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Evaluation of turbulent mixing methods in HYSPLIT using measurements from Sagebrush Tracer Experiment

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The Sagebrush experiment, led by NOAA's Field Research Division of the Air Resources Laboratory, consisted of five releases of chemically inert trace gases on five different days in October 2013. All releases occurred in the afternoon under either near neutral stability conditions with higher wind speeds or unstable conditions with low wind speeds. The sampling network for the tracer concentrations covered distances from 200 to 3,200 m from the release location and samples were obtained in 10-minute averages. HYSPLIT, NOAA's transport and dispersion model, was used to simulate the spatial and temporal distribution of the tracer. The dispersion simulation was driven by WRF meteorological data with a 333-m grid spacing and using the YSU and MYJ PBL schemes. The dispersion results were compared against the tracer measurements obtained during the experiment. HYSPLIT uses turbulent velocity variances to simulate the dispersion of the tracer, represented by lagrangian particles. There are different methodologies to estimate these turbulent velocity variances in the model; namely, a) based on other meteorological variables such as friction velocity, stability parameters, and mixing height, b) the total turbulent kinetic energy, when available, or c) the eddy diffusivity from the WRF meteorology. In addition to temperature and wind observations, fiction velocity, flux parameters, and velocity variances were measured during the Sagebrush Tracer Experiment at a site about 800 m northeast of the tracer release location. We present a comparison of these parameters, which are relevant to dispersion modeling, against measurements to understand the mixing characteristics generated by the different methods available in HYSPLIT.