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Mapping and comparing wildfire progressions using freely available, multi-source satellite data

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Extreme wildfire seasons are becoming the new normal in Canada, and satellite imagery is a useful way to map these fires as they grow across the vast, fire-prone regions of the country. However, single-date and single-sourced imagery of active fires often contain clouds, flares, smoke, and haze that can create challenges for monitoring burned areas over time. To address this gap, we applied rapid and scalable methods for synthesizing information on fire progressions using freely available satellite imagery, novel image fusion algorithms, and cloud-based data processing platforms. We identified images from Landsat-7, -8, Sentinel-2, and MODIS (MCD64A1 burned-area dataset) for the 2017 and 2018 British Columbia fire seasons that intersect the buffered extents of Canadian wildfires as determined by Canadian National Fire Database. We classified each raw image individually using a standard burned-area classification protocol related to each data source. We used the Bayesian Updating of Land Cover Classifications (BULC) algorithm to create coherent time series from the single-date classifications of optical data sources in Google Earth Engine. From the BULC classification stack, we calculated within-year, intra-annual fire progression metrics to compare satellite-derived fire behaviours between the 2017 and 2018 fire seasons, both at the whole fire season and the individual fire level. End-of-season burned-area estimates corresponded with estimates derived from the National Burned Area Composite (NBAC) product that is generated retrospectively from best-available fire mapping approaches. Additionally, we compared the BULC time series with fire progression estimates from MCD64A1 burned-area dataset to evaluate the influence of spatial resolution on burned-area estimates. Information outputs from this research enable cross-validation of fire behaviour models for different fire seasons and comparison of fire progression metrics between historic fires and fire seasons in Canada. The approach presented can be used to provide rapid and reliable information about active wildland fire progressions to better understand fire growth and associated drivers.