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Assessing Uncertainties in the Validation of TROPOMI SO_2 Using Balloonsondes at Costa Rica

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Ozone profiles obtained by the NASA Ticosonde project in Costa Rica have been displaying notches from SO_2 interference on a regular basis for over twelve years. These result from the passage of the ozonesonde through SO_2 plumes emitted from nearby Turrialba Volcano.

SO_2 induces notching in ozonesonde profiles because of interference by SO_2 of the electrochemical reaction between ozone and potassium iodide that is the basis of the ECC ozonesonde measurement. These notches can be used to estimate the vertical column of density (VCD) of SO_2. In the first year since TROPOMI First Light on November 8, 2017, 20 of 42 Ticosonde ozonesonde launches showed identifiable notches. Five of these notched profiles were obtained from dual ozonesondes and one of these was also obtained by means of a prototype SO_2 sonde. The dual sonde technique estimates SO_2 from the difference between ozone mixing ratios in an ozonesonde measuring ambient air and a second sonde equipped with an SO_2-scrubbing filter at intake. Notwithstanding the sensitivity of the several balloonsonde techniques employed by Ticosonde and the unprecedented resolution of TROPOMI, spatial and temporal collocation of the sondes in the TROPOMI field-of-view remains a critical factor in reducing uncertainty in the validation of the TROPOMI SO_2 product. We present results of an examination the degree to which spatial and temporal differences and other factors such a cloud cover have affected the validation of the VCD obtained from TROPOMI. For example, uncertainty is introduced by differences between the sonde launch time and the 1330 LT TROPOMI overpass. One simple mitigation approach that we examine is estimating the sonde location at overpass time and then comparing with the corresponding TROPOMI pixel.