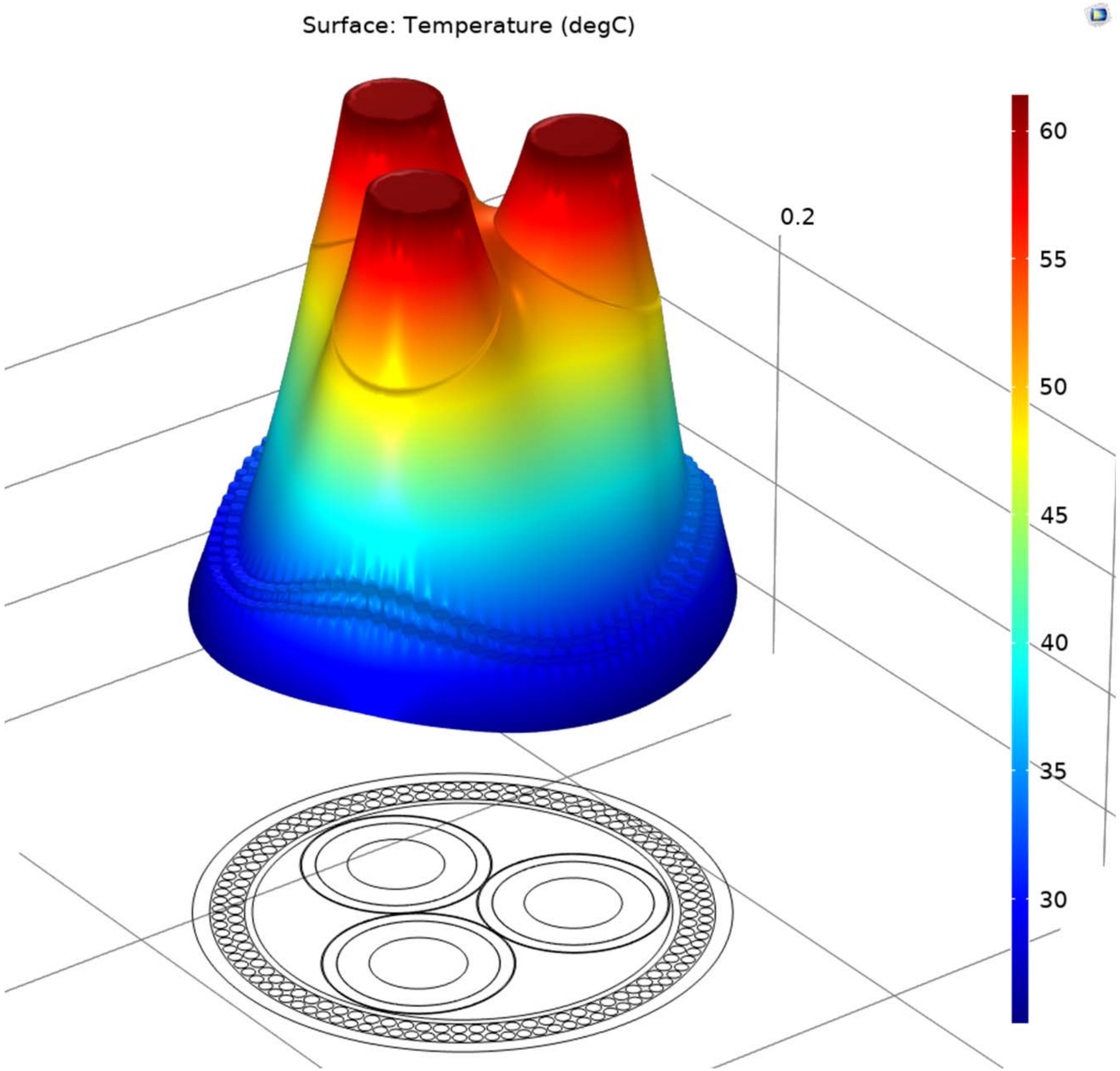
Optimization of power cable ampacity in offshore wind farm applications



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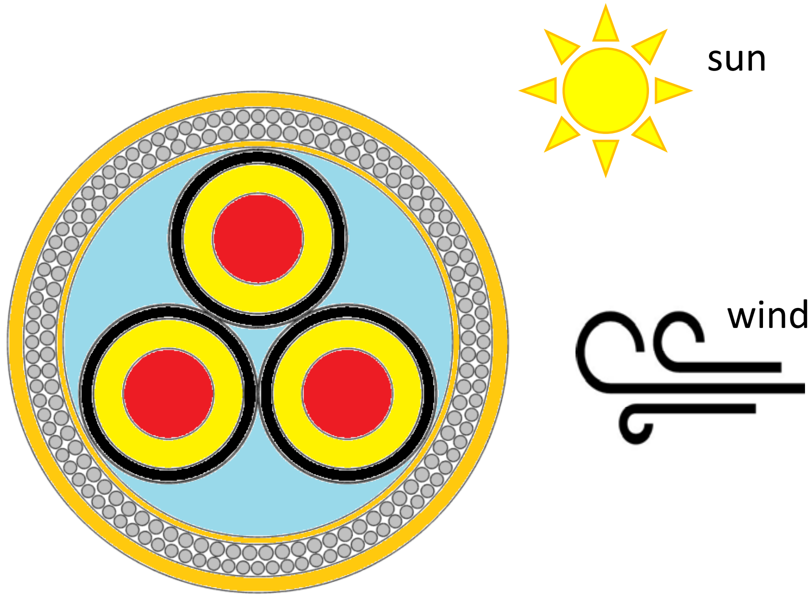
EERA Deepwind, 2022

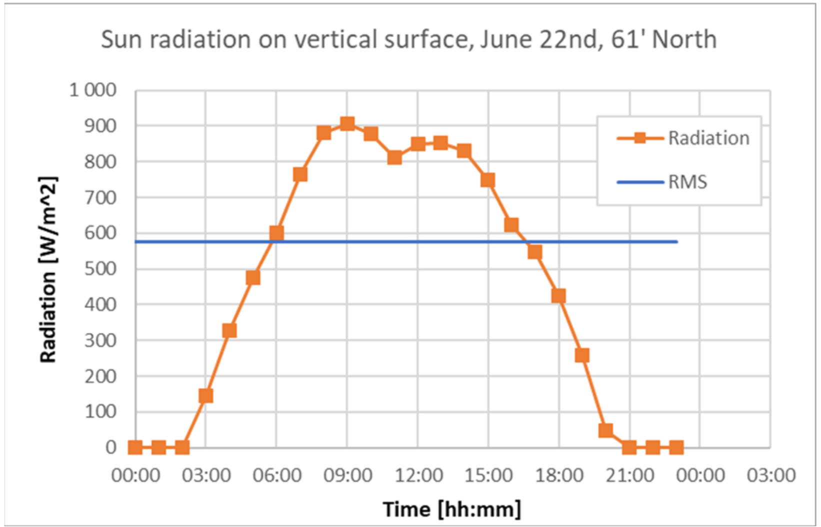
Background

- 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
- Coupled electromagnetic and thermal
- Generic 72kV 800mm2 triad cable
- Free hanging and inside J-tube
- Exposed to sun
- Effect of wind cooling

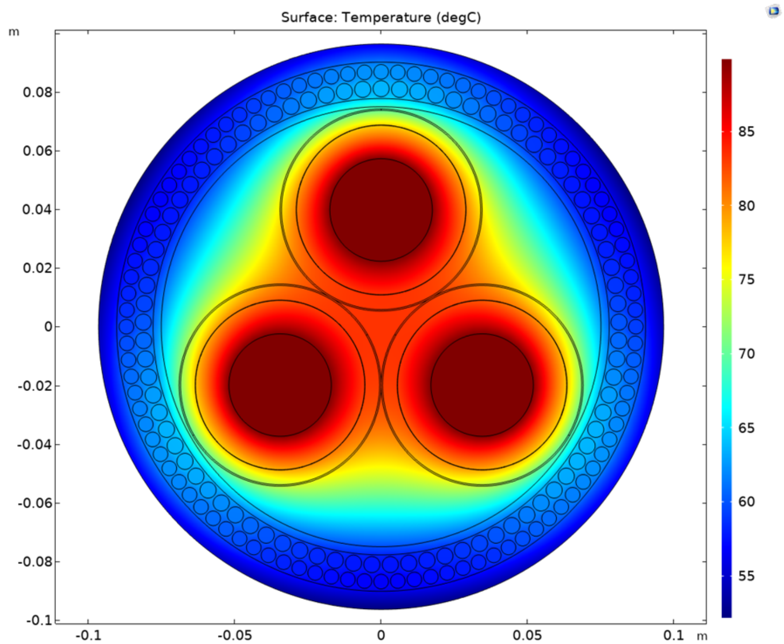


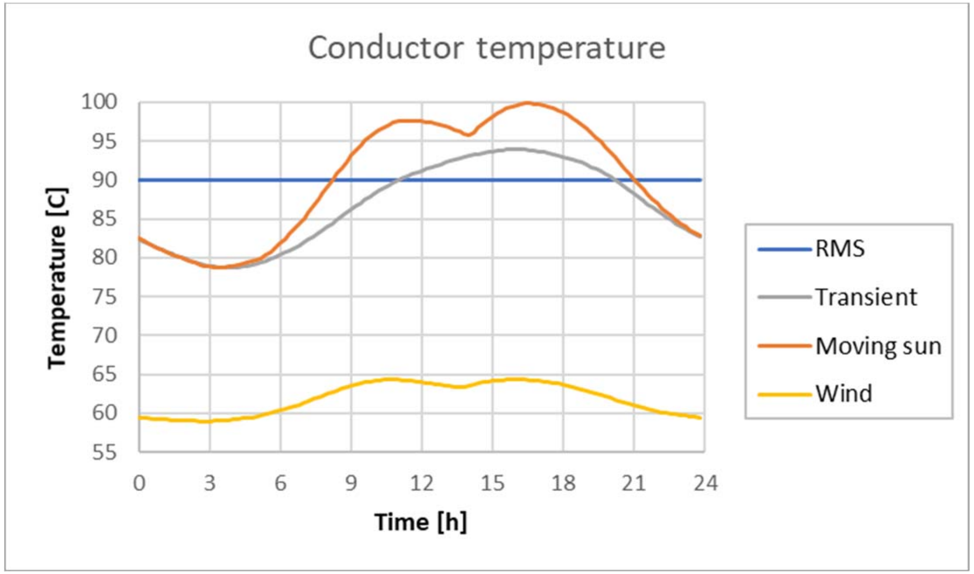


Main findings

Vertically free-hanging cable:

- Worst case situation (steady-state)
- Transient response (homogeneous radiation)
- Moving sun
- Effect of wind (h =60 W/m2 K)





Main findings

Vertically hanging cable in J-tube:

- Worst case situation (steady-state)
- Transient response (homogeneous radiation)
- Moving sun
- Effect of wind (h =60 W/m2 K)