2F01: GLOBAL MODEL FOR THE COMBUSTION OF GAS MIXTURES RELEASED DURING FOREST FIRES.

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The measured temperature above the sample is lower than the numerical result more than 5 cm from the sample. Considering that the natural convection which depends on the length scale and there are several transitions of flow field with Grashof number, the enhanced mixing by the natural convection may result these lower measured values. In your numerical model, these fluid dynamic effects are included?

Reply by Virginie Tihay
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The numerical model used in this study was laminar on the whole domain in order to simulate the laminar flames obtained experimentally and in order to focus on the combustion kinetic in the flame area. The transition of the flow fields between the laminar flame and the thermal plume, which becomes slightly turbulent with height, has not been modeled. In the next step concerning static turbulent flames, this effect must be considered.

In the flame zone, the predicted temperatures are very close to the mean experimental measurements and remain in the range of the experiments. These results show that the combustion mechanism including both carbon monoxide and methane is suitable to model the flame of forest fuels. This point was the aim of our study.

For the thermal plume, we agree with the fact that the laminar modeling underestimates the cooling due to the mixing of ambient air. The turbulence was not considered and the natural-convection was modeled by using the Boussinesq model. For all conservation equations except for the buoyancy term in the momentum equation, the density was treated as a constant by using:

$$(\rho - \rho_0)g \approx -\rho_0 \beta (T - T_0)g$$

where ρ_0 is the density of the flow at $T_0 = 299.16K$ and β is the thermal expansion coefficient. These assumptions led to a slight overestimation of the temperature in the thermal plume.