Strategies and Philosophies - Environmental and Geotechnical

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Agenda

- Summary of natural environmental parameters as design drivers
- Measurement considerations
- Status of data knowledge
- How environmental & geotechnical data will be used

Summary of design drivers

- Temperature
  - Cooling loads
  - Heating loads
  - Thermoelastic effects
    - Distortion
    - Failures
      - Instantaneous
      - Fatigue
  - Human factors
- Humidity
  - Fungal growth
  - Corrosion
  - Insulation failure
  - Human factors
  - Electrostatic effects
- Precipitation
  - Erosion
  - Drainage
  - Structural damage (hail)
  - Floral growth
  - Structural loads
- Insolation (UV/VIS)
  - Materials ageing
  - Floral growth
- Wildfires
- Wind
  - Structural loads
    - Stability
    - Failure
- Aeolian transport
  - Dust
  - Salt
- Seismicity
  - Structural loads
    - Shifts
    - Failures
- Lightning
  - Conducted effects
  - Induced effects
- Fauna
  - Destructive intrusion
  - Contamination
  - Human factors
- Soil mechanics
  - Solid geology
  - Drift geology
    - Soil types
    - Stratigraphy
  - Hydrology
  - Compressive strengths
- Substrate electrical properties

Measurand collection considerations

- Effects on design are episodic or/and cumulative
- Environmental data must be collected in such a way that sampling effects on the end use are minimised
  - Some measurands may be used in several radically different ways
- *Case 1: Ambient temperature effects on cooling loads*
  - *Cooling loads are related to temperature differentials*
    - *Conventionally, design data is in the form of 'degree days'*
- *Case 2: Ambient temperature effects on reflector distortion*
  - *Distortion is due to temperature differentials*
    - *The forcing function of temperature differentials is ambient temperature rate of change*
- *Average monthly temperature maxima and minima cannot be directly used in these cases*

Status of Data Knowledge

- Data in hand is that supplied for Site Selection purposes
- Present activity on the two sites is generating data and experience
  - Although the timespan of data is very limited versus what is ultimately required for lifetime requirements
- All data will require considerable augmentation for requirements drafting and design tradeoffs
  - This may require dedicated additional measurement campaigns or analyses
- The Environmental Requirements document will quantify the design drivers using an appropriate specification for each parameter
- Limitations on knowledge result in conservative requirements, which in turn result in conservative designs which will elevate cost and perhaps reduce capability
  - This is a particular problem for a project on the scale of SKA

How data will be used

- Environmental:
  - Where the risk is acceptable to the SKA Project, data will be enveloped in order to generate requirements to the design
  - Environmental data from the site(s) will be spatially and temporally limited
    - The enveloping process will include analysis of the effect of these limitations
    - Any necessary interpolation requires climatological expertise in some cases
  - The relationship between the values of the data and the associated requirements will create design margins
  - The effect of this margin must be understood in terms of cost and complexity
  - Where the uncertainty cannot be further reduced except by additional study/measurement, the approach given below will be adopted
- Geotechnical
  - It is unwise to provide geotechnical data in a high level requirements document
  - The requirements document will specify the structure locations and may contain descriptive text for information
  - Contractors will be required to accept the risks of geotechnical variability and undertake site surveys accordingly

Next steps

- A preliminary Environmental Requirements document will be drafted, containing:
  - A comprehensive table of contents
  - A complete set of exemplar requirements pending data analysis
    - Showing the form in which parameters will be expressed (‘degree days’, ‘100-year’ values, etc)
    - Enveloping both sites (reduced to one post selection)
  - Preliminary verification means
- An environmental data analysis plan will be drafted to show how requirements are derived from data
- These documents will be reviewed at SRR

Questions