QUIC-Fire Input File Description

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Table of Contents

1 FIRETEC legacy files

1.1 gridlist

The gridlist file is originally a Firetec input file. As such, it contains a number of inputs that are not used in QUIC-Fire. In the following, only the relevant inputs will be discussed. The file is ascii and assumes the use of namespace to read in the file. QUIC-Fire does not use this paradigm and reads in all the lines as text and keys on the “=” to assign values.

An example of input is reported here:

```
n=2000 m=2000 l=100
dx=10.0 dy=10.0 dz=100.0
aa1=0.1
```

Namelist	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran
`n`	INT	> 0	> 0	Number of cells in the x-direction	[-]	`ft%nx`
`m`	INT	> 0	> 0	Number of cells in the y-direction	[-]	`ft%ny`
`l`	INT	> 0	> 0	Number of cells in the z-direction	[-]	`ft%nz`
`dx`	REAL	> 0	> 0	Cells size in the x-direction Recommended value: 2 m	[m]	`ft%dx`
`dy`	REAL	> 0	> 0	Cells size in the y-direction Recommended value: 2 m	[m]	`ft%dy`
`dz`	REAL	> 0	> 0	Number that multiplied by the number of cells in the z-direction would provide the height of the domain	[m]	`zb`
`aa1`	REAL	> 0	> 0	Stretching factor for the vertical grid spacing	[-]	`aa1`

1.2 rasterorigin.txt

The rasterorigin.txt file is an ascii files. QUIC-Fire uses only the first two line and therefore, only those will be described.

# Line	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran
1	REAL	> 0	> 0	South-west corner of the Firetec domain, UTM-x	[m]	`ft%utmx`
2	REAL	> 0	> 0	South-west corner of the Firetec domain, UTM-y	[m]	`ft%utmy`

1.3 ignite.dat

There are a number of ways to specify complex ignitions patterns in QUIC-Fire (outside of QUIC_fire.inp), namely:

- Ignition option: 4. 3D array of ignitions, file name: QF_Ignitions.inp (see Section 3.1)
- Ignition option: 5. Time-dependent ignition pattern, file name: QF_IgnitionPattern.inp (see Section 3.2)
- Ignition option: 7. Firetec ignition patterns, file name: ignite.dat:
    - Aerial ignition pattern
    - ATV ignition pattern

1.3.1 Aerial ignition pattern

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran
1	INT	4	4	Ignition flag. 4 = aerial ignition pattern	[-]	`ignition_flag`
3	INT	> 0	> 0	Number of ignition points. The information is presented as a string. Flag is found after “=” symbol		`fire_ignition%npoints`

After three more headers, there are `fire_ignition%npoints` lines with the following columns

Column #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran

1	INT	[1 firetec grid nx]	Any	Cell index in the x-direction in the Firetec grid specified by the gridlist and rasterorigin.txt files	[-]	`ip`
2	INT	[1 firetec grid ny]	Any	Cell index in the y-direction in the Firetec grid specified by the gridlist and rasterorigin.txt files	[-]	`jp`
3	INT	[0 sim time]	Any	Time of ignition	[s]	`temp_time`

1.3.2 ATV ignition pattern

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran
1	INT	5	5	Ignition flag. 5 = ATV ignition pattern	[-]	`ignition_flag`
3	INT	> 0	> 0	Number of ignition lines. The information is presented as a string. Flag is found after "=" symbol		`nlines`

After three more headers, there are `nlines` lines with the following columns:

Column #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran
7 to number of ignition lines	REAL	[0 firetec grid Lx]	Any	Beginning of the line in the x-direction in the Firetec grid specified by the gridlist and rasterorigin.txt files	[m]	`atv_x`
7 to number of ignition lines	REAL	[0 firetec grid Lx]	Any	End of the line in the x-direction in the Firetec grid specified by the gridlist and rasterorigin.txt files	[m]	`atv_x`

7 to number of ignition lines	REAL	[0 firetec grid ny]	Any	Beginning of the line in the y-direction in the Firetec grid specified by the gridlist and rasterorigin.txt files	[m]	`atv_y`
7 to number of ignition lines	REAL	[0 firetec grid ny]	Any	End of the line in the y-direction in the Firetec grid specified by the gridlist and rasterorigin.txt files	[m]	`atv_y`
7 to number of ignition lines	REAL	[0 sim time]	Any	Time of the beginning of the ignition of the line	[s]	`atv_time`
7 to number of ignition lines	REAL	[0 sim time]	Any	Time of the end of the ignition of the line	[m]	`atv_time`

1.4 trees*.dat

The fuel files were originally developed for Firetec and QUIC-Fire was adapted to read them in and interpolate then on its own grid. If fuel density or moisture is specified via the trees* files, the gridlist and rasterorigin.txt files must also be supplied.

The name and format depend on the ft%fuel_file_type flag in QUIC_fire.inp:

- If its value is 1, then all fuel types are in the same file;
- If its value is 2, then the fuel types are in separate files, marked with the number of the fuel type.

It is considered that

- Fuel #1: dead thin fuel
- Fuel #2: live thin fuel
- Fuel #3: dead thick fuel
- Fuel #4: unburnable

The fuel files are binary and their format depends on the flag “ft%fuel_file_format” specified in QUIC_fire.inp:

- ft%fuel_file_format = 1: binary files are in stream format;
- ft%fuel_file_format = 2: binary files have Fortran headers.

The fuel files that can be read in by QUIC-Fire are called:

- treesrhof.dat: bulk fuel density
- treesmoist.dat: fuel moisture
- treesfueldepth.dat: fuel depth

The files contain a 4d array (type real) shaped as such:

- If the fuels%density_flag or the fuels%moisture_flag are "3": (ft%n_fuel_types, firegrid%nx, firegrid%ny, ft%n_grid_top). Files were created for a Firetec grid that matches the QUIC-Fire fire grid.
- If the fuels%density_flag or the fuels%moisture_flag are "4": (ft%n_fuel_types, ft%nx, ft%ny, ft%n_grid_top). Files were created for a Firetec grid that does not matches the QUIC-Fire fire grid and interpolation is needed.

2 QUIC-URB legacy files

2.1 QU_buildings.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	STRING	N/A	N/A	Header	[-]		N
2	REAL	> 0	> 0	Wall roughness length	[m]	`bld%zo`	N
3	INT	> 0	[1 30k]	Number of buildings Recommended value 0 (building algorithms are not part of QUIC-Fire)	[-]	`bld%number`	N
4	INT	> 0	[1 500]	Number of polygon building nodes Recommended value 0	[-]	`inumpolygon`	N

2.2 QU_fileoptions.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified

1	STRING	N/A	N/A	Header	[-]		N
2	INT	[0 3]	[0 3]	Output data file format flag: 1 = ascii 2 = binary 3 = both Recommended value 2	[-]	`flag%frm`	N
3	INT	[0 1]	[0 1]	Flag to write out non-mass conserved initial field (uofield.dat): 0 = do not write 1 = write Recommended value 0	[-]	`flag%uofield`	N
4	INT	[0 1]	[0 1]	Flag to write out the file uosensorfield.dat, the initial sensor velocity field: 0 = do not write 1 = write Recommended value 0	[-]	`flag%uosensor`	N
5	INT	[0 1]	[0 1]	Flag to write out the file QU_staggered_velocity.bin used by QUIC-Pressure: 0 = do not write 1 = write Recommended value 0	[-]	`flag%staggered`	N
6	INT	[0 1]	[0 1]	Generate wind startup files for ensemble simulations 0 = do not write 1 = write	[-]	`flag%genStartup`	Y

2.3 QU_landuse.inp

File is binary (Fortran format with headers between data blocks)

Read one header (int32)

Read three data points (int32)

Entry #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	INT	[0 1]	[0 1]	Flag for land use: 0 = no land use 1 = land use provided Recommended value 0 – Not used to build fuels	[-]	`landuse%flag`	N
2	INT	[0 1]	[0 1]	Vegetation flag: 0 = vegetation land use not provided 1 = vegetation land use provided	[-]	`landuse%veg_flag`	N
3	INT	[0 1]	[0 1]	Urban flag: 0 = urban land use not provided 1 = urban land use provided	[-]	`landuse%urb_flag`	N

2.4 QU_metparams.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	STRING	N/A	N/A	Header	[-]		N
2	INT	[0 3]	[0 3]	Meteorology input flag: 0 = QUIC 1 = WRF 2 = ITT MM5 3 = HOTMAC If from WRF, specify 1; otherwise use 0	[-]	`met_input_flag`	Y
3	INT	[1 Inf)	[1 Inf)	Number of measuring sites	[-]	`windProfile% num_sites`	Y

4	INT	> 0	[1 30]	Maximum number of data points in the vertical wind profiles	[-]	windProfile% num_vert_points	N

For each profile, repeat the following information:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
5	STRING	N/A	N/A	Name of the wind profile	[-]	N/A	Y
6	STRING	N/A	N/A	Header (“!File name” in the provided examples)	[-]		N
7	STRING	N/A	N/A	Name of the file containing the wind profile	[-]	f_name	Y

2.5 QU_simparams.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	STRING	N/A	N/A	Header	[-]		N
2	INT	> 0	100-2000	Number of cells in the x-direction Recommended value > 100	[-]	qugrid%nx	Y
3	INT	> 0	100-2000	Number of cells in the y-direction Recommended value > 100	[-]	qugrid%ny	Y
4	INT	> 0	10-100	Number of cells in the z-direction	[-]	qugrid%nz	Y
5	REAL	> 0	0.5-250	Cell size in the x-direction Recommended value 2 m	[m]	qugrid%dx	Y
6	REAL	> 0	0.5-250	Cell size in the y-direction Recommended value 2 m	[m]	qugrid%dy	Y
7	INT	[0 4]	[0 4]	Vertical grid stretching flag:	[-]	stretchgridflag	Y

				0 = uniform vertical cell size 1 = custom vertical cell size 2 = stretching with parabolic z-coordinate 3 = stretching with parabolic vertical cell size 4 = exponential Recommended value 3			

If vertical grid stretching flag is 0:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
8	REAL	> 0	0.5-5.	Surface vertical cell size	[m]	`N/A`	Y
9	REAL	> 0	0.5-200.	Value of the vertical cell size	[m]	`qugrid%dz_array`	Y

If vertical grid stretching flag is 1:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
8	REAL	> 0	0.5-5.	Surface vertical cell size	[m]	`N/A`	Y
9	STRING	N/A	N/A	Header	[-]		N
10-(9+nz)	REAL	> 0	0.5-200.	Values of the vertical cell sizes	[m]	`qugrid%dz_array`	Y

If vertical grid stretching flag is 2 or 3:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
8	REAL	> 0	0.5-5.	Surface vertical cell size	[m]	`N/A`	Y

9	INT	> 0	1-5	Number of cells with uniform cell size at the surface	[-]	`N/A`	Y
10	STRING	N/A	N/A	Header	[-]		N
11-(10+nz)	REAL	> 0	0.5-200.	Values of the vertical cell sizes	[m]	`qugrid%dz_array`	Y

If vertical grid stretching flag is 4:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
8	REAL	> 0	0.5-5.	Surface vertical cell size	[m]	`N/A`	Y
9	INT	> 0	1-5	Number of cells with uniform cell size at the surface	[-]	`N/A`	Y
10	REAL	(0-2]	(0-2]	Vertical growth factor	[-]	`N/A`	Y
11	STRING	N/A	N/A	Header	[-]		N
12-(11+nz)	REAL	> 0	0.5-200.	Values of the vertical cell sizes	[m]	`qugrid%dz_array`	Y

The last line at the previous setup will be called X.

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
X+1	INT	> 0	1-36	Number of times at which the winds are provided	[-]	`qutime%nsteps`	Y
X+2	INT	-12 - +12	-12 - +12	Hours difference from UTM	[h]	`qugrid%utc_offset`	Y
X+3	STRING	N/A	N/A	Header	[-]		N
(X+4) – (X+3+ ntimes)	INT	0 - Inf	0 - Inf	List of times at which the winds are available in in Unix Epoch time (integer seconds since 1970/1/1 00:00:00)	[s]	`qutime%unix`	Y
X+4+ ntimes	INT	[0 2]	[0 2]	Rooftop flag: 0 = none 1 = log profile	[-]	`bld%flag%roof`	N

				2 = vortex Not used			
X+5+ ntimes	INT	[0 3]	[0 3]	Upwind cavity flag: 0 = none 1 = Rockle 2 = MVP 3 = HMVP Not used	[-]	`bld%flag%upwind`	N
X+6+ ntimes	INT	[0 4]	[0 4]	Street canyon flag: 0 = none 1 = Rockle 2 = CPB 3 = exponential parameterization PKK 4 = Rockle with Fackrel Not used	[-]	`bld%flag%streetcanyon`	N
X+7+ ntimes	INT	[0 1]	[0 1]	Street intersection flag: 0 = off 1 = on Not used	[-]	`bld%flag%intersection`	N
X+8+ ntimes	INT	[0 3]	[0 3]	Wake flag: 0 = none 1 = Rockle 2 = Modified Rockle 3 = Area Scaled Not used	[-]	`bld%flag%wake`	N
X+9+ ntimes	INT	[0 1]	[0 1]	Sidewall flag: 0 = off 1 = on	[-]	`bld%flag%sidewall`	N

				Not used			
X+10+ ntimes	INT	[1 2]	[1 2]	Canopy flag: 1 = Cionco without wakes 2 = Cionco with wakes Not used	[-]	`N/A`	N
X+11+ ntimes	INT	[1 3]	[1 3]	Season flag: 1 = Summer 2 = Winter 3 = Transition Not used	[-]	`N/A`	N
X+12+ ntimes	INT	[1 500]	[10 500]	Maximum number of iterations of the SOR wind solver Recommended value 10	[-]	`sor%itermax`	N
X+13+ ntimes	INT	[1 5]	3	Residual reduction to assess convergence of the SOR solver (orders of magnitude) Recommended value 3	[-]	`sor%residual_reduction`	Y (only if running only winds)
X+14+ ntimes	INT	[0 1]	[0 1]	Use diffusion algorithm: 0 = off 1 = on Recommended value 0	[-]	`diff%flag`	N
X+15+ ntimes	INT	[0 50]	20	Number of diffusion iterations (not used if diffusion algorithm is off)	[-]	`diff%step`	N
X+16+ ntimes	REAL	(-90 +90)	(-90 +90)	Domain rotation relative to true north (clock-wise is positive) Recommended value 0 deg	[degrees]	`qugrid%domain_rotation`	N
X+17+ ntimes	REAL	Can go across		UTM-x coordinates of the south-west corner of domain	[m]	`qugrid%utmx`	Y

		UTM zones					
X+18+ ntimes	REAL	Can go across UTM zones		UTM-y coordinates of the south-west corner of domain	[m]	qugrid%utmy	Y
X+19+ ntimes	INT	[1 60]	[1 60]	UTM zone number	[-]	qugrid%utmzone	Y
X+20+ ntimes	INT	[1 26]	[1 26]	UTM zone letter (A=1, B=2,..)	[-]	N/A	Y
X+21+ ntimes	INT	[0 1]	[0 1]	QUIC-CFD flag: 0 = off 1 = on Recommended value 0	[-]	qcfd_flag	N
X+22+ ntimes	INT	[0 1]	[0 1]	Explosive building damage flag: 0 = off 1 = on Recommended value 0	[-]	damage%flag	N
X+23+ ntimes	INT	[0 1]	[0 1]	Building array flag 0 = off 1 = on Recommended value 0	[-]	N/A	N

2.6 QU_TopoInputs.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	STR	Any	Any	Header	[-]		N
2	STR	Any	Any	Path to the custom topo file (only used with option 5). Cannot be .bin. Use .dat or .inp	[-]	topo%path	Y

3	INT	[0 2]	[0 2]	Topo flag: 0 = no terrain file provided, QUIC-Fire is run with flat terrain 1 = Gaussian hill 2 = hill pass 3 = slope mesa 4 = canyon 5 = custom 6 = half circle 7 = sinusoid 8 = cos hill 9 = terrain is provided via QP_elevation.bin (see Section 2.7) 10 = terrain is provided via terrainOutput.txt 11 = terrain.dat (firetec)	[-]	`topo%flag`	Y

If topo flag = 1:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
4	REAL	[0 Lx]	[0 Lx]	Gaussian hill top location x-dir	[m]	`topo%gauss_hill_center_x`	Y
5	REAL	[0 Ly]	[0 Ly]	Gaussian hill top location y-dir	[m]	`topo%gauss_hill_center_y`	Y
6	REAL	[0 Lz/3]	[0 Lz/3]	Gaussian hill max elevation	[m]	`topo%gauss_hill_max_height`	Y
7	REAL	> 0	> 0	Gaussian hill standard deviation	[m]	`topo%gauss_hill_sigma`	Y

If topo flag = 2:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified

4	REAL	[0 Lz/3]	[0 Lz/3]	Hill pass maximum height	[m]	`topo%hill_pass_max_height`	Y
5	REAL	> 0	> 0	Hill pass location parameter	[m]	`topo%hill_pass_loc_param`	Y

If topo flag = 3:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
4	INT	[0 1]	[0 1]	Slope axis: 0 = X 1 = Y	[-]	`topo%slope_axis`	Y
5	REAL	> 0	> 0	Slope in dh/dx or dh/dy	[-]	`topo%slope_val`	Y
6	REAL	[0 1]	[0 1]	Fraction of domain that is flat	[-]	`topo%slope_fraction_flat`	Y

If topo flag = 4:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
4	REAL	[0 Lx]	[0 Lx]	Canyon location in x-dir	[m]	`topo%canyon_x_start`	Y
5	REAL	[0 Ly]	[0 Ly]	Canyon location in y-dir	[m]	`topo%canyon_y_center`	Y
6	REAL	> 0	> 0	Slope in dh/dx or dh/dy	[-]	`topo%canyon_slope_val`	Y
7	REAL	> 0	> 0	Canyon function standard deviation	[m]	`topo%canyon_std`	Y
8	REAL	> 0	> 0	Canyon vertical offset	[m]	`topo%canyon_height_offset`	Y

If topo flag = 6:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
4	REAL	[0 Lx]	[0 Lx]	Half circle x-location	[m]	`topo%halfcircle_x`	Y
5	REAL	[0 Ly]	[0 Ly]	Half circle y-location	[m]	`topo%halfcircle_y`	Y

6	REAL	> 0	(0 Lx/2)	Half circle radius	[-]	`topo%halfcircle_radius`	Y

If topo flag = 7:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
4	REAL	> 0	> 0	Sinusoid period	[-]	`topo%sinusoid_nu`	Y
5	REAL	> 0	> 0	Sinusoid amplitude	[-]	`topo%sinusoid_amplitude`	Y

If topo flag = 8:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
4	REAL	> 0	> 0	Hill aspect	[-]	`topo%coshill_aspect`	Y
5	REAL	[0 Lz/3]	[0 Lz/3]	Hill height	[-]	`topo%coshill_height`	Y

Using X for the last line of previous specification.

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
X+1	INT	[0 2]	[0 2]	Smoothing method 0 = none (default for idealized topo) 1 = Blur 2 = David's method based on second derivative Recommended value 2 for real topo	[-]	`topo%smoothing_method`	Y
X+2	INT	[0 500]	[0 200]	Number of smoothing passes	[-]	`topo%smoothing_niter`	Y

				Recommended value 200 for real topo			
X+3	INT	[0 10,000]	[0 1000]	Number of SOR iteration to define background winds before starting the fire Recommended value 500 for real topo	[-]	sor%topo_init_iter	Y
X+4	INT	[0 10]	[0 4]	Number of times the SOR solver initial fields is reset to define background winds before starting the fire Recommended value 4 for real topo	[-]	sor% number_of_reset_cycles_topo	Y
X+5	REAL	[0 2]	[0.9 1.8]	SOR overrelaxation coefficient. Only used if there is topo. Recommended value 0.9-1.3 for real topo	[-]	sor%omegarelax	Y
X+6	INT	[0 1]	[0 1]	Add thermodynamic flow effects. Requires QUIC-Slope Recommended value 1	[-]	topo% add_slopeflow_correction	Y
X+7	N/A	N/A	N/A	Header	[-]		N
X+8	STRING	N/A	N/A	How to launch the slope flow exe LINUX/MAC: ./QUIC-Slopeflow_MACI.exe WIN: QUIC-Slopeflow_WIN64.exe	[-]	topo%slopeflow_cmd	Y

2.7 QP_elevation.inp

File is binary (Fortran format with headers between data blocks)

Read one header (int32)

Read three data points (real). If the first element is greater than or equal to 0.5, then the topography is read in.

Read one header (int32)

Read (qugrid%ny+2) × (qugrid%nx+2) elevation points (real, in meters). There is one ghost cell layer surrounding the external boundary of the domain.

2.8 sensor1.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	STRING	N/A	N/A	Header	[-]		N
2	INT	[0 1]	[0 1]	Upper-level flag: 0 = do not use this profile for upper-level winds 1 = use this profile for upper-level winds Recommended value 0	[-]	N/A	N
3	INT	> 0	(0 50]	Upper-level height Not used if the upper-level flag is set to 0.	[m]	N/A	N
4	INT	[1 3]	[1 3]	Site coordinate flag 1 = QUIC [m] 2 = UTM [m] 3 = Lat/Lon [deg] Recommended value 1	[-]	coordFlag	N (unless using WRF winds)
5	REAL	Any	Any	Wind profile x-coordinates (may be outside the domain)	[m or deg]	windProfile%site%xcoord	Y
6	REAL	Any	Any	Wind profile y-coordinates (may be outside the domain)	[m or deg]	windProfile%site%ycoord	Y

If UTM coordinates:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
7	REAL	Any	Any	Wind profile UTM-x-coordinates	[m]	utm_x	Y
8	REAL	Any	Any	Wind profile UTM-y-coordinates	[m]	utm_y	Y
9	INT	[1 60]	[1 60]	UTM zone number	[-]	N/A	Y
10	INT	[1 26]	[1 26]	UTM zone letter (1=A, 2=B, …)	[-]	N/A	Y

If Lat/Lon coordinates:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
7	REAL	Any	Any	Wind profile latitude	[degree]	`lat`	Y
8	REAL	Any	Any	Wind profile longitude	[degree]	`lon`	Y

Repeat for each time at which winds are available at this profile.

The last line at the previous setup will be called X.

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
X+1	INT	[0 Inf)	[0 Inf)	Beginning of time step in Unix Epoch time (integer seconds since 1970/1/1 00:00:00)	[-]	`N/A`	Y
X+2	INT	[1 4]	[1 4]	Site boundary layer flag: 1 = log 2 = exp 3 = urban canopy 4 = discrete data points	[-]	`windProfile%site%blayer_flag`	Y
X+3	INT	> 0	0.01 – 1.	Site aerodynamic roughness	[m]	`windProfile%site%pp`	Y

If site boundary layer flag is 1:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
X+4	REAL			Inverse Monin-Obukhov length Recommended value 0. Code not well tested otherwise	[1/m]	`windProfile%site%rL`	N

X+5	STRING	N/A	N/A	Header	[-]		N
X+6	REAL	> 0	N/A	Three values separated by space: 1. Wind measurement height 2. Wind speed 3. Wind direction	1. [m] 2. [m/s] 3. [degree]	1. `windProfile%site%z_data` 2. `windProfile%site%ws_data` 3. `windProfile%site%wd_data`	Y

If site boundary layer flag is 2:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
X+4	STRING	N/A	N/A	Header	[-]		N
X+5	REAL	> 0	N/A	Three values separated by space: 1. Wind measurement height 2. Wind speed 3. Wind direction	1. [m] 2. [m/s] 3. [degree]	1. `windProfile%site%z_data` 2. `windProfile%site%ws_data` 3. `windProfile%site%wd_data`	Y

If site boundary layer flag is 3:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
X+4	REAL			Inverse Monin-Obukhov length Recommended value 0. Code not well tested otherwise	[1/m]	`windProfile%site%rL`	N
X+5	REAL	> 0	> 0	Canopy height	[m]	`windProfile%site%H`	Y
X+6	REAL	(0 3]	(0 3]	Canopy attenuation coefficient	[-]	`windProfile%site%ac`	Y
X+7	STRING	N/A	N/A	Header	[-]		N
X+8	REAL	> 0	N/A	Three values separated by space: 1. Wind measurement height	1. [m] 2. [m/s]	1. `windProfile%site%z_data`	Y

				2. Wind speed 3. Wind direction	3. [degree]	2. `windProfile%site%ws_data` 3. `windProfile%site%wd_data`	

If site boundary layer flag is 4:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
X+4	INT			Number of data points in the vertical profile	[-]	`windProfile%site%nz_data`	Y
X+5	STRING	N/A	N/A	Header	[-]		N
(X+6) – (X+5+ npoints)	REAL	> 0	N/A	Three values separated by space: 1. Wind measurement height 2. Wind speed 3. Wind direction	1. [m] 2. [m/s] 3. [degree]	1. `windProfile%site%z_data` 2. `windProfile%site%ws_data` 3. `windProfile%site%wd_data`	Y

3 QUIC-Fire files

3.1 QF_Ignitions.inp

This file is read in if the ignition option is 4. The file in binary and contains a 3d array, type int32 with the number of ignitions per cell. The 3d array has the same number of cells of the Fire domain. File is in Fortran file format with headers.

3.2 QF_IgnitionPattern.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran
1	INT	> 0	> 0	Number of ignition points	[-]	`fire_ignition%npoints`
2	STRING	N/A	N/A	Header	[-]	

After the headers, there is one entry per line with the following columns, separated by space:

Column #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran
1	REAL	[0 sim time]	Any	Time of ignition	[s]	`fire_ignition%time`
2	REAL	[0 domain x-length]	Any	x-location, in QUIC coordinates, of the ignition point	[m]	`fire_ignition%x`
3	REAL	[0 domain y-length]	Any	y-location, in QUIC coordinates, of the ignition point	[m]	`fire_ignition%y`
4	REAL	[0 domain z-length]	Any	z-location, in QUIC coordinates, of the ignition point	[m]	`fire_ignition%z`
5	REAL	> 0	Any	Radius around the location of ignition that is on fire	[m]	`fire_ignition%radius`
6	INT	> 0	Any	Number of ignitions	[m]	`fire_ignition%new_num`

3.3 QFire_Advanced_User_Inputs.inp

Firebrands have not been tested for small scale problems.

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	REAL	(0 1]	0.05-0.9	Fraction of cells that could launch firebrand tracers from which firebrand tracers will actually be launched Higher value = more firebrand tracers Recommended value 0.05	[-]	`fb_const%FRACTION_LAUNCHED`	Y
2	REAL	> 1	40-80	Multiplicative factor used to relate the length scale of the mixing (firebrand distribution entrainment length scale) to the initial size of the distribution	[-]	`fb_const%c_s`	N

				Higher value = higher growth rate or RT (firebrand distribution) with flight time Recommended value 40			
3	INT	≥1	1	Time step used to determine the firebrand tracer trajectory Higher value = less accurate trajectory Recommended value 1 s	[s]	`fb_const%time_step`	Y
4	INT	> 0	10-20	Time interval between launching of firebrand tracers Higher value = less firebrand tracers launched Recommended value 10 s	[s]	`fb_const%LAUNCH_TIME`	Y
5	INT	> 0	500	Number of firebrand tracers that one firebrand tracer launched represents This currently has basically no effect since the number of firebrand tracers deposited is decided by the limits imposed via inputs #12 and 13, but we expect it to have more significance in future. Recommended value 500	[-]	`fb_const%num_deposited`	Y
6	REAL	> 0	10-20	Multiplicative factor used to relate the cell area and fraction of cells from which tracers are launched to initial area represented by one firebrand. Higher value = one firebrand tracer impacts a lower area Recommended value 20	[-]	`fb_const%FRACTION_ LAUNCHED_to_RT_ratio`	N
7	REAL	> 0	50	Multiplicative factor relating the minimum mass-loss rate that a firebrand tracer needs to have to justify	[-]	`fb_const%min_b_value_coef`	N

				continuing to track its trajectory to the energy associated with a new ignition (otherwise it is considered extinct and it is removed from the calculations) Higher value = more firebrand tracers are considered extinct and are removed from the calculations Recommended value 50			
8	REAL	> 0	0.5-0.75	Multiplicative factor relating the thickness of launched firebrand tracer to maximum loftable firebrand thickness. This thickness of launched firebrand tracers is also compared to a minimum thickness to decide if the tracer should be launched or is too small and will most definitely burn out during flight Recommended value 0.75	[-]	`fb_const%frac_of_max_size`	Y
9	INT	> 0	0-300	How long after a firebrand has landed, a fire is started Higher value = fire spread is slower Recommended value 180 s	[s]	`fb_const%germination_delay`	Y
10	REAL	> 1	5-10	Maximum value of the multiplicative factor of the vertical velocity experienced by a firebrand = 1/(fraction of the QUIC-URB on fire). It represents the fact that firebrand tracers can be caught in local updrafts, which can be significantly higher than mean vertical velocity for a cell. Higher value = the firebrand tracers are lofted higher in the atmosphere Recommended value 5	[-]	`fb_const%max_w_mult`	N

11	INT	> 0	50-100	Minimum number of ignitions to be sampled in a position where a firebrand lands Higher value = more firebrand tracers deposited Recommended value 50	[-]	fb_const%min_number_of_ignitions	Y
12	INT	> 0	100-500	Maximum number of ignitions sampled at positions distributed within RT around where a firebrand tracer lands Higher value = more firebrand tracers Recommended value 100	[-]	fb_const%max_number_of_ignitions	Y
13	REAL	[0 PI/2]	PI/3-PI/6	Minimum value considered for the angle between the trajectory of the firebrand when it hits the ground and horizontal (theta approaches zero if the fire brand is moving nearly horizontal when it hits the ground and is pi/2 when then the firebrand is falling straight down). This value caps the deformation of the firebrand landing patterns. A shallower angle (as theta gets closer to zero the major axis of the elliptical pattern grows with respect to the minor axis). Recommended value 0.523598 (PI/6)	[rad]	fb_const%min_theta_value	N
14	REAL	> 0	0.03-0.05	Maximum firebrand's thickness Recommended value 0.03 m	[m]	fb_const%max_thickness	Y

3.4 QFire_Bldg_Advanced_User_Inputs.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	INT	[0 1]	0, 1	Flag: 0 = do not convert buildings to fuel (buildings must be specified in QU_buildings.inp) 1 = convert buildings to fuel Recommended value 0 – Currently no effect since no buildings are specified	[-]	`flag%bld_to_fuel`	N
2	REAL	> 0	0.5	If `flag%bld_to_fuel` = 1, the cells with buildings will be filled with thin fuel with the specified density. If a cell already contains fuel, its density is not overwritten Higher value = more fuel in the cell Recommended value 0.5	[kg/m^3]	`canopy%BLDG_FUEL_DENS`	N
3	REAL	> 0	1-2	If `flag%bld_to_fuel` = 1, the cells with buildings will be assigned the specified attenuation coefficient Higher value = more drag due to the fuel in the building Recommended value 2	[-]	`canopy%BLDG_ATTEN_COEFF`	N
4	REAL	> 0	0.01-0.1	If `flag%bld_to_fuel` = 1, the cells with buildings will be assigned the specified surface roughness Higher value = smaller wind velocity at the same height above the ground	[m]	`canopy%BLDG_CANOPY_Z0`	N

				Recommended value 0.01 m			
5	INT	[0 1]	1	Flag: 0 = do not convert fuel to canopy 1 = convert fuel to canopy Recommended value 1	[-]	flag%fuel_to_canopy	N
6	INT	[0 1]	0, 1	Flag: 0 = do not update winds within fuel as fuel is consumed 1 = update winds within fuel as fuel is consumed Recommended value 1	[-]	canopy%UPDATE_WINDS	N
7	REAL	> 0	1-2	Fuel attenuation coefficient Higher value = more drag due to the fuel Recommended value 1	[-]	canopy%FUEL_ATTEN_COEFF	Y
8	REAL	> 0	0.01-0.1	Fuel surface roughness Higher value = smaller wind velocity at the same height above the ground Recommended value 0.1 m	[m]	canopy%FUEL_CANOPY_Z0	N

3.5 QFire_FireFrontDistances.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	INT	≥ 0	[0 10]	Number of distances	[-]	front%num_distances	Y
2	INT	[1 5]	[1 5]	Front direction 1: positive x 2: negative x 3: positive y	[-]	front%direction	Y

				4: negative y 5: circle			
3	STRING	N/A	N/A	Header	[-]		N

For each distance:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
4	REAL	[0 max(Lx, Ly)]	[0 max(Lx, Ly)]	Distance	[m]	`front%distance`	Y

After all distances have been provided

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
5 + ndist	INT	[0 1]	[0 1]	Flag for the coordinates of the point from where to measure the distances: 0: use the center of all the ignition points 1: user provided	[-]	`coordinates_type`	Y

If the point is provided:

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
6 + ndist	INT	[0 1]	[0 1]	Coordinates units: 0: quic 1: UTM (SW domain corner must be provided in QU_simparams.inp)	[-]	`coordinates_type`	Y
7 + ndist	REAL	Within the domain	Within the domain	Coordinate of the point from where to measure the distances in the x-direction	[-]	`front%ignition_center(1)`	Y
8 + ndist	REAL	Within the domain	Within the domain	Coordinate of the point from where to measure the distances in the y-direction	[-]	`front%ignition_center(2)`	Y

3.6 QFire_ListOutputTimes.inp

This file specifies at what times the outputs are printed out. Individual options are used only if the time in QUIC_Fire.inp are set to -1 (lines 8 to 11).

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	STRING	N/A	N/A	Header	[-]	N/A	N
2	INT	> 0	1-10	Number of output times for fire variables ** Only used if line 8 in QUIC-Fire.inp is -1	[-]	`output_time_list(1)%number`	Y
3	INT	[0 simulation time]	[0 simulation time]	List of times at which to generate output files for the fire variables ** Only used if line 8 in QUIC-Fire.inp is -1	[s]	`output_time_list(1)%val`	Y
4	STRING	N/A	N/A	Header	[-]	N/A	N
5	INT	> 0	1-10	Number of output times for the instantaneous QUIC wind variables ** Only used if line 9 in QUIC-Fire.inp is -1	[-]	`output_time_list(2)%number`	Y
6	INT	[0 simulation time]	[0 simulation time]	List of times at which to generate output files for the instantaneous QUIC wind variables ** Only used if line 9 in QUIC-Fire.inp is -1	[s]	`output_time_list(2)%val`	Y
7	STRING	N/A	N/A	Header	[-]	N/A	N
8	INT	> 0	1-10	Number of output times for the emission and thermal radiation variables ** Only used if line 10 in QUIC-Fire.inp is -1	[-]	`output_time_list(3)%number`	Y
9	INT	[0 simulation time]	[0 simulation time]	List of times at which to generate output files for the emission and thermal radiation variables	[s]	`output_time_list(3)%val`	Y

				** Only used if line 10 in QUIC-Fire.inp is -1			
10	STRING	N/A	N/A	Header	[-]	N/A	N
11	INT	> 0	1-10	Number of output times for the average QUIC wind variables ** Only used if line 11 in QUIC-Fire.inp is -1	[-]	output_time_list(4)%number	Y
12	INT	[0 simulation time]	[0 simulation time]	List of times at which to generate output files for the average QUIC wind variables ** Only used if line 11 in QUIC-Fire.inp is -1	[s]	output_time_list(4)%val	Y

3.7 QFire_Plume_Advanced_User_Inputs.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	INT	> 0	[50k 500k]	Maximum number of plumes at each time step Higher value = slower simulation Recommended value 150,000	[-]	plume_const%MAX_NUM_PLUMES_TIMESTEP	Y
2	REAL	> 0	0.1-0.5	Minimum plume updraft velocity. If a plume updraft is below this value, the plume is removed from the simulation. Higher value = less plumes, faster simulation Recommended value 0.1 m/s	[m/s]	plume_const%WC_MIN	Y
3	REAL	> 0	200	Maximum updraft velocity Recommended value 100 m/s	[m/s]	plume_const%WC_MAX	Y

4	REAL	> 0	0.05-0.1	Minimum ratio between the plume updraft velocity and the wind speed. If the ratio falls below the specified value, the plume is removed from the simulation, unless its updraft is 0.5 m/s or higher. Higher value = less plumes, faster simulation Recommended value 0.1	[-]	`plume_const%SPEEDS_RATIO`	N
5	REAL	≥ 0	0	Inverse of the Brunt-Vaisala frequency squared (measure of atmospheric stability) Recommended value 0 $1/s^2$	$[1/s^2]$	`plume_const%BRUNT_VAISALA_FREQ2`	Y
6	INT	[0 1]	0, 1	Flag: 0 = do not spread fire by creeping 1 = spread fire by creeping Recommended value 1	[-]	`CREEPING_FLAG`	N
7	INT	[0 1]	0, 1	Time step flag: 0 = constant time step 1 = adaptive time step Adaptive time step = more accurate plume trajectory, longer simulation time Recommended value 0	[-]	`plume_const%time_step_flag`	Y
8	REAL	> 0	1-10	Time step used to compute the buoyant plume trajectory Higher value = less accurate plume trajectory	[s]	`plume_const%time_step`	Y

				Recommended value 1 s			
9	INT	[0 1]	0, 1	SOR solver option: 0 = standard SOR 1 = memory SOR Recommended value 1	[-]	`sor%option`	Y
10	REAL	> 0	1-10	SOR α_2 value (plume centerline) Higher value = w-component in the cells affected by the plumes is modified less by the SOR solver Recommended value 10	[-]	`sor%` `alpha2_fire_center`	N
11	REAL	> 0	1-10	SOR α_2 value (plume periphery) Higher value = w-component in the cells affected by the plumes is modified less by the SOR solver Recommended value 1	[-]	`sor%` `alpha2_fire_outer`	Y
12	REAL	(0 180]	30-60	Maximum angle between plumes to determine if they can be merged Higher value = more plumes merged Recommended value 30 deg	[deg]	`plume_const%` `maximumPlumeMergingAngle`	N
13	REAL	(0 1]	0.7-1	Maximum fraction of a plume P trajectory length used to determine if a plume Q overlaps enough to be merged Higher value = more plumes merged Recommended value 0.7	[deg]	`plume_const%` `maximumPlumeTrajectoryLenghtFraction`	N

14	INT	[0 1]	[0 1]	Method to compute the plume-to-grid updrafts 0 = new method, needed if smoke is simulated afterwards. Takes longer 1 = old method Recommended value 1	[-]	flag%which_ww_calc	Y
15	INT	[1 100]	[2-10]	How many points to sample along the QU cells edges for the new method (line above) Recommended value 10	[-]	plume_const% maxPointsAlongCellEdgeOverlap	Y
16	INT	[0 1]	[0 1]	Scheme to compute the plume-to-grid updrafts when more than one plume intersects with a QU cell 0 = use the cube method 1 = use the max value Recommended value 1	[-]	flag%which_wsum	Y

3.8 QUIC_Fire.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	INT	[0 1]	0, 1	0 = only QUIC-URB simulation, no other input required 1 = fire is simulated	[-]	flag%isfire	Y
2	INT	[-1 +Inf)	Any	-1 = use time and date to define the random number seed >0 = use specified value to initialize random number generator Recommended value any integer > 0	[-]	randnum%optionFlag	Y

3	STRING	-	-	Section title (FIRE TIMES)	[-]	-	
4	INT	≥ 0	Any	When the fire is ignited in Unix Epoch time, i.e., integer seconds since 1/1/1970 00:00:00 (fire must start at or after the first wind, see QU_simparams.inp)	[s]	`fire_ignition%unix_time`	N
5	INT	> 0	(0 10800]	Total simulation time for the fire model Higher value = longer simulation	[s]	`fcatime%len_simulation`	Y
6	INT	> 0	1-10	Time step for the simulation for the fire model Higher value = less accurate simulation Recommended value 1 s	[s]	`fcatime%dt_int`	N
7	INT	≥ 1	1-5	Number of fire time steps done before updating the wind field Higher value = less accurate simulation (less coupling between winds and fire) Recommended value 1 to 5	[-]	`qutime%` `firesteps_to_update`	Y
8	INT	≥ 1 or -1	1-100 and -1	Number of updates of the fire before printing the output files for the fire model (all but emissions and thermal radiation) Higher value = less output Recommended value 4 or higher Use -1 to provide custom times	[-]	`flag%num_fireca_updates`	Y
9	INT	≥ 1 or -1	1-100 and -1	Number of updates of the wind field before printing the output files for the instantaneous QUIC-URB winds Higher value = less output Recommended value 2 or higher Use -1 to provide custom times	[-]	`flag%num_qu_updates`	Y
10	INT	≥ 1 or -1	1-100 and -1	Number of updates of the fire before printing the output files for the emissions and thermal radiation	[-]	`flag%` `num_emission_and_rad_updates`	Y

				Higher value = less output Use -1 to provide custom times			
11	INT	≥ 1 or -1	1-100 and -1	Number of updates of the wind field before printing the output files for the average QUIC-URB winds (needed for smoke calculations) Higher value = less output Use -1 to provide custom times	[-]	`flag%` `num_qu_updates_avewinds`	Y
12	String	-	-	Section title (FIRE GRID)	[-]	-	N
13	INT	≥ 1	1-100	Number of cells in the vertical direction for the fire model	[-]	`firegrid%nz`	N
14	INT	[0 1]	0	Vertical spacing model: 0 = constant dz, only one value must follow 1 = custom dz, one dz per line must be specified, from the ground to the top of the domain Recommended value = 0	[-]	`stretchflag`	N
15	REAL	> 0	1-10	Fire model cell size in the vertical direction If `stretchflag == 0:` only one entry If `stretchflag == 1:` as many entries as the number of cells in the vertical direction (one entry per line) Higher value = less accurate fire and fuel description Recommended value = 1 m	[m]	`firegrid%dz_array`	Y
16	STRING	-	-	Section title (FILE PATH)	[-]	-	N
17	STRING	-	Any	Files it refers to: treesrhof.dat, treesmoist.dat; treesfueldepth.dat; ignite.dat; rasterorigin.txt; gridlist	[-]	`ft%file_path`	Y

				Empty quotes "": Firetec files are in the same folders of all other inputs Path within quotes, with folder separator at the end: Firetec files are in the specified folder			
18	INT	[1-2]	1-2	Format of the trees* files: 1 = all fuel types are in one file 2 = files are broken down by fuel type and named with "_#" to reduce peak RAM use	[-]	ft%fuel_file_type	Y
19	INT	[1-2]	1-2	Format of the trees* files: 1 = binary files have stream format (ARA format) 2 = binary files have Fortran headers Recommended value 1	[-]	ft%fuel_file_format	Y
20	STRING	-	-	Section title (FUEL)	[-]	-	N
21	INT	[1 4]	1-4	Fuel density flag: 1 = density is uniform over the domain and provided with the next line input 2 = density is provided through QF_FuelDensity.inp 3 = density is provided through Firetec file (treesrhof.dat) matching QUIC-Fire grid 4 = density is provided through Firetec files for an arbitrary grid. The files gridlist and rasterorigin.txt must also be provided	[-]	fuels%density_flag	Y
22	REAL	> 0	0.2-3	Fuel density Line not present if fuels%density_flag is ≠ 1	[kg/m^3]	fuels%input_density	Y
23	INT	[1 4]	1-4	Fuel moisture flag: 1 = moisture is uniform over the domain and provided with the next line input 2 = moisture is provided through QF_FuelMoisture.inp 3 = moisture is provided through Firetec files for QUIC-Fire grid	[-]	fuels%moisture_flag	Y

				4 = moisture is provided through Firetec files for an arbitrary grid. The files gridlist and rasterorigin.txt must also be provided			
24	REAL	[0 1]	0-1	Fuel moisture = mass of water/mass of dry fuel Line not present if fuels%moisture_flag is ≠ 1	[-]	fuels% input_moisture	Y
25	INT	[0 1]	1-4	Fuel height flag: 1 = fuel height is uniform over the domain and provided with the next input 2 = fuel height is provided through QF_FuelHeight.inp 3 = fuel height is provided through Firetec files for QUIC-Fire grid 4 = fuel height is provided through Firetec files for an arbitrary grid. The files gridlist and rasterorigin.txt must also be provided Line not present if fuels%density_flag is ≠ 1	[-]	fuels%height_flag	Y
26	REAL	> 0	0.7-30	Fuel height Line not present if fuels%height_flag is ≠ 1 Line not present if fuels%density_flag is ≠ 1	[m]	fuels%input_height	Y
27	STRING	-	-	Section title (IGNITION LOCATIONS)	[-]	-	Y
28	INT	[1 6]	1-6	Ignition source shape flag: 1 = rectangle 2 = square ring 3 = circular ring 4 = initial ignition locations provided through file QF_Ignitions.inp 5 = time- and space-dependent ignition locations provided through file QF_IgnitionPattern.inp 6 = ignite.dat (Firetec file) Recommended value 6	[-]	fire_ignition%flag	Y

If ignition flag = 1 (line fire):

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
29	REAL	[0 Lx]	Any	South-west corner in the x-direction	[m]	`fire_ignition%xo`	Y
30	REAL	[0 Ly]	Any	South-west corner in the y-direction	[m]	`fire_ignition%yo`	Y
31	REAL	> 0	Any	Length in the x-direction	[m]	`fire_ignition%xlen`	Y
32	REAL	> 0	Any	Length in the y-direction	[m]	`fire_ignition%ylen`	Y
33	INT	> 0	10-10,000	Number of ignition per cell of the fire model Recommended value = 100 – seems to have no effect	[-]	`fire_ignition% num_ign_percell`	Y

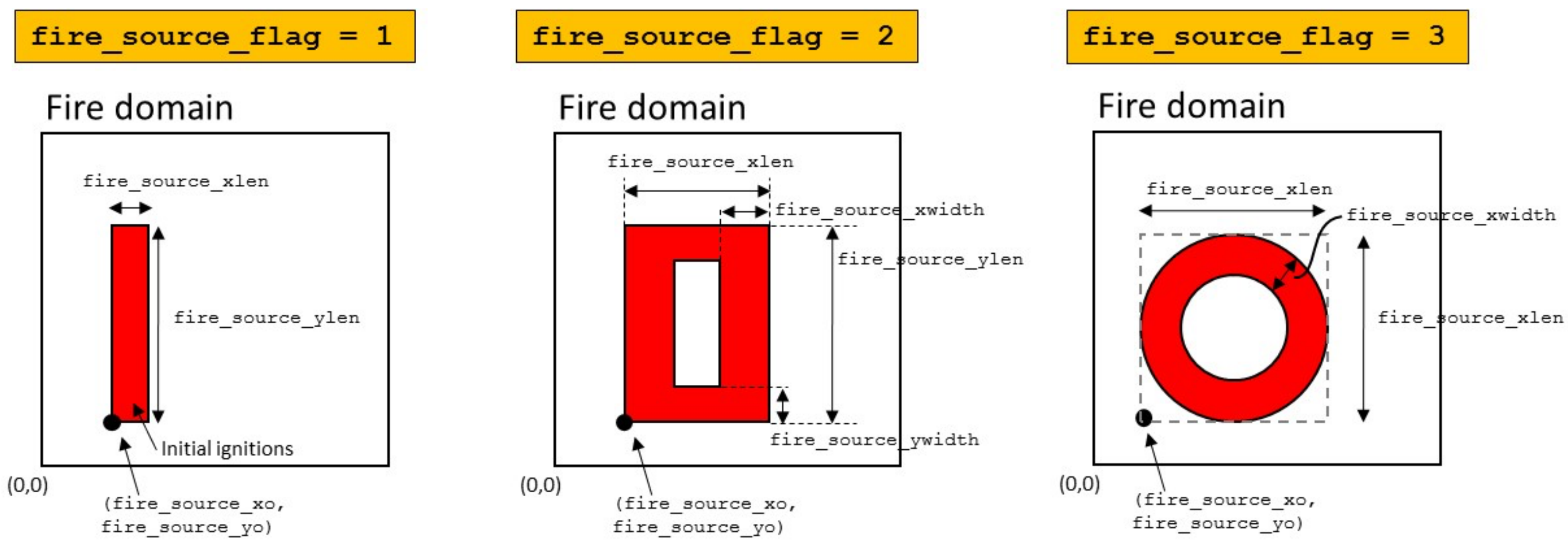
If ignition flag = 2 (square ring):

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
29	REAL	[0 Lx]	Any	South-west corner in the x-direction	[m]	`fire_ignition%xo`	Y
30	REAL	[0 Ly]	Any	South-west corner in the y-direction	[m]	`fire_ignition%yo`	Y
31	REAL	> 0	Any	Length in the x-direction	[m]	`fire_ignition%xlen`	Y
32	REAL	> 0	Any	Length in the y-direction	[m]	`fire_ignition%ylen`	Y
33	REAL	> 0	Any	Width of the ring in the x-direction	[m]	`fire_ignition%xwidth`	Y
34	REAL	> 0	Any	Width of the ring in the y-direction	[m]	`fire_ignition%ywidth`	Y
35	INT	> 0	10-10,000	Number of ignition per cell of the fire model Recommended value = 100 – seems to have no effect	[-]	`fire_ignition% num_ign_percell`	Y

If ignition flag = 3 (circular ring):

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
29	REAL	[0 Lx]	Any	South-west corner in the x-direction	[m]	`fire_ignition%xo`	Y

30	REAL	[0 Ly]	Any	South-west corner in the y-direction	[m]	`fire_ignition%yo`	Y
31	REAL	> 0	Any	Length in the x-direction of the ring	[m]	`fire_ignition%xlen`	Y
32	REAL	> 0	Any	Length in the y-direction of the ring	[m]	`fire_ignition%ylen`	Y
33	REAL	> 0	Any	Width of the ring	[m]	`fire_ignition%xwidth`	Y
34	INT	> 0	10-10,000	Number of ignition per cell of the fire model Recommended value = 100 – seems to have no effect	[-]	`fire_ignition% num_ign_percell`	Y



Calling X the last line.

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified

X+1	STRING	-	-	Section title (FIREBRANDS)	[-]	–	N
X+2	INT	[0 1]	[0 1]	Flag: 0 = firebrands are off 1 = firebrands are on Recommended value = 0 – firebrands are untested for small scale problems	[-]	fb%flag	N
X+3	STRING	-	-	Section title	[-]	–	N
X+4	INT	[0 1]	0, 1	Flag to output (1) or not (0) the gridded energy-to-atmosphere. File name: fire-energy_to_atmos-XXXXX.bin	[-]	flag%output_en2atm_file	Y
X+5	INT	[0 1]	0, 1	Flag to output (1) or not (0) the gridded reaction rate. File name: fire-reaction_rate-XXXXX.bin	[-]	flag%output_reactrate_file	Y
X+6	INT	[0 1]	0, 1	Flag to output (1) or not (0) the gridded fuel density. File name: fuels-dens-XXXXX.bin NOTE: if flag%output_emissions_file is set to 4, this flag is set to 1 independently from the user choice	[-]	flag%output_fuelmass_file	Y
X+7	INT	[0 1]	0, 1	Flag to output (1) or not (0) the gridded wind components (u,v,w) for the fire grid File names: winduXXXXX.bin = x-component windvXXXXX.bin = y-component windwXXXXX.bin = z-component	[-]	flag%output_qfwinds_file	Y
X+8	INT	[0 1]	0, 1	Flag to output (1) or not (0) the gridded wind components (u,v,w) for the QUIC-URB grid File names: qu_winduXXXXX.bin = x-component qu_windvXXXXX.bin = y-component qu_windwXXXXX.bin = z-component	[-]	flag%output_quwinds_inst_file	Y

				qu_wplumeXXXXX.bin = w field from buoyant plumes, before mass consistency			
X+9	INT	[0 1]	0, 1	Flag to output (1) or not (0) the gridded average wind components (u,v,w) for the QUIC-URB grid File names: qu_windu_aveXXXXX.bin = x-component qu_windv_aveXXXXX.bin = y-component qu_windw_aveXXXXX.bin = z-component Recommended value = 0 Set to 1 only if QUIC-Smoke is run for PM2.5 and CO plume transport and dispersion simulations	[-]	`flag%output_quwinds_ave_file`	Y
X+10	INT	[0 2]	0, 2	Flag to output the plume trajectories: 0 = do not output 1 = use csv format 2 = use binary format File names: plume_trajectory.bin or csv plume_mergetrajectory.bin or csv Recommended value = 0 Files will be huge, used for debugging only	[-]	`flag%output_plume_traj_file`	Y
X+11	INT	[0 1]	0, 1	Flag to output (1) or not (0) the fuel moisture File name: fuels-moist-XXXXX.bin	[-]	`flag%output_moisture_file`	Y
X+12	INT	[0 1]	0, 1	Flag to output (1) or not (0) the vertically-integrate % of mass burnt File name: mburnt_integ-XXXXX.bin	[-]	`flag%output_int_massburnt_file`	Y
X+13	INT	[0 1]	0, 1	Flag to output (1) or not (0) the firebrands trajectories. File name: firebrabrands_traj.bin	[-]	`flag%output_firebrands_traj_file`	Y

				Recommended value = 0			
X+14	INT	[0 4]	[0 4]	Flag for emissions: 0 = do not output any emission related variables 1 = output emissions files and simulate CO in QUIC-SMOKE 2 = output emissions files and simulate PM2.5 in QUIC- SMOKE 3 = output emissions files and simulate both CO and PM2.5 in QUIC-SMOKE 4 = output emissions files but use library approach in QUIC-SMOKE 5 = output emissions files and simulate both water in QUIC-SMOKE File names: pm_emissions-XXXXX.bin emissions_distribution-XXXXX.bin co_emissions-XXXXX.bin water_emissions-XXXXX.bin Note: to run smoke transport and dispersion, the flag%quwinds_ave_file must be set to 1 too.	[-]	`flag%output_emissions_file`	Y
X+15	INT	[0 1]	[0 1]	Flag to output (1) or not (0) the thermal radiation File names: thermalradiation-XXXXX.bin thermaldose-XXXXX.bin Recommended value = 0	[-]	`flag%output_thermalrad_file`	Y
X+16	STRING	-	-	Section title	[-]	-	N
X+17	INT	[0 1]	0, 1	Flag to kill (1) or not (0) the simulation if the ire goes out and there are no more ignitions	[-]	`flag%auto_kill_fire_sim`	Y

				or firebrands or plumes. The fuel and winds will be dumped at this last time step.			

3.9 Runtime_Advanced_User_Input.inp

Line #	Data type	Values accepted	Tested values range	Description	Units	Variable name in Fortran	Can be modified
1	INT	> 0	[1 8]	Maximum number of CPU to use Do not exceed 8. Use 1 for ensemble simulations.	[-]	`ompspec% usrMaxNumThreads`	Y

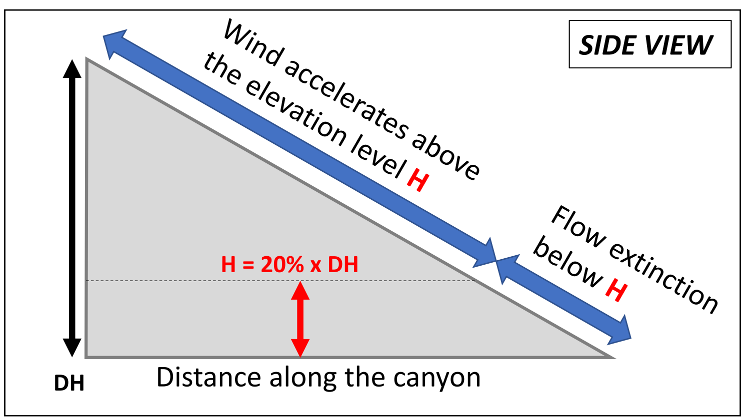
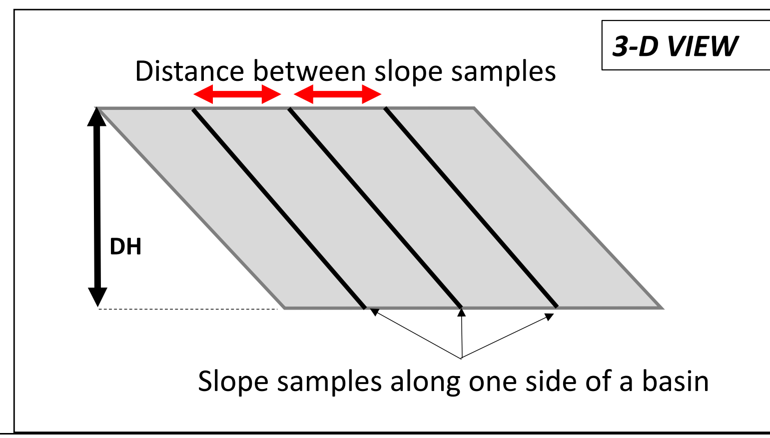
3.10 QU_slopeflow.inp

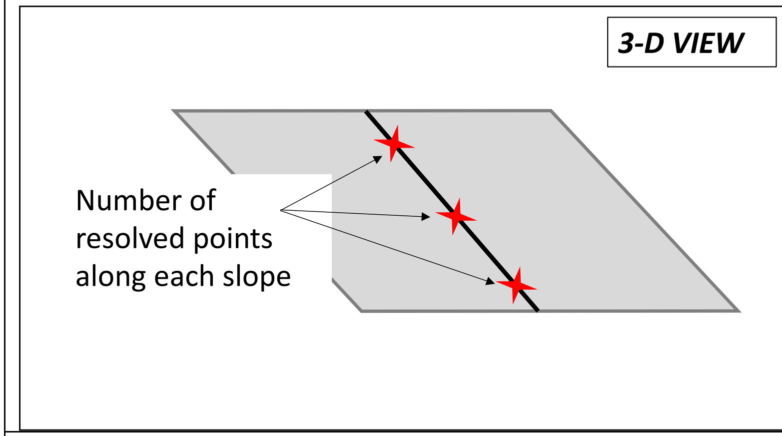
Line	Type	Value accepted	Tested range	Description	Units	Variable name in C++	Can be modified
1	FLOAT	[0 1]	0-1	Canyon flow extinction in % of change in terrain elevation. Determines the location from which the canyon flow decelerates (downslope case) or accelerates (upslope case). If set to 0, the canyon flow propagates from the basin outlet to its channel head (or vice-versa). If set to 1, the canyon flow never develops. Recommended value 0.2	[%]	`Coeffs[0]; FlowExtinction`	N
2	FLOAT	≥0.0001	1-10000	Distance between each slope sample. If it is small, the code will be longer to compute but the slope wind will be more accurate.	[m]	`Coeffs[1]; DistBtwSlopes`	N

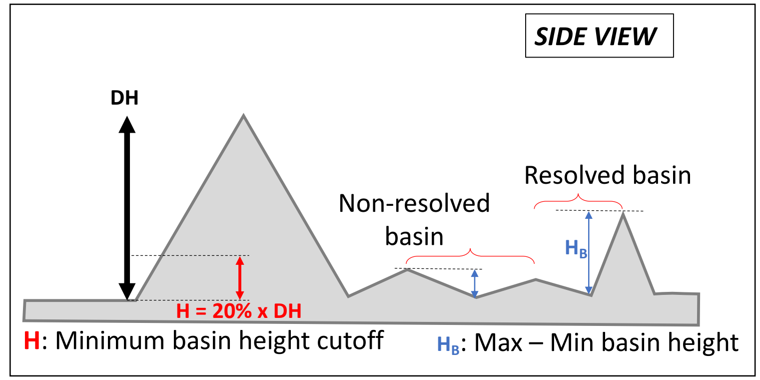
				If it is large, the program will assign at least 3 slope samples per basin (when possible). Recommended value 10 DX			
3	FLOAT	> 2	3-10000	Number of points along each slope sample. The more points, the higher the resolution of the slope wind, but it will also impact the speed of execution. If it is large, the program will assign at least 3 points per slope. Recommended value 5	Cells	`Coeffs[2]; PtsOnSlopes`	N
4	FLOAT	[0.0001 0.999]	0.01-0.99	Cut-off for shallow basin, in % of the maximal difference in terrain elevation over the domain. It is used to remove basins away from the main obstacle, where the slope wind would be weak in any case. Recommended value 20%	[%]	`Coeffs[3]; CFlatBasin`	N
5	FLOAT	[0.01 0.5]	0.01-0.5	Canyon flow width, in % of the canyon flow depth. Smaller canyon flow areas will improve the speed of execution. This parameter can be used to distinguish domains with narrow canyons from domains with wider valleys. Recommended value 10%	[%]	`Coeffs[4]; CanyonWidth`	N

6	FLOAT	> 1	10 - 2xdomain size	Minimum drainage area of a given basin. Smaller values will only detect small basins and might lead to errors in detecting larger streams. Recommended value is the minimum between both horizontal dimensions NX and NY and stay with a factor of 2 (e.g., NX/2 to 2 NX)	Cells	`Coeffs[5]; CMinArea`	N
7	FLOAT	Not 0	[-100 +100]	Ground minus air temperature difference. Positive difference means downslope flow. It is the temperature of the layer just a few inches above the ground level. Recommended value +/- 5.	[K]	`Coeffs[6];  DT`	Y
8	FLOAT	≥ 200	270-350	Ambient temperature (a few meters above the ground). Recommended value N/A	[K]	`Coeffs[7]; To`	Y
9	FLOAT	[0 Domain size]	0 - Domain size	Cut-off radius for the interpolation of slope samples within each basin. A larger radius will make the slope flow faster but decrease its resolution. Recommended value 0, i.e., the slope wind is interpolated at the highest resolution point.	Cells	`Coeffs[8]; R_interp`	N
10	INTEGER	[0 1]		Option to display warnings and information messages.	[-]	`Options[0]; Comment`	N

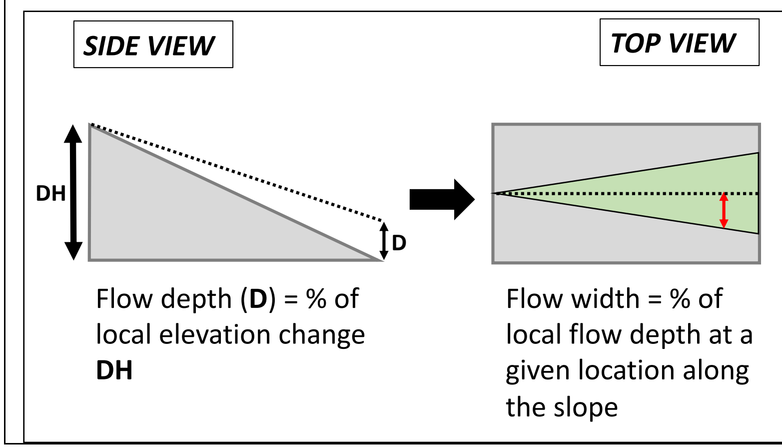
				Recommended value 0			
11	INTEGER	[0 1]		Option to save to file basins, streams, canyon zones and slope samples. Recommended value 0	[-]	`Options[1]; OptIntp`	N
12	INTEGER	[0 1]		Option to save to file 2-D canyon wind and flow depth, slope wind and flow depth. Recommended value 0	[-]	`Options[2]`	N
13	INTEGER	[0 2]		Option to run the code for: 0 = small basins only 1 = large basins only 2 = both basin sizes Recommended value 2	[-]	`Options[3]; OptPas`	N

`FlowExtinction`	`DistBtwSlopes`
	
`PtsOnSlopes`	`CFlatBasin`





`CanyonWidth`



`R_interp`