WISE imagery was atmospheric corrected based on the Dark Spectrum Fitting (DSF) algorithm developed by Vanhellemont (2018). This algorithm assumes the path reflectance are spatial homogenous, it computes atmospheric path reflectance based on multiple dark targets in the scene or subscene, with no a priori defined dark band (Vanhellemont, 2018). For each band, correction of the gas absorption is performed firstly, then, the darkest radiance is estimated from the offset from a linear fit to the first 500,000 pixels sorted by the TOA radiance from minimum to the maximum. Figure 1 illustrates how DSF works, the blue line refers to the TOA radiance of all the pixels sorted from the minimum to the maximum, the dashed orange line refers to the fitting line, and the blue point refers to the estimated darkest radiance for the current band. Repeated use of this method to estimate the darkest radiance of all bands, so as to obtain the darkest reflectance spectrum. The first 40 minimum reflectance in the darkest spectrum is assumed to be the path reflectance. Match the path reflectance in the LUT of path reflectance, the path reflectance in the other bands as well as the transmittance are found. The path reflectance is subtracted from the TOA reflectance and the surface reflectance is finally obtained.

Chart

Description automatically generated

Figure 1. Illustration of estimation of darkest radiance based DSF. B1 represent the first band of WISE.

LUTs that support this AC method, including the LUTs of transmittance due to gas absorption and path reflectance, are generated using 6SV. Note that the reflectance due to the water surface reflected the diffuse sky light () are also include in the path reflectance. It is calculated using Eq.1 and 2.

Where, refers to the downwelling diffuse irradiance at the ground level, and refer to the extraterrestrial irradiance and solar zenith angle, *r* and *w* refers to the air-water interface reflection coefficient for radiance equal to the Fresnel reflection coefficient in the case of a flat sea surface, and wind speed.

(Vanhellemont & Ruddick, 2018)

Vanhellemont, Q., & Ruddick, K. (2018). Atmospheric correction of metre-scale optical satellite data for inland and coastal water applications. *Remote Sensing of Environment*, *216*(March), 586–597. https://doi.org/10.1016/j.rse.2018.07.015