



## MAIN FEATURES OF COMPLEMENTARY MLDP AND FIREWORK SYSTEMS

Features	MLDP (AutoSim)	FireWork
<b>Model type</b>	Full 3D Lagrangian atmospheric transport and dispersion offline model	Full 3D Eulerian atmospheric chemistry inline model
<b>Domains</b>	<ul style="list-style-type: none"> <li>• Pan-Canadian (including Canada and Northern CONUS)</li> <li>• Regional in Canada</li> </ul>	North America (including Canada, CONUS and Alaska)
<b>Driving meteorological model</b>	HRPDS	RDPS
<b>Meteorological spatial and temporal resolution</b>	2.5 km, 1 h	10 km, 1 h
<b>Dynamical &amp; physical processes</b>	<ul style="list-style-type: none"> <li>• Advection</li> <li>• Turbulent diffusion</li> <li>• Planetary Boundary Layer</li> <li>• Dry deposition</li> <li>• Wet scavenging (in-cloud)</li> </ul>	<ul style="list-style-type: none"> <li>• Advection</li> <li>• Turbulent diffusion</li> <li>• Radiation</li> <li>• Planetary Boundary Layer</li> <li>• Condensation</li> <li>• Convection</li> <li>• Cloud Microphysics</li> <li>• Surface processes</li> </ul>
<b>Chemical processes</b>	No chemical transformations/reactions (inert passive tracer)	<ul style="list-style-type: none"> <li>• Gas-phase, Aqueous-phase, and Heterogeneous chemistry is included</li> <li>• Aerosol dynamics (nucleation, condensation, coagulation, inorganic gas-particle partitioning, sedimentation and dry deposition, in-cloud and below-cloud scavenging, and secondary organic aerosol (SOA) formation)</li> <li>• Employs a simple 2-bin sectional representation of the PM size distribution (Bin 1 is 0-2.5 <math>\mu\text{m}</math> aerodynamic diameter and Bin 2 is 2.5-10 <math>\mu\text{m}</math>), but PM chemical composition is treated in more detail.</li> <li>• Nine chemical components are considered: <math>\text{SO}_4</math>, <math>\text{NO}_3</math>, <math>\text{NH}_4</math>, elemental carbon (EC), primary organic aerosol (POA), SOA, crustal material, sea salt, and particle-bound water.</li> </ul>



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<b>Emissions</b>	Wildfires sources (PM <sub>2.5</sub> ) calculated from effective biomass burned multiplied by emission factor for PM <sub>2.5</sub> only.	<ul style="list-style-type: none"> <li>• Anthropogenic sources based on the 2010 Canadian national Air Pollutant Emissions Inventory (APEI), the 2011 U.S. National Emissions Inventory (NEI) and the 1999 Mexican emissions inventory.</li> <li>• Biogenic sources calculated online based on the algorithm from BEIS version 3.09 with BELD3-format vegetation land cover for Canada and the U.S.</li> <li>• Wildfires sources (PM<sub>2.5</sub>, COV, NO<sub>x</sub>, SO<sub>2</sub>, CO, NH<sub>3</sub>) calculated by CFFEPS based on effective biomass burned multiplied by emission factors for different chemical species.</li> </ul>
<b>Hotspot source</b>	NRCan's Canadian Wildland Fire Information System (CWFIS) in near real-time biomass burning emissions <ul style="list-style-type: none"> <li>• Total Fuel Consumption &gt; 0.1 kg/m<sup>2</sup></li> </ul>	NRCan's Canadian Wildland Fire Information System (CWFIS) in near real-time biomass burning emissions <ul style="list-style-type: none"> <li>• Total Fuel Consumption (kg/m<sup>2</sup>)</li> </ul>
<b>Emission source term</b>	<ul style="list-style-type: none"> <li>• Emission time profile: Constant</li> <li>• Injection plume height: Fixed (200 m)</li> <li>• Vertical mass distribution: Uniform</li> </ul>	<ul style="list-style-type: none"> <li>• Emission time profile: Variable (diurnal profile)</li> <li>• Fire growth and spread calculated from meteorological forecast information</li> <li>• Injection plume height: Variable, i.e. calculated from thermodynamic properties and atmospheric stability</li> <li>• Vertical mass distribution: Uniform</li> </ul>
<b>Assimilation period of hotspots</b>	48 h	24 h
<b>Old smoke recycling</b>	Yes	Yes
<b>Number of daily runs</b>	4 times (00 UTC, 06 UTC, 12 UTC, 18 UTC)	2 times (00 UTC, 12 UTC)
<b>Support status</b>	Operational 24/7	Operational 24/7
<b>System total run time</b>	Between 75 and 90 minutes, approximately	50 minutes, approximately



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<b>Available products</b>	<ul style="list-style-type: none"> <li>48-h hourly forecasts of PM<sub>2.5</sub> near-ground concentrations</li> </ul>	<ul style="list-style-type: none"> <li>48-h hourly forecasts of PM<sub>2.5</sub> concentrations at ground level</li> <li>48-h hourly forecasts of PM<sub>2.5</sub> total mass column concentrations</li> <li>24-h average of PM<sub>2.5</sub> concentrations at ground level</li> <li>24-h maximum of PM<sub>2.5</sub> concentrations at ground level</li> <li>Air Quality Health Index (AQHI, internal)</li> </ul>
<b>Output formats</b>	<ul style="list-style-type: none"> <li>HTML animations</li> <li>ZIP animations</li> <li>SHP</li> <li>PNG</li> </ul>	<ul style="list-style-type: none"> <li>HTML animations</li> <li>PNG</li> <li>GRIB</li> </ul>
<b>Product time availability</b>	Between 5 and 6 hours after the time of the HRDPS cycle run: <ul style="list-style-type: none"> <li>00 UTC run: between 05 and 06 UTC</li> <li>06 UTC run: between 11 and 12 UTC</li> <li>12 UTC run : between 17 and 18 UTC</li> <li>18 UTC run: between 23 and 00 UTC</li> </ul>	Approximately 4 hours after the time of the RDPS cycle run: <ul style="list-style-type: none"> <li>00 UTC run: 04 UTC</li> <li>12 UTC run: 16 UTC</li> </ul>



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Web site	<a href="http://eer.cmc.ec.gc.ca/mandats/AutoSim/Fire/index.html">http://eer.cmc.ec.gc.ca/mandats/AutoSim/Fire/index.html</a>	<ul style="list-style-type: none"> <li>• <a href="https://weather.gc.ca/firework/index_e.html">https://weather.gc.ca/firework/index_e.html</a></li> <li>• <a href="http://collaboration.cmc.ec.gc.ca/cmc/air/firework/">http://collaboration.cmc.ec.gc.ca/cmc/air/firework/</a></li> <li>• <a href="http://aqhi.cmc.ec.gc.ca/firework/">http://aqhi.cmc.ec.gc.ca/firework/</a></li> </ul>
Real-time additional support	Yes <ul style="list-style-type: none"> <li>• high-resolution products provided upon request</li> <li>• Highly configurable and flexible system</li> </ul>	No
Recommended for	<ul style="list-style-type: none"> <li>• Planning and prevention purposes for emergency management organizations               <ul style="list-style-type: none"> <li>○ On-site operations</li> <li>○ Tactical decisions</li> <li>○ Establishment of command post</li> <li>○ Evacuation of area at risk</li> <li>○ Shelter in place</li> <li>○ Guidance for air/ground sampling</li> </ul> </li> <li>• Air Concentrations</li> <li>• Local, regional and continental scales</li> <li>• More frequent updates (4 times daily)</li> <li>• Custom products at high resolution (upon request)</li> </ul>	<ul style="list-style-type: none"> <li>• Air quality advisories and special weather statements</li> <li>• Health impact</li> <li>• Air concentrations</li> <li>• Regional and continental scales</li> <li>• Secondary aerosols</li> <li>• Custom products (health impact guidance)</li> <li>• Long-term analysis for air-quality, health and climate change studies</li> </ul>
Users	<ul style="list-style-type: none"> <li>• Weather Preparedness Meteorologists (WMPs)</li> <li>• Storm Prediction Centres (SPCs)</li> <li>• National Environmental Emergency Centre (NEEC)</li> <li>• Aviation and Defence Services (Joint Meteorological Centre CFB Gagetown)</li> <li>• Public Safety Canada (Government Operations Centre)</li> <li>• Provincial and Municipal Emergency Management Organizations</li> <li>• Federal, Provincial and Municipal Public Health Agencies</li> <li>• Provincial Departments of Environment</li> </ul>	<ul style="list-style-type: none"> <li>• Storm Prediction Centres (SPCs)</li> <li>• Federal, Provincial and Municipal Governments</li> <li>• Decision Makers</li> <li>• Universities</li> <li>• Federal and Provincial Public Health Agencies</li> <li>• Private Sector and Media</li> <li>• International partners (NOAA, USFS, ECMWF)</li> </ul>