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The development of GPS *TroWav* tool for atmospheric – terrestrial studies

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Abstract. We have developed an efficient tool to process dual-frequency Global Positioning System (GPS) signals and the surface meteorological data, called the Tropospheric Water Vapor (*TroWav*) program. *TroWav* is a stand-alone program to compute atmospheric precipitable water vapor (PWV). The source of the program is developed using Matlab™ and the graphical user interface for the system was developed using a Visual Basic. The algorithms of the program capable to compute satellite elevation angle, Zenith Tropospheric Delay (ZTD), Zenith Hydrostatic Delay (ZHD), Zenith Wet Delay (ZWD) and mapping function. The tool is very practical and useful for sustainable atmospheric management.

1. Introduction

Precipitable water vapor (PWV) is one of the paramount importance parameters for atmospheric studies that can improve numerical weather prediction (NWP), nowcasting and forecasting, and viable use to study the thunderstorms, flooding, natural climate variability (global warming, climate change and El Niño–Southern Oscillation), precipitation budget, teleconnections, terrestrial coupling, etc. Global Positioning System (GPS) has an established reputation as a reliable technique of positioning equipment and has a complete turnkey capability in all areas of process equipment and space supply from integrated design through to engineering, fabrication, commissioning and testing. In contrast to atmospheric science applications, improvement of the system should be carried out to solve the data complexity with good practices and useful to support sustainable development.

GPS Meteorology technique has been developed since 1990s to measure PWV with superior in temporal and spatial resolution [1],[2]. Suparta and Alhasa [3] has proposed to estimate the PWV using an adaptive neuro-fuzzy inference system (ANFIS) due to the GPS data are not always available for a full 24-hour. However, as for a comparison of PWV from ANFIS, PWV derived from GPS data is necessary. Therefore, a suitable tool at low-cost and with high accuracy, named as the Tropospheric water vapor (*TroWav*) has been initiated since 2003 and the study was first started from the polar region. The tool is to compute PWV using GPS signals and the surface meteorological data [4]. The result of the PWV has been validated with radiosonde data [5]. Since then, the program has been updated that suitable for ENSO studies over the Borneo region [6]. In this paper, we updated the