Micrometeorological methods to determine methane emissions – exercise/demonstration of bLS using WindTrax

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Given data / needed numbers:

- Google image of the feedlot (feedlotimage.jpg)

- files feedyard.txt, lagoon.txt, TX05_datafragment.txt

- image needs to be rotated about 1.2 degrees to align with GPS-measured coordinates of the cattle pens (feedyard.txt)

- distance from upper left corner of pens to upper right corner of pens is 801 m

- surface elevation of feedlot 1073 m

- laser in feedlot spans (x,y) = (299, -629) to (509,-636) measured in [m] relative to the upper left corner of the feedlot pens. Path height is 1 m

- laser outside feedlot (measuring “background”) spans path (x,y) = (-58, -1737) to (164,-1748), path height 1 m

- Save Often – no “Undo” button!

Banff2010_handout.ppt
Vers. 1 Oct., 2010

OBJECTIVE	ACTION
Import photo of site:	Draw → Miscellaneous → Bitmap Image
Rotate site photo (if needbe):	Right click on the image → Imported image properties → Grid angle (1.2)
Set the WindTrax origin at some convenient point	Edit → select grid icon → Move origin to a convenient grid vertex
Adjust position of photo so that (any) convenient point of reference (e.g. NW corner of pens) lies at the selected WindTrax origin	
Calibrate the ruler (and the Grid Scale) by using a known distance on the photo	Edit → Select ruler → move crosshair over one end of the known distance → hold down left mouse button and move to other end of known distance → release mouse button → enter the known length into the textbox and hit RETURN. (If you want to check: Project → Map → Grid brings up a text box reporting the scale; you may then check it matches what you want)

OBJECTIVE	ACTION
Import a source as a closed polygon defined in a text file containing positions [m] relative to origin… 0,0 in first line will position that vertex over WindTrax origin **or**	Draw → Miscellaneous → Import polygon → *select file feedyard.txt* → select colour representing this source and Output mode (unknown)
Simply draw the source	Select a colour for this source, then: Draw → Shapes → *your choice of freehand or geometric object* *(Optionally also import lagoon.txt, assign a different colour, define as KNOWN with strength zero)*
Having taken the above steps, lock positions to avoid accidentally shifting anything	Edit → Lock positions

OBJECTIVE	ACTION
Enter details of the landscape *(not all properties need be set as static constants – some are read from the input file)*	Right click with mouse anywhere outside the imported image, and left click “Surface Properties.” Enter the surface elevation (1073 m), used to estimate pressure when converting mixing ratios to concentrations
Place laser gas detectors on map and define their properties	Sensors → select Line concentration sensor → place crosshair on map and hold down left mouse button to draw light path (position and length approximate – corrected in next step). Place selection tool (white arrow) over the sensor, right click → Line concentration sensor → Properties: enter known coordinates of ends of the light path → Species: select CH4 → Measurement: select “Output mode” (measured); select units of measurement (ppmv x m) *(repeat for second laser)*
In this configuration, i.e. one laser upwind of all sources, we can compute background concentration	Project → BG Concentration → Data → *unknown*

OBJECTIVE	ACTION
Connect WindTrax to file containing measured input data (wind speed, direction, stability, concentration data,…)	Data → select leftmost icon (“Data source (input file)” → place icon at any convenient point on map, and right click it. Browse to select filename TX05_datafragment.txt
“Data connections” link the appropriate file column to the various inputs WindTrax needs…	*“View File” opens a window allowing you to view the column-organized data with its column headers (identifiers) – you may leave this open or reopen at any time*
e.g. line concentration from sensor 1 is in column 7 in ppmv x m	Data connections. Expand “Line Concentration Sensor 1” in right hand panel. Place mouse over “CH4 concentration (ppmv m)” and with left button down drag over to row 7 of the left hand panel, which will self-identify as “C1(ppmm),” release mouse button Similarly, data for Line Concentration Sensor 2 are in file column 6 All other data pertaining to these detectors have been entered earlier *To undo and reset a data connection, click the double right arrow between the two panels*

OBJECTIVE	ACTION
“Data connections” (continuing) … e.g. atmospheric conditions need to be linked to the “Surface Layer Model”	Data connections. Expand “Surface Layer Model” in right hand panel. Place mouse over “U* m/s” and with left button down drag over to row 3 of the left hand panel, which will self-identify as “u* (m/s),” release mouse button Similarly, connect “Direction angle (degrees)” to column 1 Connect “Stability (MO length, m)” to column 5 self-identifying as L
… and the nature of the “Map surface” needs to be linked to the measured effective roughness length	Expand “Map surface” and Connect “Surface roughness Zo (m)” to column 17 self-identifying as z0

OBJECTIVE	ACTION
Connect WindTrax to an OUTPUT file	Data → select icon second from left (“Data logger (output file)” → place icon at any convenient point on map, and right click it. Browse to select filename.
Set up the outputs you want (may include any or all of the inputs) in any order you want…	Connections. Expand “Input data file 1” in right hand panel. Place mouse over “Column 1” (which is time) and with left button down drag over to the left hand panel. *The single right arrow will undo any output connection you done want* Connections. Expand “Aqua area source” (or whatever colour you used) in right hand panel. Place mouse over “Tracer area-integrated emssion rate” and with left button down drag over to the left hand panel • • • *Repeat for all outputs you want*

OBJECTIVE	ACTION
Prepare to compute an ensemble of backward trajectories	*How many paths?* Project → Backward LS Model → Number of particles → 5000 *How far upwind to compute paths?* Project → Backward LS Model → Horizontal tracking distance mode → minimum required
Optionally, place a “camera” on the surface to record the gas plume for each interval (a handy diagnostic)	Data → drag camera icon onto map → right click and set specifications (e.g. where to store these images)
Ready to perform simulation and get Q?	Check status of WindTrax – the Questionmark button
Perform bLS simulation	Large green “play” arrow