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On the potential of public available gridded precipitation re-analysis and monitoring products to access the wet-deposition impact on PTS radionuclide monitoring capability

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Accessing global maps of the monthly detection capability of the radio-nuclide compartment of the International Monitoring System (IMS) of the Provisional Technical Secretariat (PTS) to the CTBTO PrepCom (http://www.ctbto.org, Wotawa et al., 2009) there is a striking similarity in the patterns of reduced monitoring capability and the monthly averaged global precipitation patterns. This is true; although wet deposition is not explicitly recognized in the atmospheric transport modeling methods applied by the PTS to daily calculate the so-called source-receptor sensitivity (SRS) fields, forming the basis for the network monitoring capability assessments.

There is an atmospheric physics reason for this: The capability is reduced in areas of systematically reduced surface level horizontal transport that is – due to the conservation of mass accompanied by regions of ascending air. The uplifting of air gives rise to condensation and formation of precipitation.

It is thus straightforward to use precipitation patterns derived from public available re-analysis data sets as proxies to describe areas of limited detection capabilities. Moreover, if available on a regular grid matching the aforementioned SRS fields, the precipitation data sets could even be utilized to recognize in a computational lightweight post-processing step the effect of wet deposition as far as the particulate radio-nuclides are concerned. This is of major importance any time, a reliable quantitative assessment of the source-receptor sensitivity is needed, e.g. for the analysis of isotopic ratios. Actually the wet deposition recognition is a prerequisite if ratios of particulate and noble gas measurements come into play. This is so far a quite unexplored field of investigation, but would alleviate the clearance of several apparently CTBT relevant detections as bogus, encountered in the past.

Key to the quality of any post-processing approach to describe the wet-deposition effect is the quality of the precipitation data set utilized. Despite their striking advantages with regard to data coverage and resolution, remote sensing based measurements of precipitation are still subdued to significant uncertainties, in particular across the land surface, i.e. the most likely area of investigation as far as evasive (underground) nuclear explosions are concerned.

As part of the Global Precipitation Climatology Project of the World Climate Research Program (WCRP) and in support of the Global Climate Observing System (GCOS) of the World Meteorological Organization (WMO), the Deutscher Wetterdienst (DWD) operates the Global Precipitation Climatology Centre at its Offenbach, Germany based headquarter (http://gpcc.dwd.de). The GPCC re-analysis and near-real time monitoring products are recognized as the most reliable global data set on rain-gauge based (in-situ) precipitation measurements.

One of the most interesting GPCC products (Schneider et al., 2010) is surely the so-called Monitoring Product that is realized roughly two months after the fact based on the data gathered while listening to the GTS to fetch the SYNOP and CLIMAT messages. This product is highly welcome to the satellite based remote sensing community to provide for a gridded data set of highly reliable in-situ precipitation measurements to supplement their products and to calibrate their in-direct precipitation measurements (Gruber and Levizzani, 2008, Chapter 2.2) yielding the Global Precipitation Climatology Project (GPCP) data set (Adler et al., 1995).

Both, the GPCC and the GPCP products bear the capability to serve as data base for the post-processing of the wet deposition impact on the radionuclide monitoring capability of the CTBT network on the regional and global scale, respectively. The presentation will present some example application to illustrate the potential of the GPCC and GPCP products in CTBT context.

References

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