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Assessing Uncertainties and Variability 34 Years of Surface Radiative Fluxes and Radiative Closure Using GEWEX SRB Release4-IP

Paul Stackhouse¹, Stephen Cox², J. Colleen Mikovitz², and Taiping Zhang²

¹NASA Langley Research Center, Hampton, VA, USA

²Science Systems and Applications, Inc., Hampton, VA USA

The NASA/GEWEX Surface Radiation Budget (SRB) project produces 3-hrly shortwave and longwave surface and top of atmosphere radiative fluxes for the 1983-near present time period. The new Release 4 Integrated Product (IP) uses the newly recalibrated and processed ISCCP HXS product as its primary input for cloud and radiance data, replacing ISCCP DX with a ninefold increase in pixel count (10 km instead of 30 km). This first version retains a 1°x1° resolution enabling intercomparison against previous versions and other data sets such as CERES, but spans 34 years from July 1983 through June 2017 and was announced by Kummerow et al. 2019 (GEWEX News). This new IP product also uses an atmospheric temperature and moisture dataset known as nnHIRS and other parameters such as near surface and skin temperatures from SeaFlux and LandFlux data sets. In addition to the input data improvements, several important algorithm improvements have been made since Release 3. These include recalculated SW atmospheric transmissivities and reflectivities, updated ocean and snow/ice albedos, and variable total solar irradiance consistent with SORCE measurements. The LW code has been updated to improve the optical property treatment for clouds and aerosols are included in this version. Radiative treatment of ice clouds is also improved in the LW. The variable aerosol optical properties for the SW and LW are specified using a detailed aerosol history from the Max Planck Institute Aerosol Climatology (MAC).

Here we present an assessment of the LW radiative fluxes and the uncertainty of those fluxes relative to the various inputs to surface SW/LW flux measurements from BSRN and PMEL buoys measurements. We review the validation of the SW and LW fluxes and then in terms of time series and then assess the products in terms of their long-term variability of the surface SW and LW net fluxes compared to multiple other data products including atmospheric reanalysis products. The comparisons of radiative estimates to observations are performed at various temporal scales and aimed at investigation of agreement at longer time averages but accessing potential change in diurnal magnitude and daily variability. Utilizing this uncertainty information, to access long-term variability of surface radiation components at selected region and global scales, considering satellite sampling/calibration "artifacts" as necessary. At the longer time scales, the net SW and net LW the TOA and surface have implications toward closure of the energy budgets at the surface, we assess these compared to other studies on energy budget closure for the same

selected global and regional scales.