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| **Monthly mapping of forest disturbances using dense time series Sentinel-1 SAR imagery and deep learning** |
| **Introduction/Aim:**  Compared with disturbance maps produced at annual time steps, high-resolution monthly mapping of forest disturbance can provide more spatio-temporal details needed for studying the socio-economic drivers (e.g., differentiating salvage logging and slash-and-burn from other timber harvesting) of disturbance and characterizing the associated intra-annual carbon and hydrological dynamics. Frequent cloud cover limits the application of optical remote sensing in timely mapping of forest changes. The freely available Sentinel-1 synthetic aperture radar (SAR) sensor provides an unprecedented opportunity to achieve more frequent mapping of forest disturbance than ever before (i.e., at monthly interval). The unique landscape pattern of forest disturbance from Sentienl-1 data holds critical information for disturbance mapping but have not been fully explored.  **Methods:**  In this study, we propose a deep learning-based approach ultilizing the landscape pattern from Sentinel-1 data to produce 10m monthly maps of forest disturbance for the whole Brazil for five years.  **Results:**  The proposed approach is reliable for monthly forest disturbance mapping with Sentinel-1 data, and can be trained using samples collected during a particular time period over one location and be fine-tuned using sparse local samples from a new area to achieve optimal performance, and hence can greatly reduce training data collection effort when applied to new study sites.  **Conclusion:**  Our novel approach for mapping forest disturbances at monthly interval represents an important step towards precise monitoring of forest dynamics and assisting stakeholders in developing sustainable strategy of forest management, especially for regions with frequent cloud cover. |