

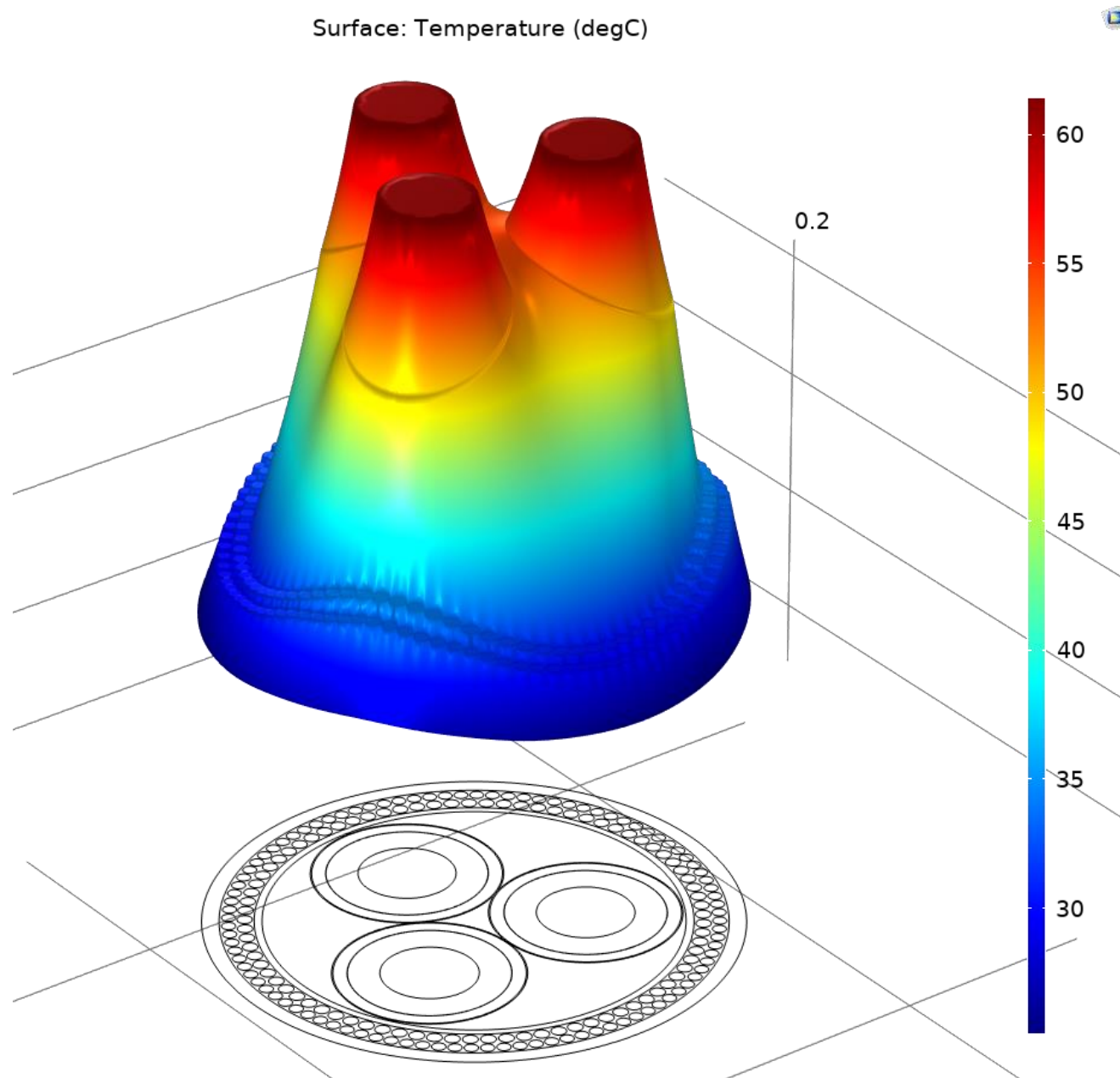


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# Optimization of power cable ampacity in offshore wind farm applications

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*How you model the environment matters!*



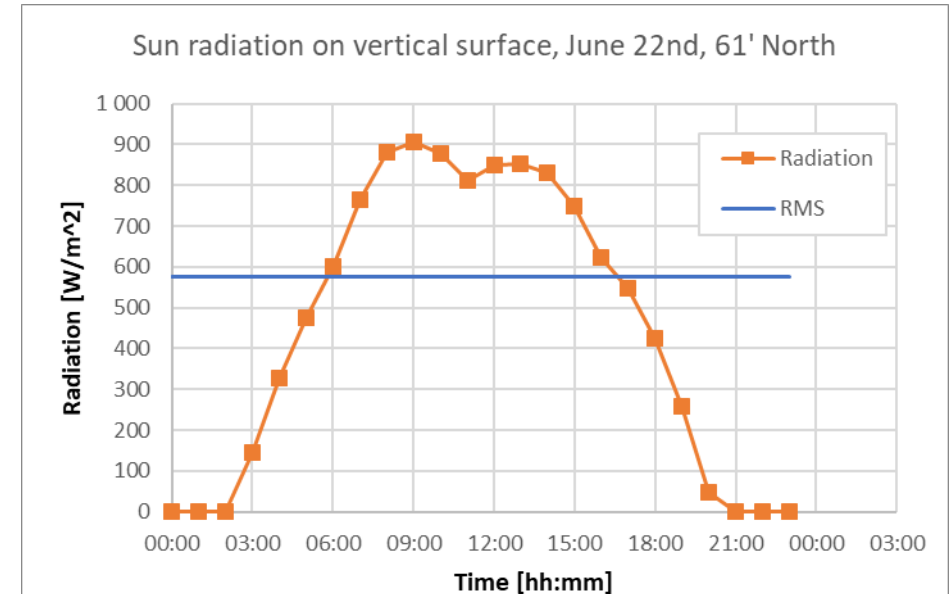
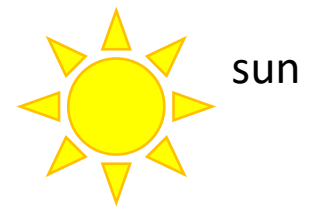
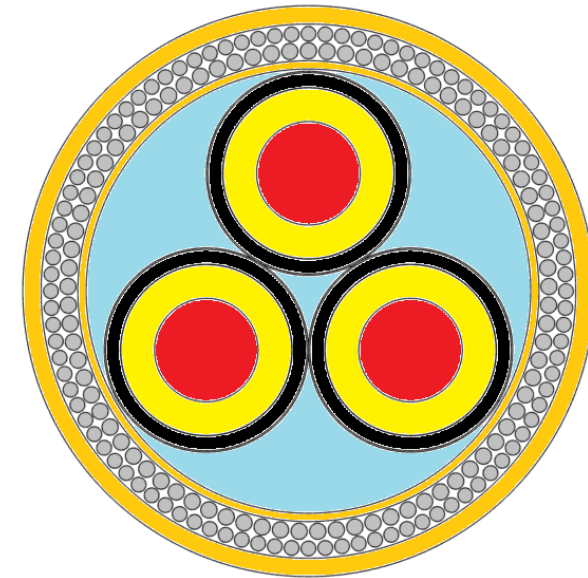
# Background

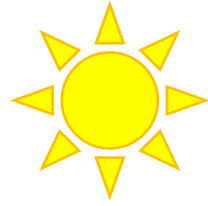


- Power transmission cables account for a substantial cost in offshore wind projects
- Cost will increase due to longer distances and deeper waters
- Current rating ("ampacity") of cables is an important limiting factor
  - Above a critical current level the cable may overheat
  - Conservative approach in design (IEC 60287)
- More accurate modelling may allow ampacity to be increased
  - Stationary vs Time-dependent
  - Ambient conditions (wind, temp, sun)

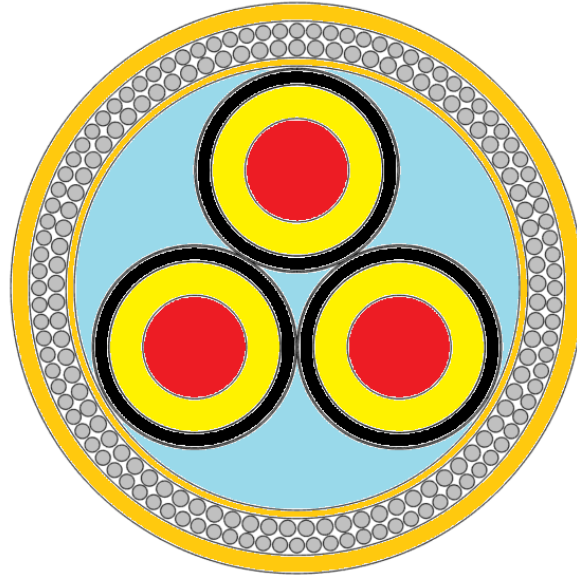
# Modelling

- 2D finite element model
- Generic 72kV 800mm<sup>2</sup> triad cable
- Coupled electromagnetic and thermal
- Free hanging and inside J-tube
- Exposed to sun
- Effect of wind cooling

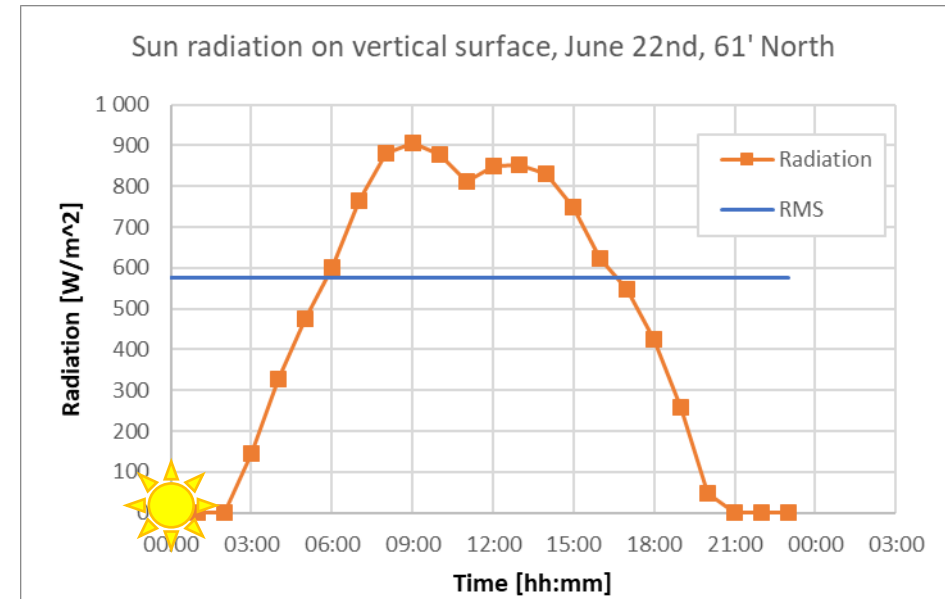




$T_{amb}=20^{\circ}\text{C}$



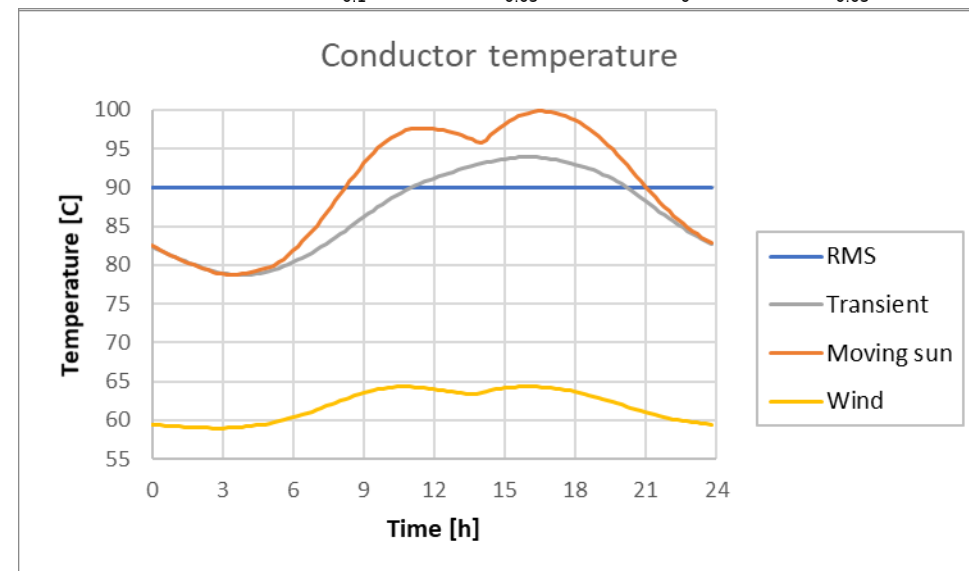
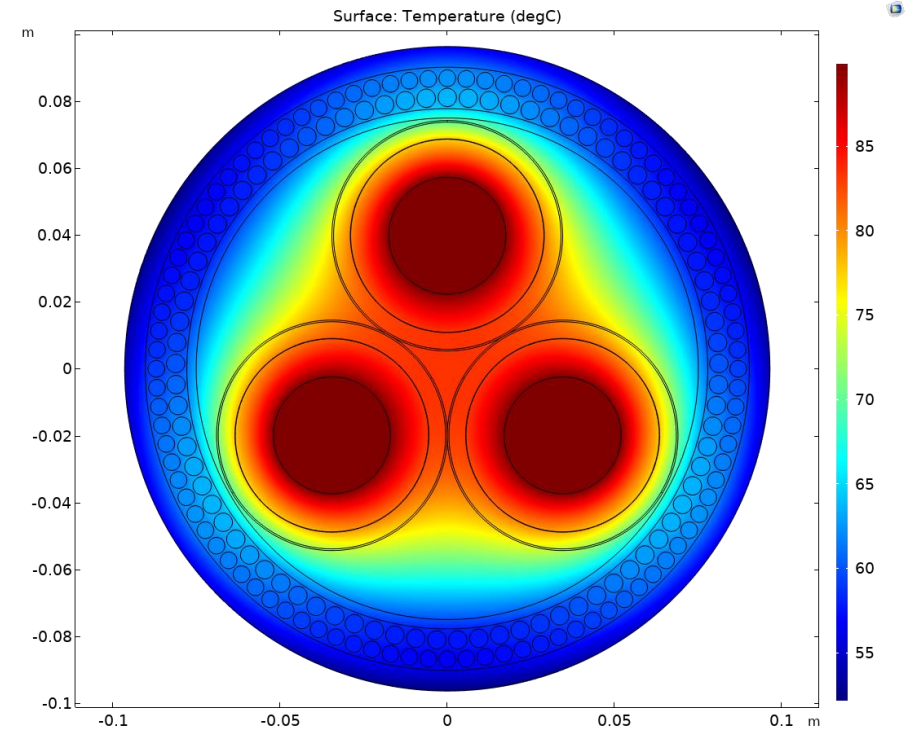
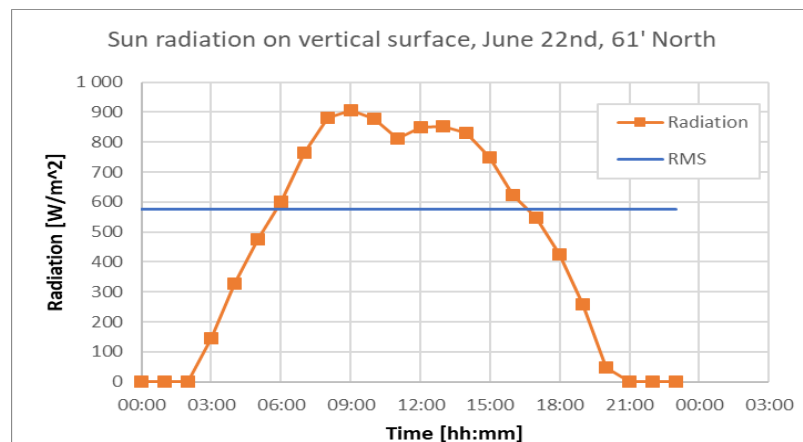
1. Stationary (steady-state)
2. Transient response (homogeneous radiation)
3. Moving sun
4. Effect of wind ( $h = 60 \text{ W/m}^2 \text{ K}$ )



# Main findings

Vertically free-hanging cable:

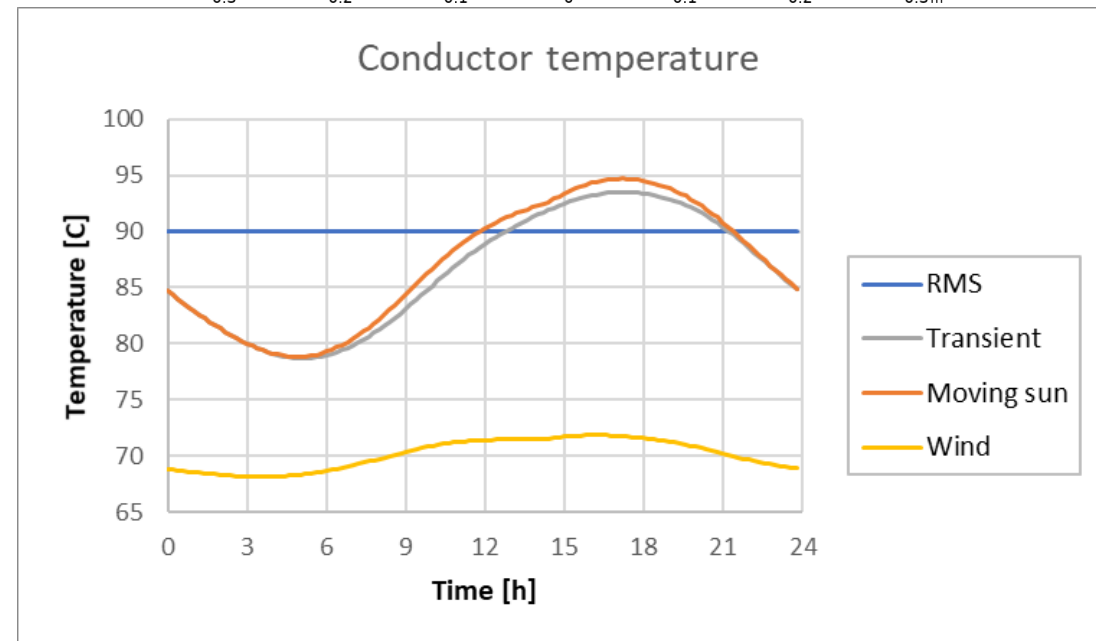
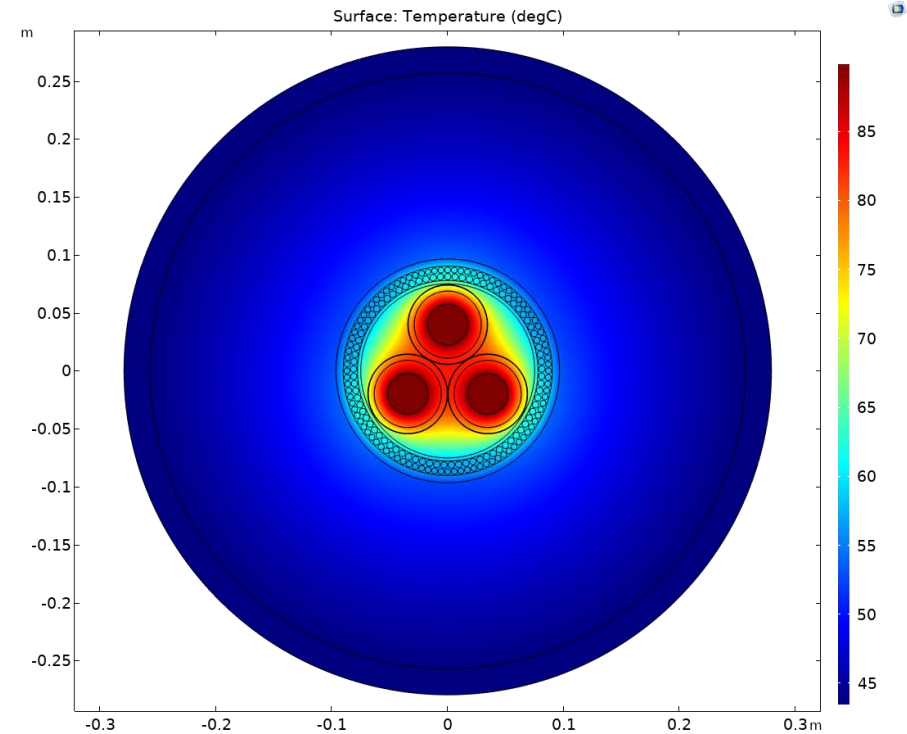
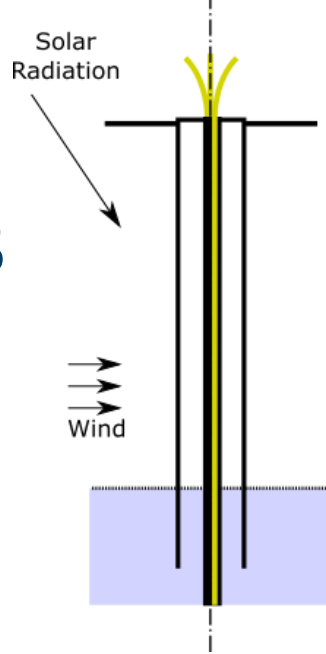
- Stationary (steady-state)
- Transient response (homogeneous radiation)
- Moving sun
- Effect of wind ( $h = 60 \text{ W/m}^2 \text{ K}$ )



# Main findings

Vertically hanging cable in J-tube:

- Stationary (steady-state)
- Transient response (homogeneous radiation)
- Moving sun
- Effect of wind ( $h = 60 \text{ W/m}^2 \text{ K}$ )





Thank you for your attention!