Geophysical Research Abstracts
Vol. 16, EGU2014-12406-1, 2014
EGU General Assembly 2014

Weather and Dispersion Modeling of the Fukushima Daiichi Nuclear Power Station Accident

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The surface deposition of radioactive material from the accident at the Fukushima Daiichi nuclear power station was investigated for 11 March to 17 March 2011. A coupled weather and dispersion modeling system was developed and simulations of the accident performed using two independent source terms that differed in emission rate and height and in the total amount of radioactive material released. Observations in Japan during the first week of the accident revealed a natural grouping between periods of dry (12-14 March) and wet (15-17 March) weather. The distinct weather regimes served as convenient validation periods for the model predictions. Results show significant differences in the distribution of cumulative surface deposition of ^{137}Cs due to wet and dry removal processes. A comparison of ^{137}Cs deposition predicted by the model with aircraft observations of surface-deposited gamma radiation showed reasonable agreement in surface contamination patterns during the dry phase of the accident for both source terms. It is suggested that this agreement is because of the weather model's ability to simulate the extent and timing of onshore flow associated with a sea breeze circulation that developed around the time of the first reactor explosion. During the wet phase of the accident the pattern is not as well predicted. It is suggested that this discrepancy is because of differences between model predicted and observed precipitation distributions.