The Enqvist Research Group at the University of Florida has been granted access to Comprehensive Nuclear Test Ban Treaty Organization International Monitoring Station (CTBTO IMS) data, including radionuclide data. These data are used by international organization to verify compliance, or a lack thereof, with the CTBTO, but is also used to track the nuclear tests of non-signatory or ratifying nations. CTBTO IMS radionuclide stations have a capability to measure presence of radioactive noble gas (RNG) isotopes. Of greatest importance is isotopes of xenon which are not naturally occurring and thus a “smoking gun” indicator of nuclear weapons detonations. This is because, while the CTBTO IMS network contains a variety of different sensors (seismic, hydroacoustic, etc.), all but radio-noble-gas sensors are susceptible to detecting natural geological activities not related to UGTs (i.e., earthquakes). However, radionuclides are produced by peaceful nuclear activities which must be accounted for just as natural activities.

Institutions such as US DOE National Laboratories do possess high-performance-computing atmospheric transport models, but they currently perform poorly beyond hemisphere-scale simulations. A method of improving these models to be undertaken by the UF Enqvist Group TA3 researchers is application of machine learning with the goal of developing bi-directional time-dependent models. I.e., models capable of taking theoretical nuclear source terms and modeling expected IMS station data, and then the capability, based on these forward-running models, to develop a model which takes CTBTO IMS data as an input (including to machine learning models), and produces results in the form of a predicted source term (nuclear weapon which was detonated). The first step in pursuing these long-term goals will be analysis of RNG data from a two-year period encompassing three DPRK UGTs.