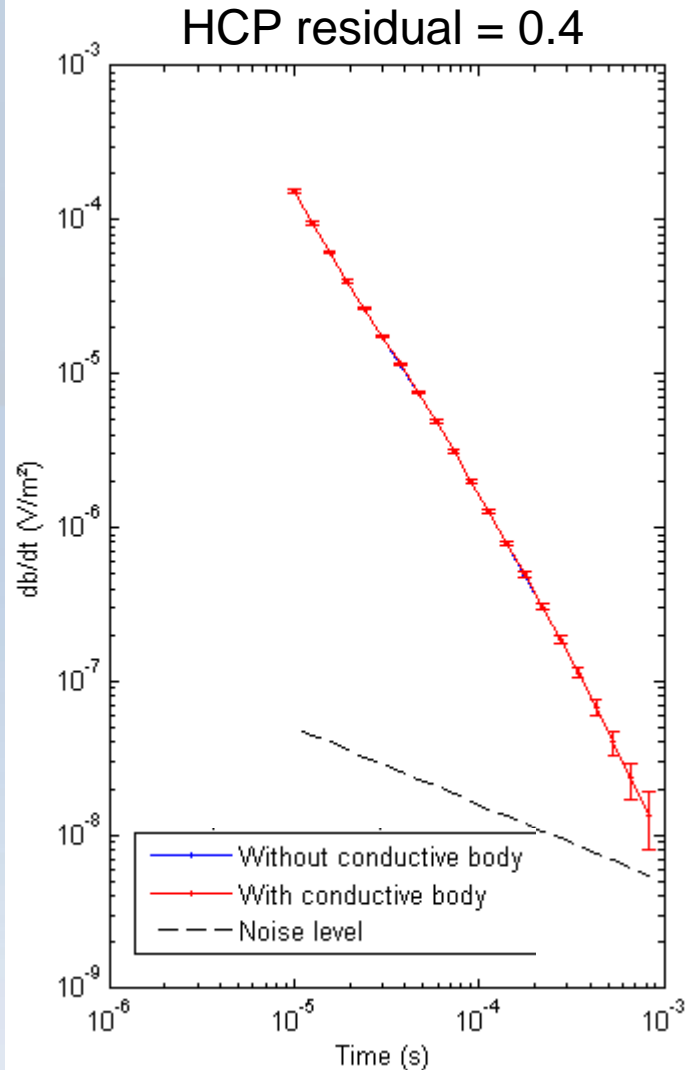
Depth = 30 m

# III. Depth of investigation



Depth = 40 m

# III. Depth of investigation



Depth = 50 m

# Conclusion

VCP promising for 3D near-surface survey vs. HCP :

- Better lateral resolution
- Better detection of 3D bodies at intermediate depths

Easy correction of antenna rotation for quasi 1D grounds

Still do not replace HCP

- Lower DOI (noise level) vs. HCP
- Requires a higher measure sampling vs. HCP

# Perspectives

- Check if angle correction is still applicable in 3D
- Other types of rotation (other axis)



- Inversion sensitivity tests
- Long term : Flight tests... :-)



# Thank you for your attention!

