

Numerical analysis of thermal pollution caused by coal-fired power plant

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GOAL OF THE STUDY

In this paper, analysis of thermal pollution from thermal power plants is carried out. This analysis is done with the use of numerical simulation. A two-dimensional numerical model was proposed and numerical results are obtained by using the Fluent software package. Four scenarios were considered, where scenario 1 represents a flow ratio of the discharge channel and the Sava River of 3% and scenario 4 a flow ratio of 12%.

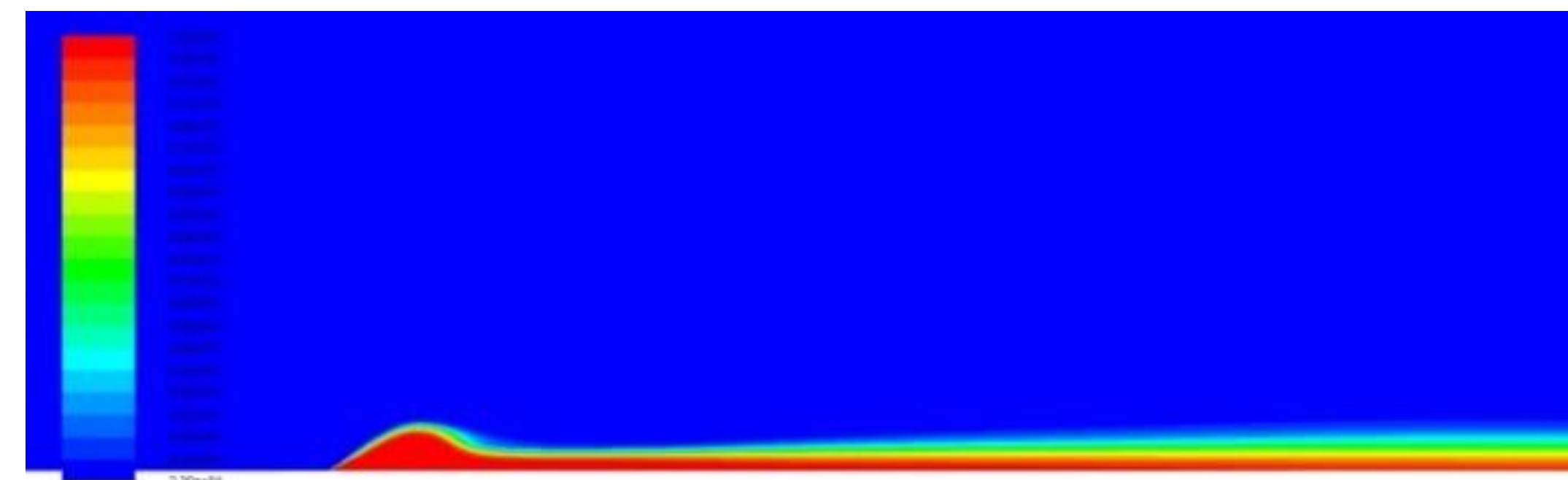
THERMAL POLLUTION AND POWER PLANTS

Thermal power plants have a big negative impact on the ecosystem of natural watercourses. Namely, during the operation of thermal power plants, so-called thermal pollution occurs. Thermal pollution is the deterioration of water quality by any process that changes the temperature of ambient water.

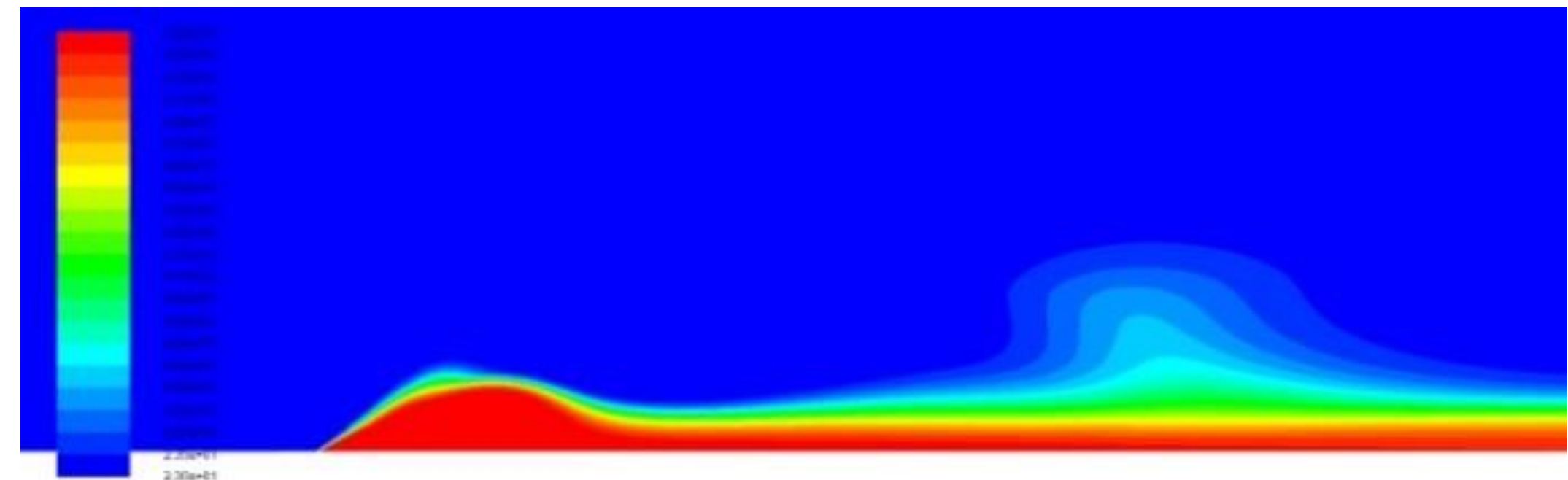
Water from nearby lakes or rivers is used to cool the condenser coils in coal fired power plants. Globally, over 46% of the thermal emissions into rivers are due to coal fired power plants and almost one third due to nuclear power plants.

Table 1. River temperature of the mixed water in different cross-sections downstream the junction area

| Scenario | River temperature [°C] | Distance [m] | | | | | |
|----------|------------------------|--------------|-------|-------|-------|-------|-------|
| | | 60 | 100 | 200 | 500 | 1000 | 2000 |
| 1 | | 24.75 | 24.77 | 24.84 | 24.74 | 24.66 | 24.64 |
| 2 | | 24.75 | 24.86 | 24.74 | 24.79 | 24.78 | 24.7 |
| 3 | | 24.69 | 24.75 | 24.85 | 24.81 | 24.86 | 24.85 |
| 4 | | 24.79 | 25.28 | 24.80 | 24.80 | 25.12 | 25.1 |



Contours of temperature for Scenario 1



Contours of temperature for Scenario 4

CONCLUSIONS

- Based on the obtained numerical results, the existence of thermal zones on the right side of the Sava River, downstream from the Nikola Tesla B thermal power plant where the heated water discharge channel is located, can be determined.
- Numerical results have shown that with the decrease of the river flow, the temperature of the Sava River increases. Comparing the most optimal scenario (scenario 1) and the most unfavourable scenario (scenario 4), the temperature increase is determined by 0.5° C at 2 km distance downstream the thermal power plant Nikola Tesla B. This temperature increase is significant for the living world in the river. This may represent temperature shock and have a negative impact.
- Numerical simulations of thermal pollution of rivers are a very reliable and useful tool for analyzing the distribution of temperatures, velocities, zones of mixing of two streams of water.

ACKNOWLEDGMENT

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