# Application of USEPA's Watershed Deposition Tool to Estimate Atmospheric Deposition of Nitrogen to the Indian River Basin, Florida

Noreen D. Poor[1], Donna B. Schwede[2], Virginia H. Barker[3], and Bach V. McClure[3]

The Indian River Lagoon (IRL) is a long, narrow, and shallow estuary that extends for 156 miles along the central east coast of Florida and is classified by the USEPA as an Estuary of National Significance for its biological diversity and habitat for endangered species. The north and central sections of the IRL are under the jurisdiction of the St. John's River Water Management District (SJRWMD) and fall within the Group 5 Basins for Total Maximum Daily Load (TMDL) development by the Florida Department of Environmental Protection (FDEP). The Group 5 TMDLs for the IRL include the Banana River Lagoon (BRL) and North and Central IRL. Segments of BRL and IRL are classified by the FDEP as impaired due to loss of seagrass, which is attributed to elevated nutrient loads. We applied USEPA's Watershed Deposition Tool with the Community Multi-Scale Air Quality (CMAQ) Model v4.7 output of reactive nitrogen (N) deposition for 2002 to 2008 to estimate the contribution of atmospherically-deposited nitrogen to total nitrogen loading within the portion of the IRL under the jurisdiction of the SJWMD. For this portion, the CMAQ-simulated 7-yr average deposition rate was 6.68 (± 0.10) kg N $ha^{-1}$. Dry and wet deposition contributed approximately 60% and 40%, respectively; and oxidized N and reduced N contributed 80% and 20%, respectively, of the average deposition rate. FDEP's TMDL Report: Nutrient and Dissolved Oxygen TMDLs for the Indian River Lagoon and Banana River Lagoon, March 2009, estimates that of the annual loading to impaired segments of Group 5 Basins 281 metric tons N $yr^{-1}$are from direct atmospheric deposition, 22.1 metric tons N $yr^{-1}$ from point sources, and 1,207 metric tons N $yr^{-1}$ from non-point sources discharged from the watershed in surface water or in stormwater runoff. For these same segments CMAQ-modeling yielded a direct atmospheric loading to lagoon waters of 426 metric tons N $yr^{-1}$ and atmospheric loading to the drainage basin was 1,300 metric tons N $yr^{-1}$. We compared CMAQ-modeled loading rates with those estimated from NADP's wet deposition and CASTNET's dry deposition monitoring sites FL99 and IRL141, respectively, as both sites are within the IRL watershed. CMAQ-modeled atmospheric deposition rates were in reasonable agreement with NADP observations of wet deposition rates of oxidized N and in fair agreement with NADP observations of reduced N, but were significantly higher than CASTNET-modeled dry deposition rates for nitric acid, nitrate, and ammonium.

[1]Kivmetrics, LLC, 1282 York Circle, Melbourne, FL 32904; noreen.poor@att.net; (813) 956-0855
[2]US Environmental Protection Agency, National Exposure Research Laboratory, Atmospheric Modeling and Analysis Division, Research Triangle Park, NC 27711; schwede.donna@epa.gov; (919) 541-3255
[3]Brevard County Natural Resources Management Office, 2725 Judge Fran Jamieson Way, Viera, FL 32940; virginia.barker@brevardcounty.us, bach.mcclure@brevardcounty.us; (321) 633-2014