



# Is soil permeability a good predictor for overland flow occurrence?

**Sibylle Hassler,  
Helmut Elsenbeer  
University of Potsdam  
EGU 2011 – 05.04.2011**



Smithsonian  
Tropical  
Research Institute



HSBC  
Climate  
Partnership



## Why permeability ( $K_s$ )?

- Dependent on static and dynamic properties
  - soil structure, porosity
  - sensitive to land use changes

## Why permeability ( $K_s$ )?

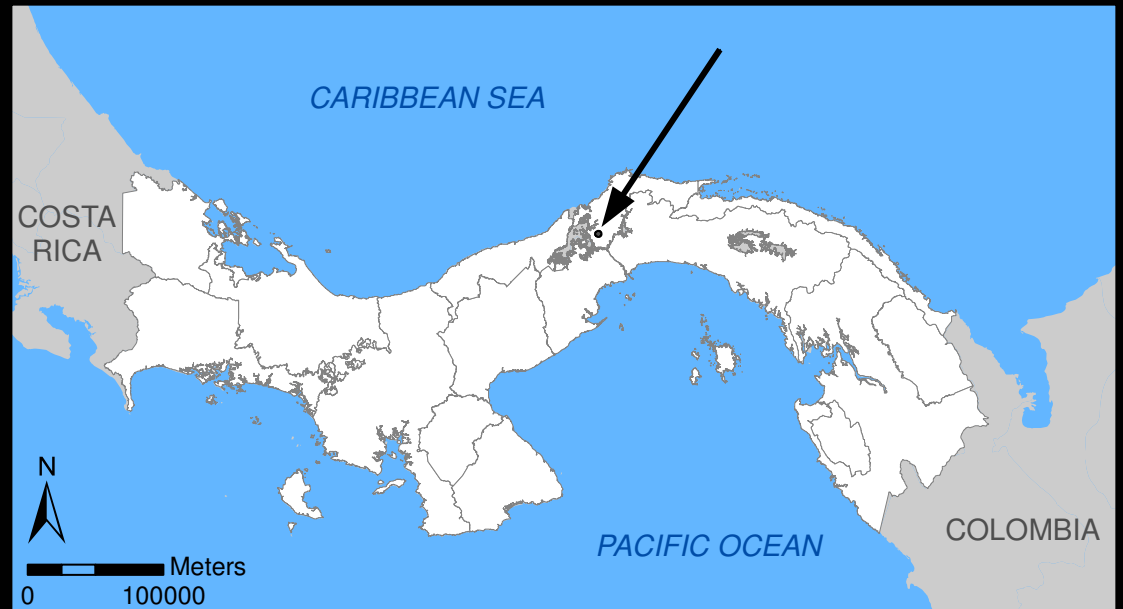
- Dependent on static and dynamic properties
  - soil structure, porosity
  - sensitive to land use changes
- Important parameter in soil hydrology
  - determines water flow paths
  - overland flow (OF) occurrence?
  - erosion, nutrient depletion

## Why permeability ( $K_s$ )?

- Dependent on static and dynamic properties
  - soil structure, porosity
  - sensitive to land use changes
- Important parameter in soil hydrology
  - determines water flow paths
  - overland flow (OF) occurrence?
  - erosion, nutrient depletion
- Few studies about  $K_s$  – OF relation
  - $K_s$  studies: comparison with rainfall intensities
    - estimates of overland flow occurrence
  - Sediment studies

## Study area

- Central Panama, Panama Canal watershed
- Climate : 27 °C MDT, 2300 mm MAP
- Land use: 8% pasture, 28% young secondary forests, 50% old secondary forests
- Soil texture: silty clay, clay

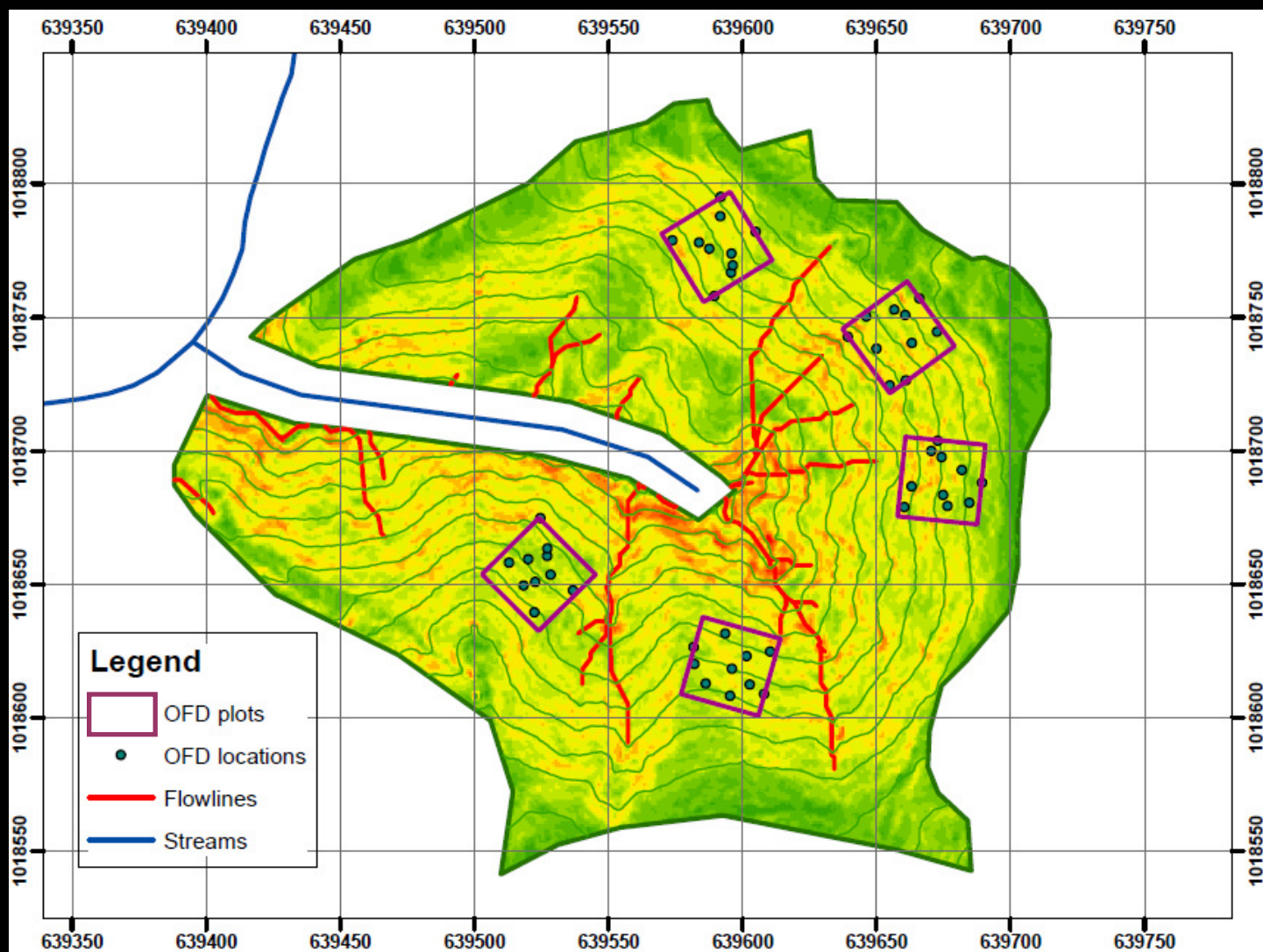


# Measurements

- Two sites
  - 5 year-old secondary forest (SF5)
  - 25 year-old secondary forest (SF25)
  - ➔ land-use effect
- Plots and flow lines
  - 5 plots in SF5, 4 plots in SF25
  - All detectable flow lines at each site
  - ➔ overland flow characteristics



# Measurements – SF5



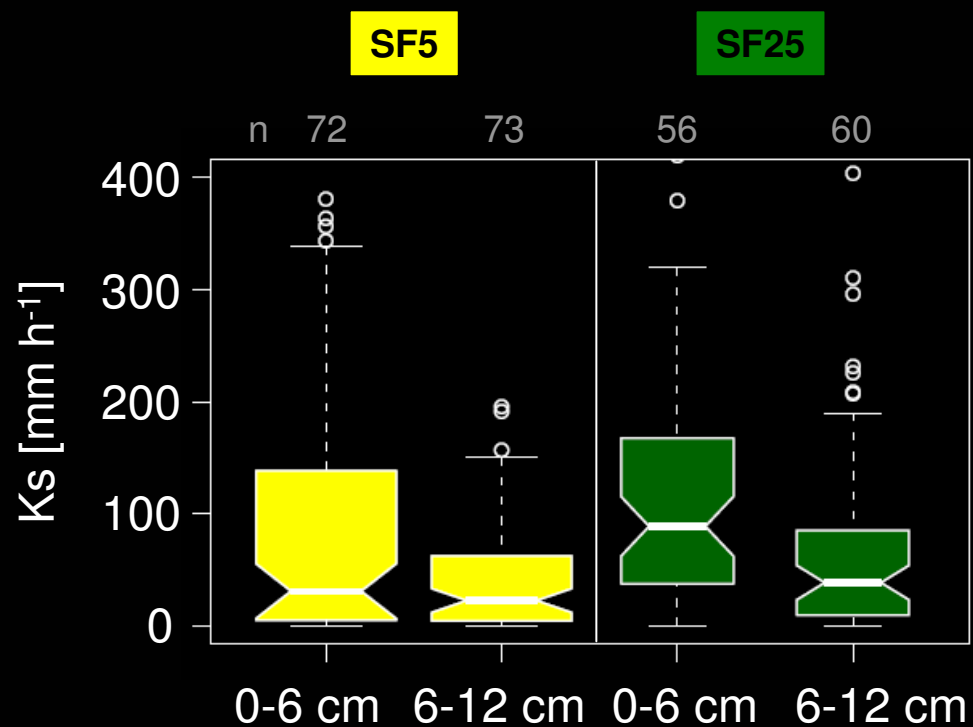
# Measurements

- Permeability
  - Undisturbed soil cores
  - Constant head
  - 15 cores on each plot, 2 depths
- Overland flow
  - OF detectors (OFD)
  - Daily P/A recording
- Precipitation
- Ancillary variables

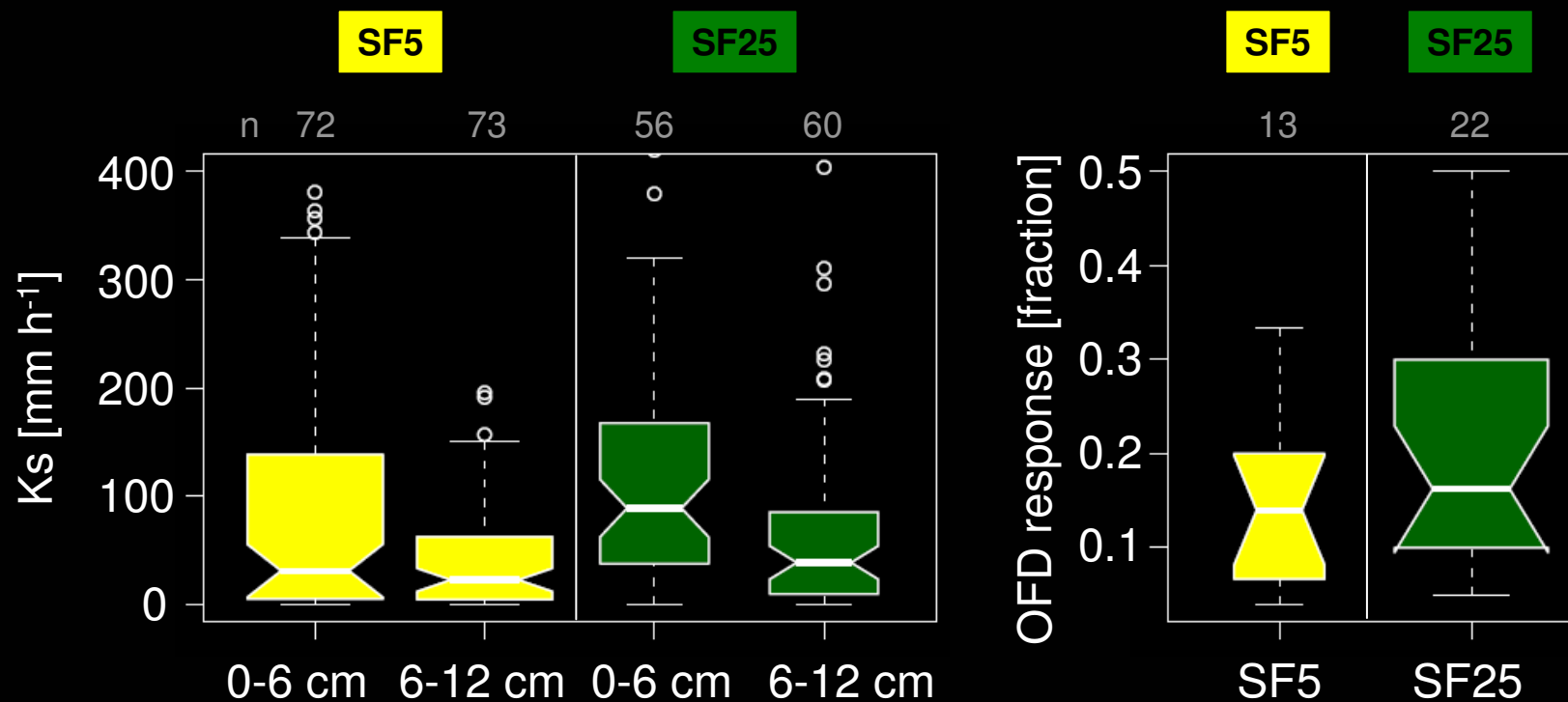




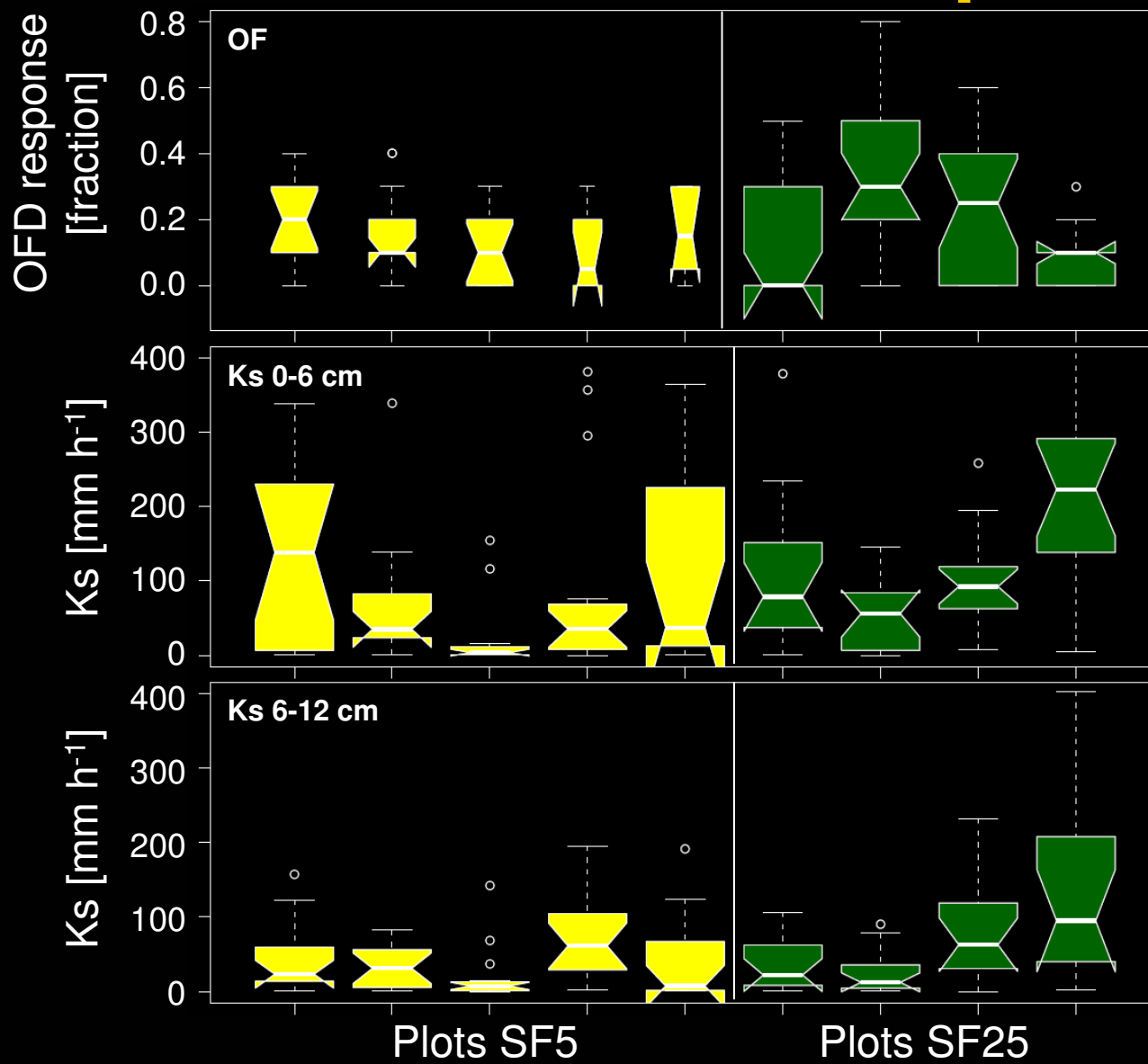
# Ks and OF at the sites



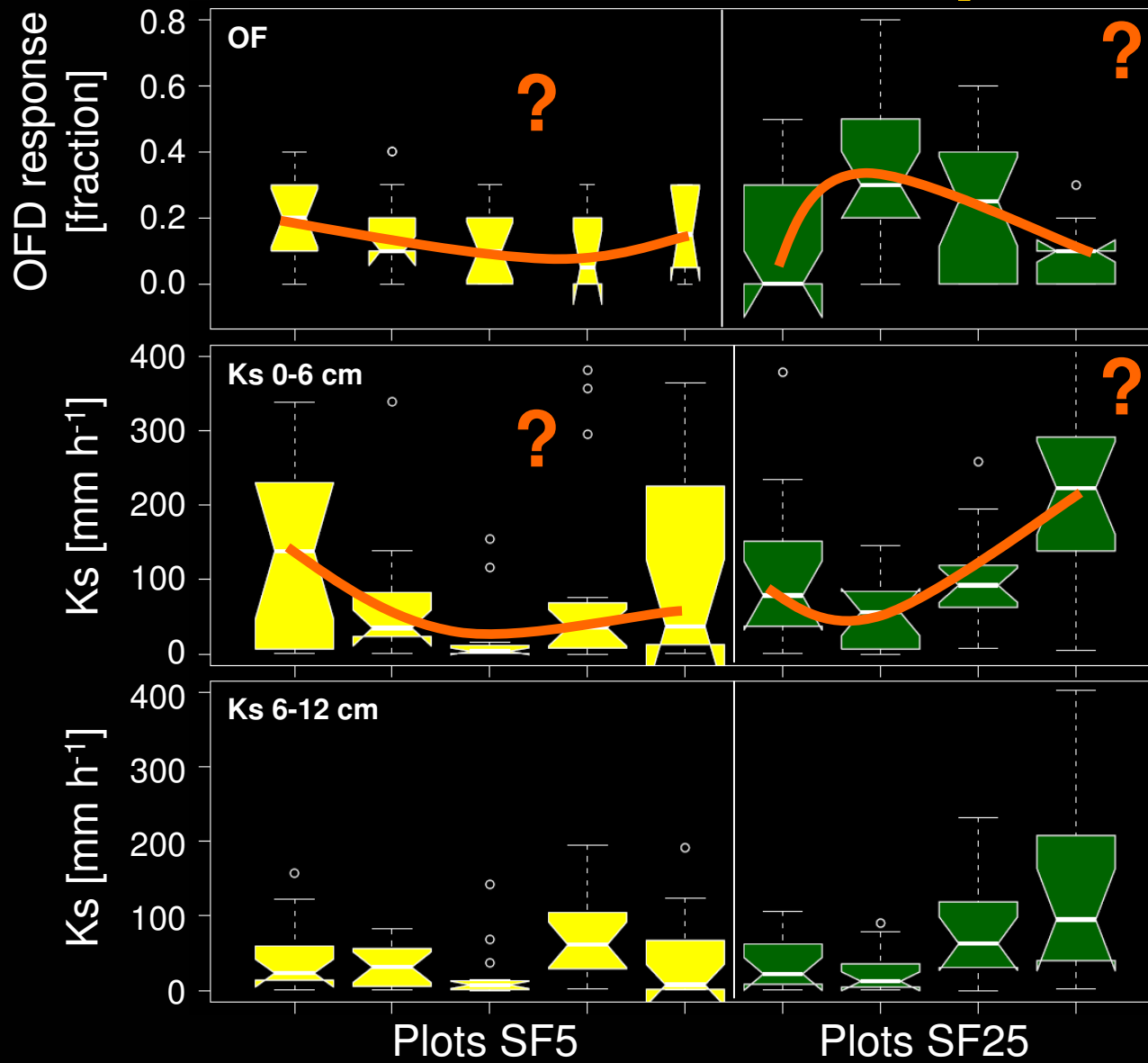
# Ks and OF at the sites



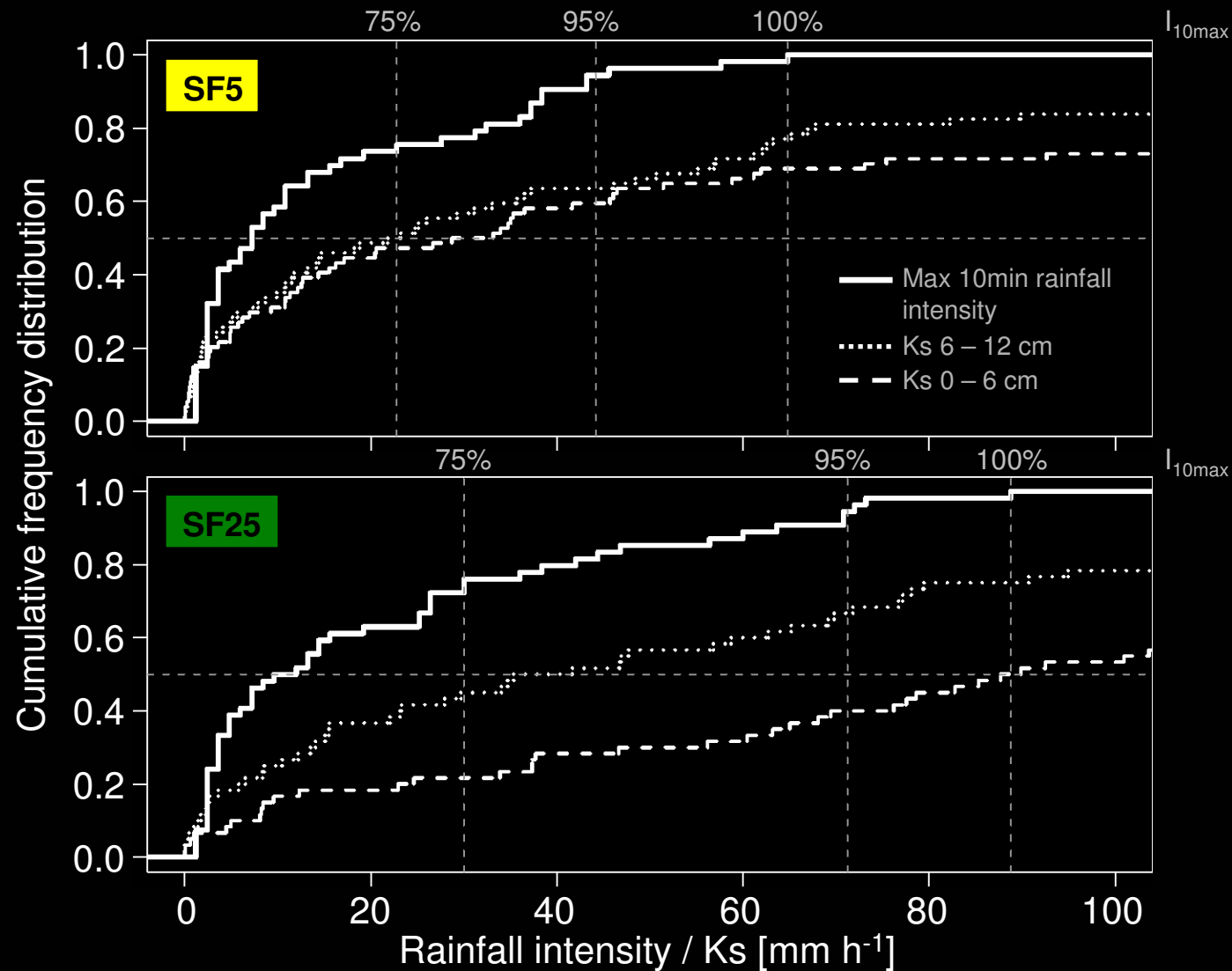
## Ks and OF on the plots



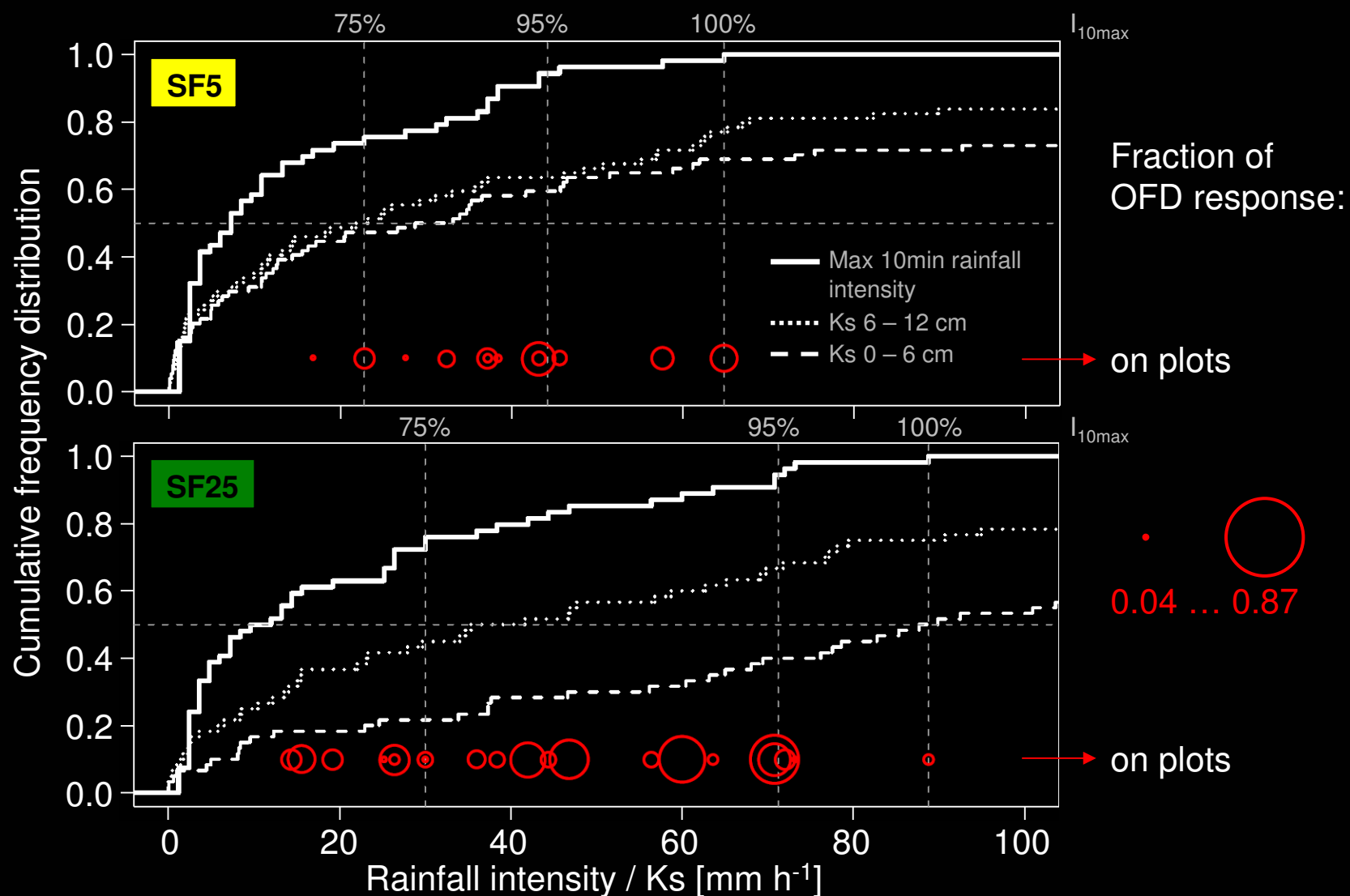
## Ks and OF on the plots



# Ks – rainfall intensity – OF

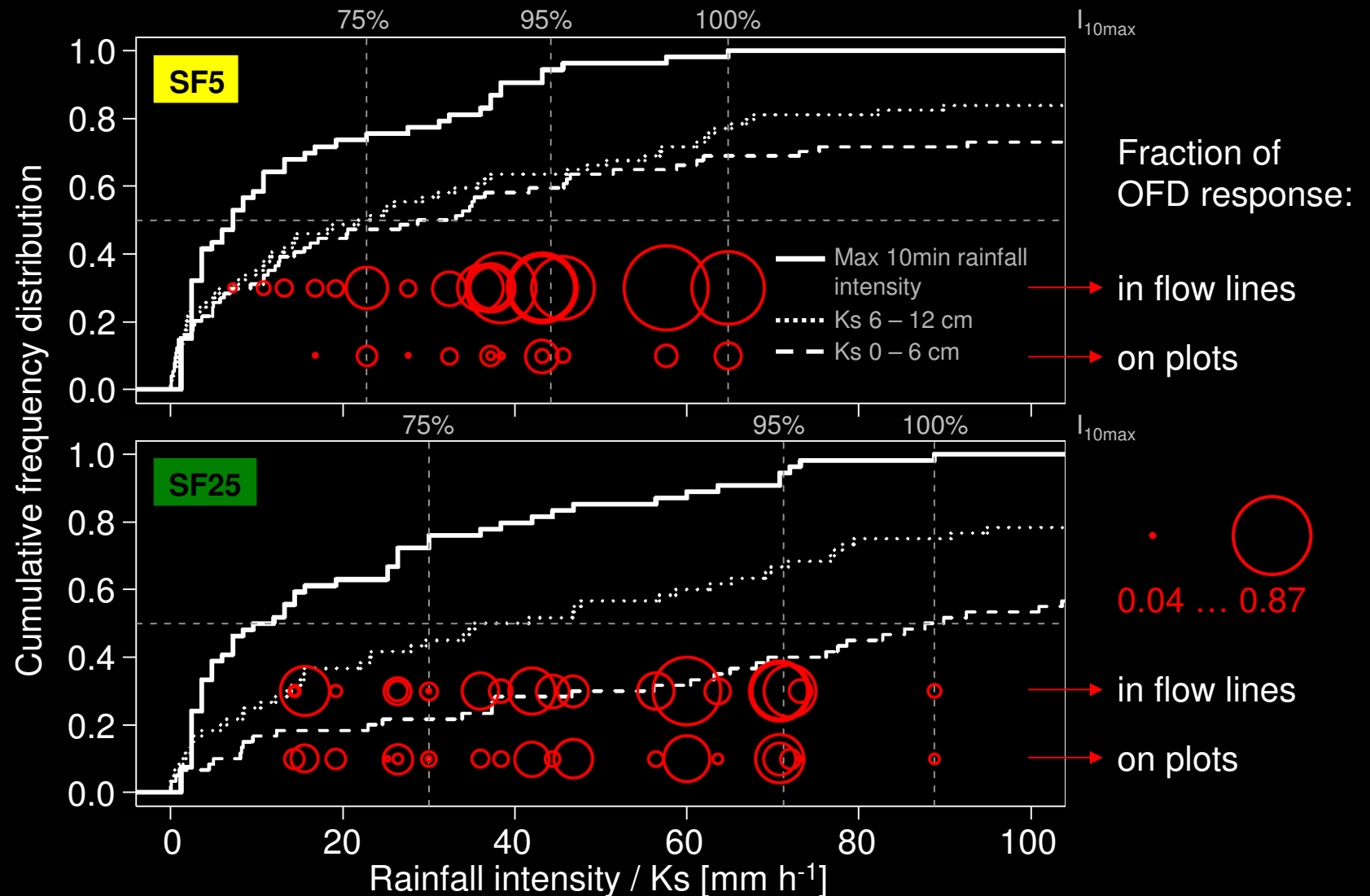


# Ks – rainfall intensity – OF





# Ks – rainfall intensity – OF



# Possible influences

- Topography?

Site	TWI
SF5	3.9
SF25	4.0



SF5



SF25

# Possible influences

- Topography?
- Vegetation? (cover fraction)

Site	Trees	Shrubs	Grasses	Herbs	Litter
SF5	0.00	0.50	0.08	0.58	0.33
SF25	0.71	0.17	0.00	0.08	0.79



SF5

SF25



# Possible influences

- Topography?
- Vegetation?
- Return flow?
- ...



SF5

SF25

## Ks as predictor for OF

- Estimation of OF occurrence from Ks values and rainfall intensities not sufficient!
- Other factors need to be considered:
  - Infiltration conditions
    - vegetation?
  - Flow path network
    - return flow?

## Thanks to...

- Financial / Logistical support:
  - Smithsonian Tropical Research Institute (STRI)
  - HSBC Climate Partnership
  - Panama Canal Authority (ACP)
  - National Environmental Authority of Panama (ANAM)
- Field support:







BY



Thank you  
for your attention!

Questions?