Using Surface Weather Observations to Reduce Atmospheric Transport Errors in Regional Inversions

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Over the next five years, Earth Networks will be deploying 100 GreenHouse Gas (GHG) measuring instruments, consisting of 50 in the United States, 25 throughout Europe and another 25 in other worldwide locations. Measurements provided by this network will represent regional to local scale atmospheric signals of carbon dioxide (CO_2) and methane (CH_4) gases and will be used for inverse modeling to estimate natural and anthropogenic sources and sinks of GHGs. Inversion approach utilizes backward trajectories and carbon footprint calculations based on meteorological fields provided by the Weather Research and Forecasting model. Errors in atmospheric transport are commonly considered as the largest source of error in inversions and of uncertainties in estimated surface fluxes of carbon. Assimilation of weather observations from the largest surface network with more than 8,000 sites within the U.S., operated by Earth Networks, improves accuracy of the transport model. GHG sensors, used in this study, are located in California and in Maryland, where Earth Networks has more than 610 and 570 surface weather sites, respectively. Root mean square error of resulting near-surface wind fields is reduced comparing to the errors before assimilation. Differences between the original footprints and footprints based on resulting analysis fields show the impact due to assimilation of surface observations. More accurate wind patterns resulted in more accurately calculated footprints and, therefore, reduced the inversion uncertainties in CO_2 and CH_4 emission estimates.

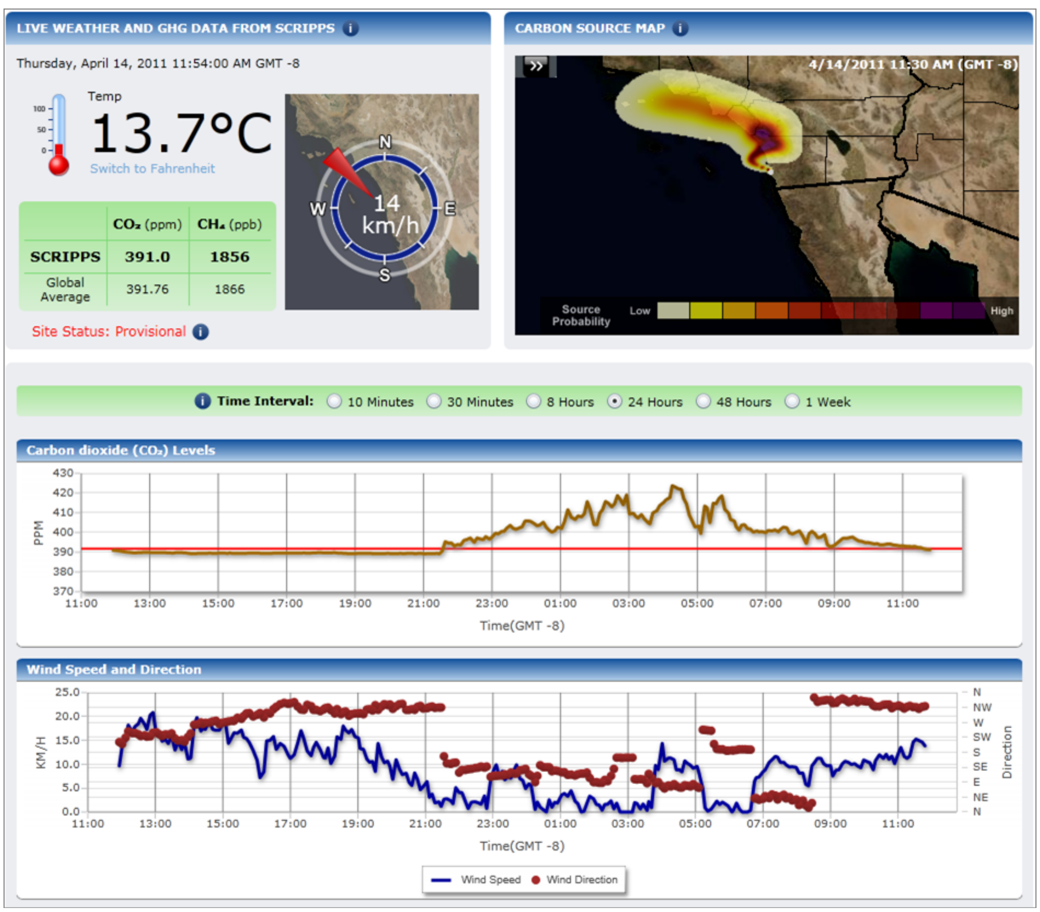

Figure 1. Example from the Earth Networks GHG portal showing live GHG observations and weather at a sensor site in California.