Note: The firebrand size comparison was done between the **Ponderosa pine** fuel (Hudson et al) and **Pitch pine** fuel (Filkov et al.). Here both vegetations are pine species. Out of number of experiments done by Hudson et al., we chose **26th** experiment since the **MC is relatively similar** with the pitch pine forest. The MC of ponderosa pine is **37%** and **31%** in pitch pine. The wind velocities are also relatively similar. The firebrand projected area( calculated based on MATLAB post-processing) plotted against the ecentricity of particles.

(eccentricity- how much varies being a circular.)

|  |  |
| --- | --- |
| **Shape** | **Ecentricity** |
| circle | 0 |
| ellipse | <1 |
| parabola | 1 |
| hyperbola | >1 |

Based on species, wind and, MC-

|  |
| --- |
|  |

Firebrand flux

186 m

0 m

320 m

FBP X

FBP Y

FBP Z

FCS X

FCS Y

FCS Z

Fire line

Road

320 m

160 m

300 m

250 m

150 m

100 m

50 m

Collection time span (s)

FCS X – 407 s

FCS Y – 513 s

FCS Z – 394 s

**Case 1: Fireline depth = 2 m**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Wind velocity  (m/s) | Particle velocity  (U,V,W) m/s | Input rate pcs/s | **Flux (pcs/m2. s)** | | | **Number of Firebrands(pcs)** | | |
| FCS Z | FCS Y | FCS X | FCS Z | FCS Y | FCS X |
| T valid- grid(0.75 m) | ≈2.2 | (8.3, 0.0, 2.1) | 11006 | 1.946 | 0.977 | 0.798 | 767 | 497 | 325 |
| Experiment | 1.4±0.6 | NA | NA | 1.361 | 0.902 | 0.824 | 536 | 463 | 335 |
| Difference(%)  (Exp /T valid) |  |  |  | 30.1% | 07.6% | -03.3% | 30.1% | 06.8% | -02.9% |

**Case 2: Fireline depth = 17 m**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Wind velocity  (m/s) | Particle velocity  (U,V,W) m/s | Input rate pcs/s | **Flux (pcs/m2. s)** | | | **Number of Firebrands(pcs)** | | |
| FCS Z | FCS Y | FCS X | FCS Z | FCS Y | FCS X |
| T valid- grid(0.75 m) | ≈2.3 | (8.3, 0.0, 2.1) | 11006 | 0.954 | 0.692 | 0.237 | 376 | 355 | 96 |
| Experiment | 1.4±0.6 | NA | NA | 1.361 | 0.902 | 0.824 | 536 | 463 | 335 |
| Difference(%)  (Exp /T valid) |  |  |  | -42.6% | -30.3% | -247.6% | -42.5% | -30.4% | -248.9% |

|  |
| --- |
| Comparison of firebrand flux on collection centers of the simulation and experiment. |
| Cumulative number of firebrands landing on the collection sites |

**Eucalyptus density**

density varies on fuel sub-species, age, MC, location, and component of the tree, etc.

1.Eucalyptus grandis, (3,5,7,9 age average) wood density **495 kg/m3**

(*Bhat K.M et al Wood density and fiber length of Eucalyptus Grandis grow in Kerala, India)*

2. Eucalyptus nitens wood density at 1.3 m height **600 - 730 kg/m3**

*(Pilodyn penetration- Greaves B.L et al. [Use of Pilodyn for the indirect selection of basic density in Eucalyptus nitens])*

3.

|  |  |  |  |
| --- | --- | --- | --- |
| E.regnans | | E.maculata | |
| Age (years) | density (kg/m3) | Age (years) | density (kg/m3) |
| 1 | 560 | 1.5 | 650 |
| 3.5 | 450 | 6.5 | 550 |
| 6.5 | 380 435(average) | 11.5 | 690 630 (average) |
| 12 | 350 |  |  |

*(Jens Mackensen et al. [Density loss and respiration rates in coarse woody debris of pinus radiata, Eucalyptus regnans, and Eucalyptus maculata]) 532.5(average)*

4. Barks =590 kg/m3, leaves =650 kg/m3 *(Table  5.1-thesis: Wadhwani.)*

Other:

**Pine dominant** (Muller et al-table 6.1)

Live canopy needles-787 kg/m3

Dead litter needles-615 kg/m3

Fine wood fuels-512 kg/m3