

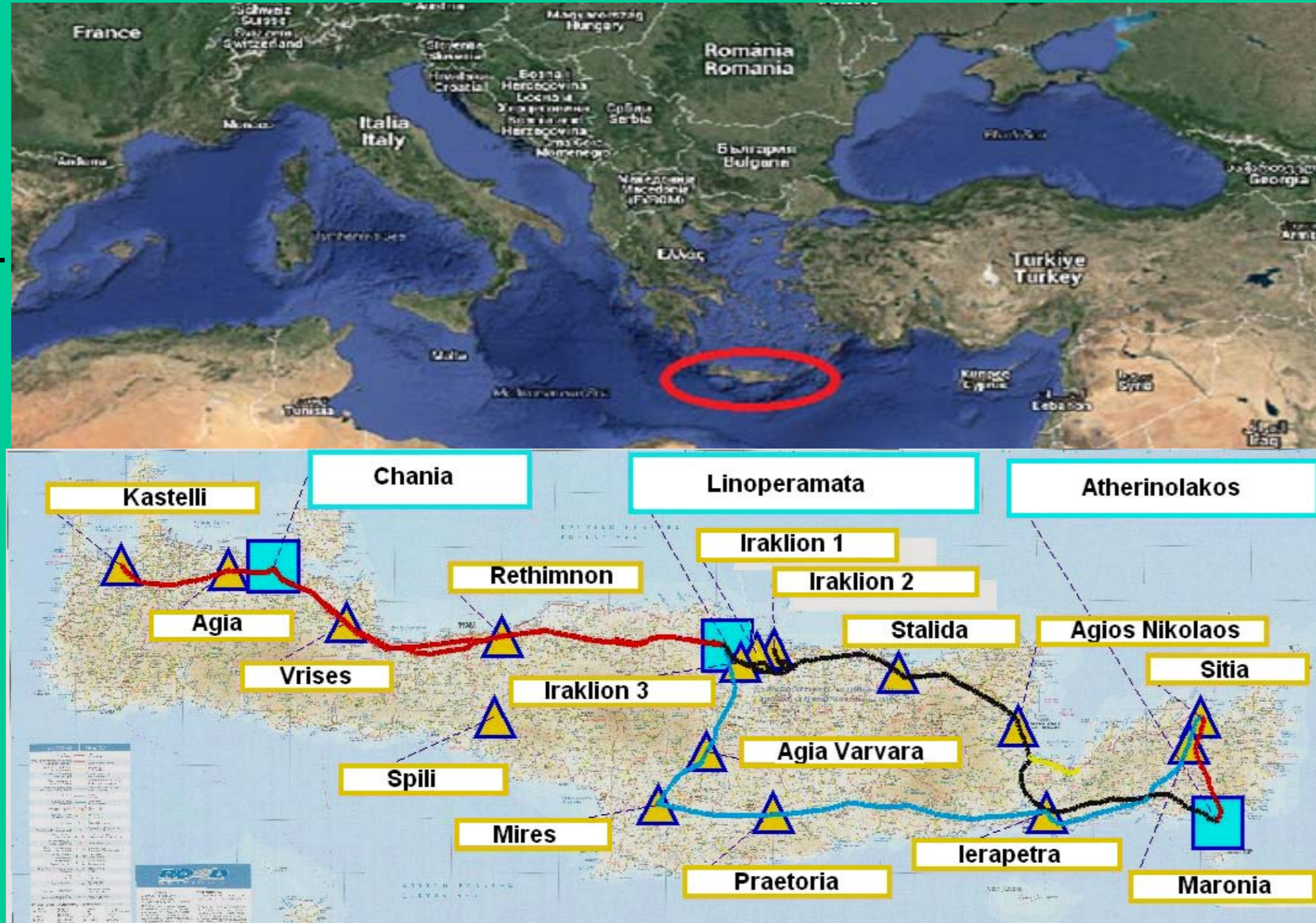
The performance and reliability of outdoor dielectrics used in power systems is strongly linked to local environmental conditions. A major factor affecting their performance is pollution severity along with climatic conditions. Sea is considered a major pollution source. The Mediterranean island of Crete provides a rather interesting case study as the particular conditions met there have resulted to the island being a reference point on both national and global scale. The Greek utility has employed several different remedies to cope with the pollution problem over the years. Pollution measurements have been performed throughout the island in order to acquire a pollution map to assist in insulation coordination and maintenance. Measurements have been performed on un-energized insulators similar to the ones used in each area/tower at that time. However, as both material and profile play an important role on the actual pollution impact, comparative measurements have also been performed in a specially designed High Voltage Test Station in order to derive a suitable correlation factor between different insulators.

LOCAL CONDITIONS & POWER NETWORK

- Greek island in the Mediterranean.
- prolonged **dry periods** (April-October)
- strong winds, rocky coast
- pollution builds up
- power **network** mostly **coastal**
- faces problems due to **pollution** (mainly **sea salt**)

GREEK UTILITY COPING WITH THE PROBLEM

- many different remedies employed over the years
- **washing** ceramic insulators



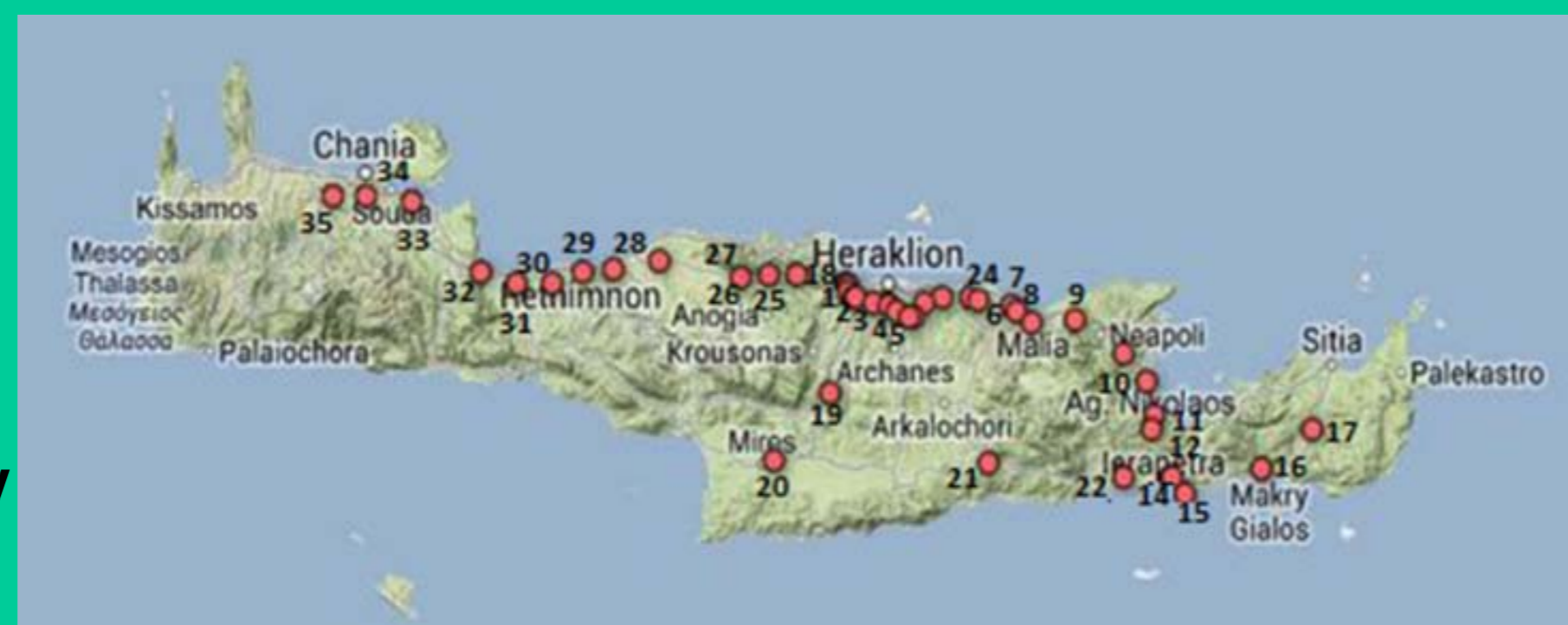
Crete: location and power network



- **profile and length** variation throughout the network (ceramic insulators)
- using **RTV SIR coatings**
- using **HTV SIR insulators** in lines with severe problems
- construct and operate an open air high voltage test station (**TALOS High Voltage Test Station**)
- **refurbishing** most lines (2013-2015) with **composite insulators**
- perform **pollution measurements** in different network towers
- measurement insulators hanged from the metal structure of 150kV towers

Pollution measurement insulators

- measurements performed **once a year**
- repeated for **2-3 years**
- **fog and disc profile**
- **glass and porcelain**
- additional **one-off** measurements on **HTV SIR** insulators removed from the grid



Measurements location

ESDD AND NSDD MEASUREMENTS

- widely used to evaluate a site's pollution severity (**SPS**)
- standardized (**IEC 60815**)
- **ESDD**: wiping the insulator and measuring the conductivity of the solution (correction with surface/temperature), performed onsite, simple procedure
- **NSDD**: filtering the solution, dry the filters and measure the weight difference. Need special equipment (vacuum pump, drying oven, desiccator, precision scale)



Measuring ESDD



Measuring NSDD

TALOS HIGH VOLTAGE TEST STATION

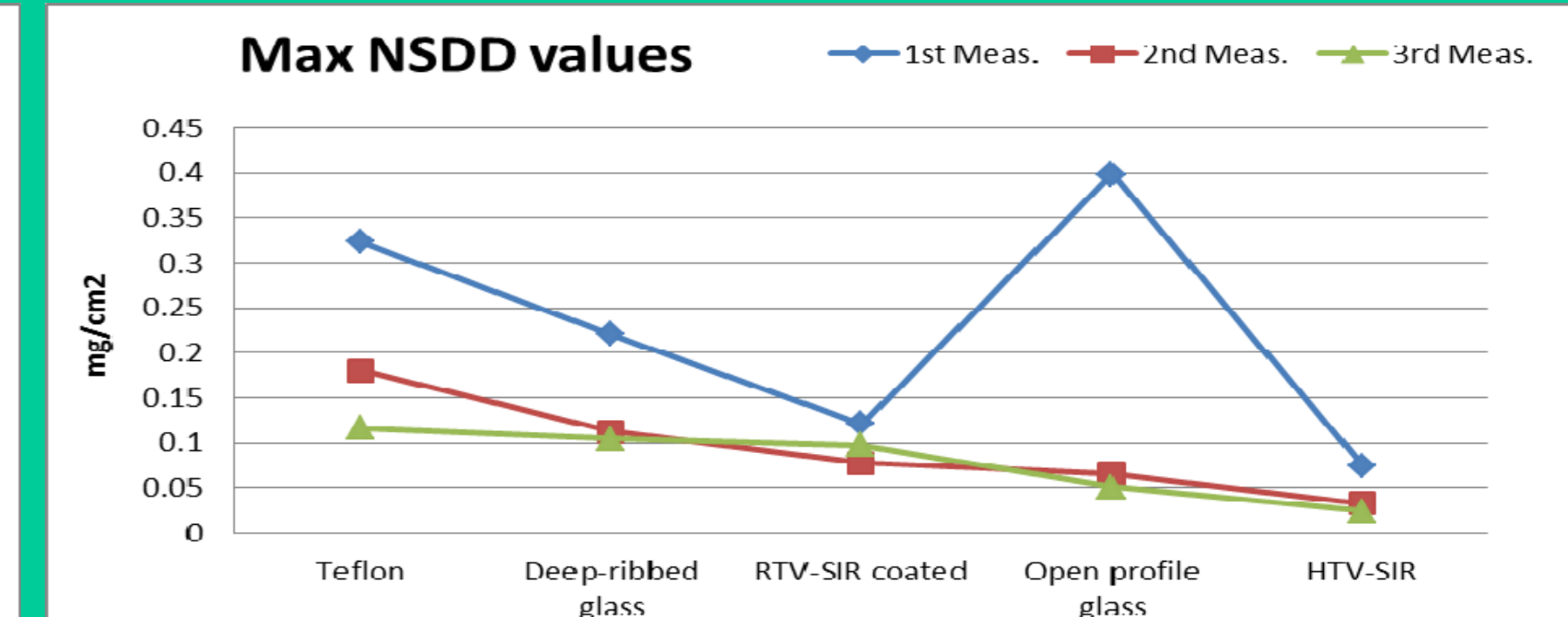
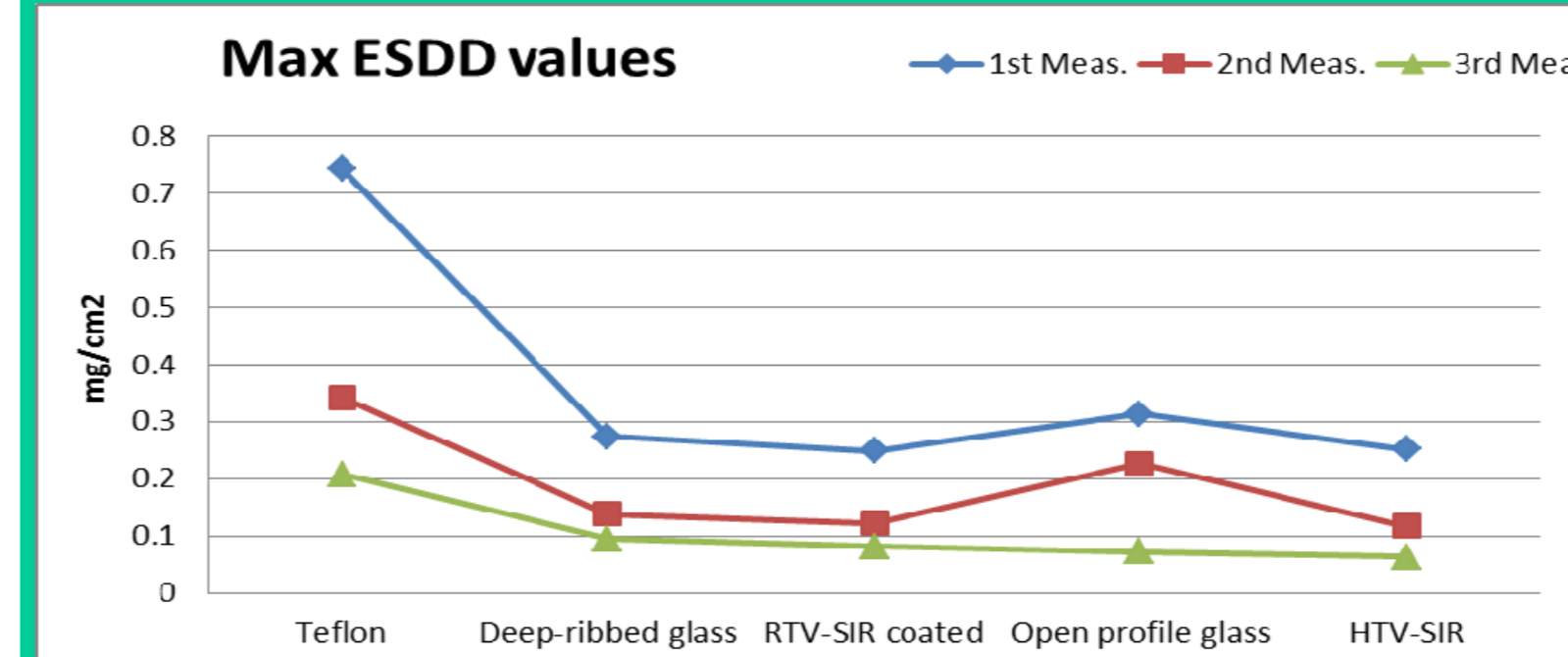
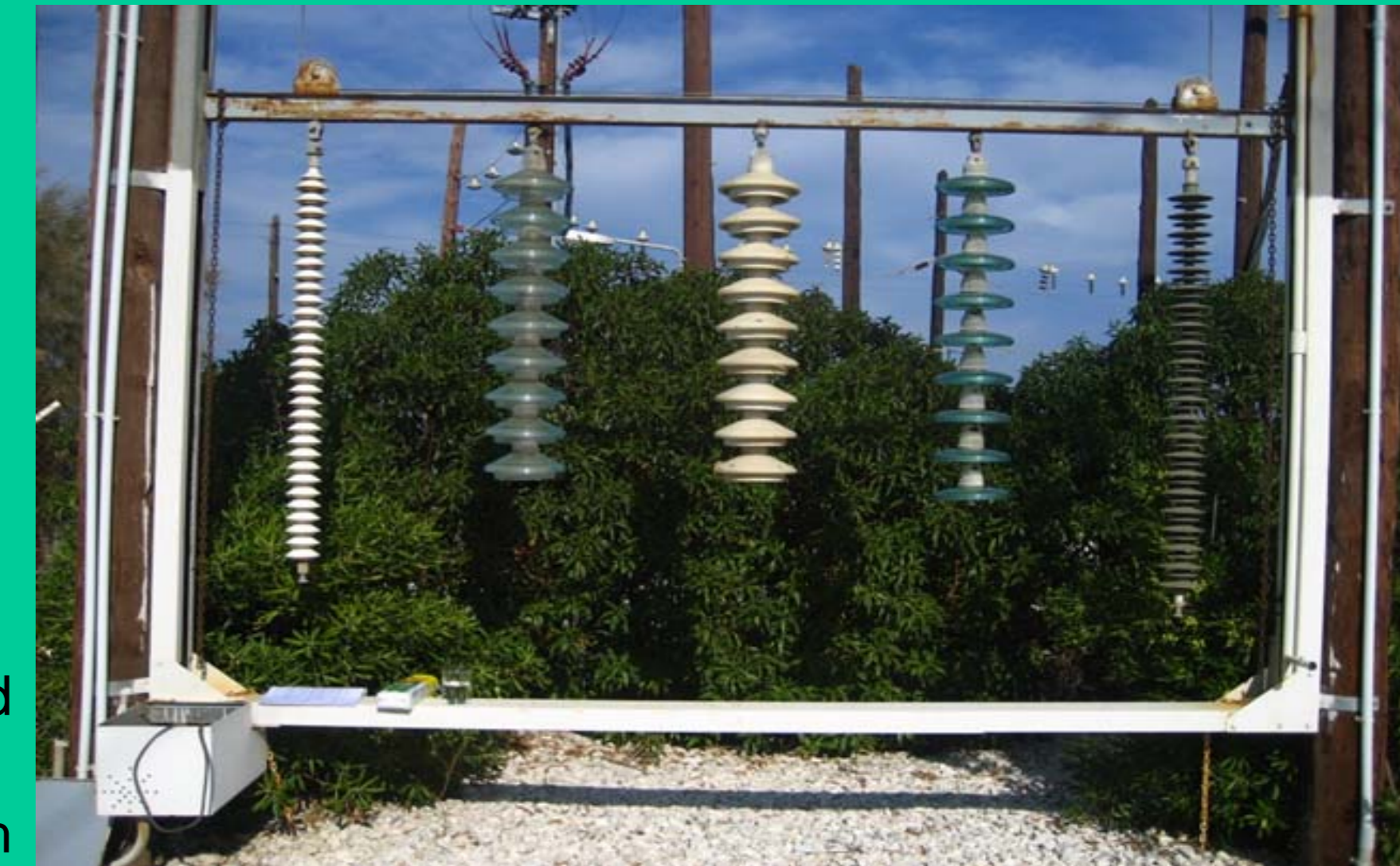


- right next to the **coast**
- in the premise of a **power plant**
- **research and testing** center
- in cooperation with **academic and research institutions**
- **150kV and 21kV**
- **post and suspension** insulators
- **weather** monitoring
- **leakage current** monitoring
- **clamp** testing

TALOS
High Voltage Test Station
www.talos-ts.com

COMPARATIVE POLLUTION MEASUREMENTS IN TALOS

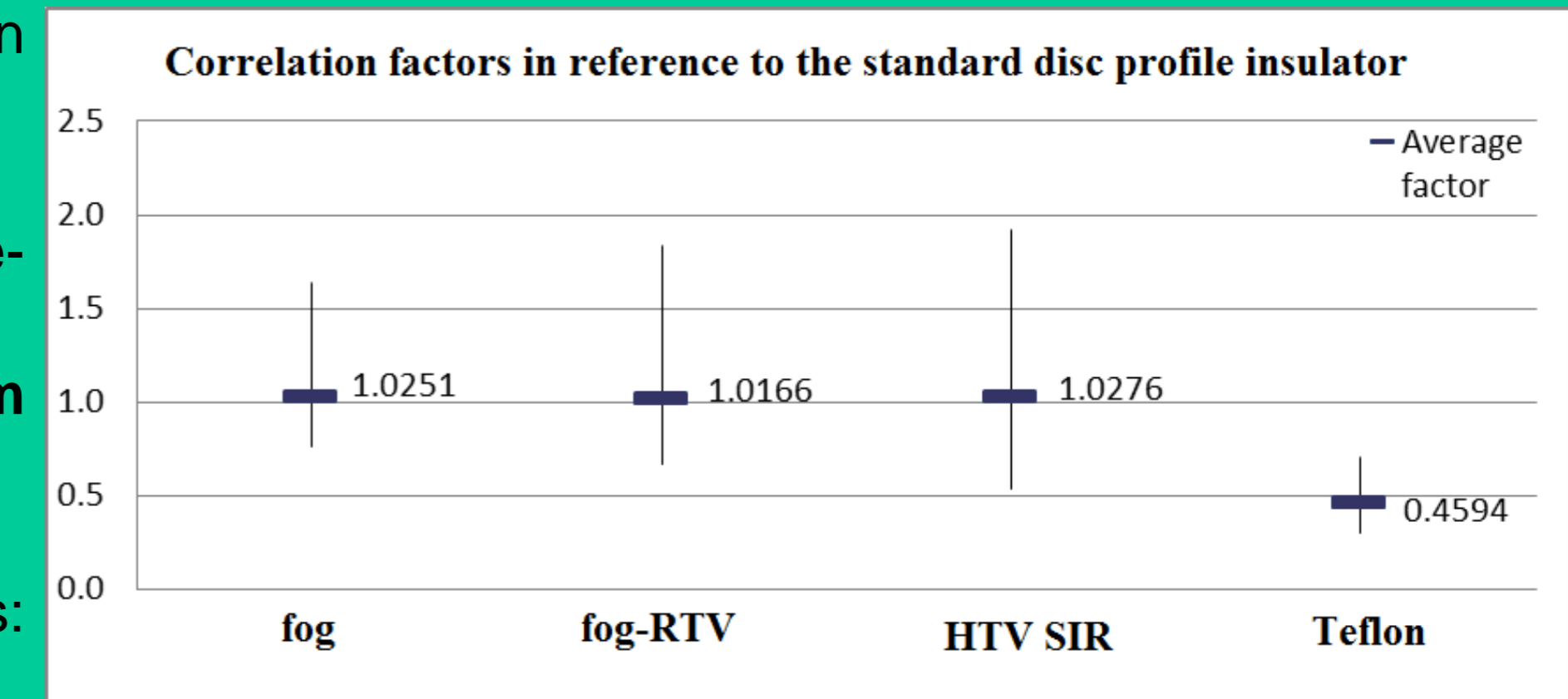
- specially designed arch for **comparative** pollution measurements
- five different types of suspension insulators hanged offline :
 - Teflon long rod
 - fog profile (deep ribbed), glass
 - Fog profile, glass, RTV SIR coated
 - disc profile (open profile), glass
 - HTV SIR long rod
- measurements for **three months** considered here
- **multiple** measurements each month (different areas/plates)



Comparative measurements results from TALOS (max values)

CORRELATION FACTORS

- needed to correlate measurements taken on **different** insulators
- for fog profile :
 - **CIGRE** proposes a wide range correlation factor (**0.8±0.3**) (WG C4.303)
 - results from **TALOS** range from **0.761 to 1.637**
 - **average value: 1.0251**
 - considering the **max ESDD values: 1.143** (worst case scenario)
- **similar values** for the rest of the insulators



Correlation factors

POLLUTION MAP

- considering **all measurements** and **all correlation factors** (average values)



Pollution map

KEY REFERENCES

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