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Oral
In late 2023, the U.S. laid out a strategy to develop a Greenhouse Gas Measurement, Monitoring, and Information System (GHGMMIS), the objective of which is to support decarbonization through enhanced and coordinated measurement and monitoring from both Federal and non-Federal capabilities. Within the GHGMMIS, the U.S. GHG Center (http://earth.gov/ghgcenter) has a critical coordination role to maximize the information available. In close coordination with academic and NASA Center partners, the JPL Multiscale Greenhouse Gas System contributes to this effort through a focus on the scales of anthropogenic emissions and natural feedbacks that govern global CO_2 and CH_4 concentrations.

In particular, anthropogenic emissions tend to be concentrated in urban regions, especially at facility-scales such as power plants. The spatial scales of these emissions can vary from tens of kilometers to tens of meters while natural processes tend to act coherently on much larger scales, from tens to hundreds of kilometers, related to biome variations and climate forcing.

Advances in imaging spectrometry, such as found on the Earth Surface Mineral Dust Source Investigation (EMIT), have revolutionized the ability to infer GHG emissions from concentrated sources. Similarly, multi-spectral sounders such as the Orbital Carbon Observatory (OCO-2), GOSAT, and TROPOMI have provided an unprecedented view of the global carbon cycle. The OCO-3 instrument aboard the International Space Station (ISS) straddles these two perspectives with urban-scale carbon measurements that sample the diurnal cycle. Together, these measurements can provide unique, multi-scale information about GHG that is valuable for both science investigations and policy applications, serving federal needs and providing societal benefits.

To fully exploit these substantial data, advances must be made in inverse modeling capabilities, which are needed to represent the complete carbon cycle, and also in the computational infrastructure on which these methods are implemented. We outline an approach for this system that will incorporate novel techniques for high-resolution GHG estimates at facility, basin, regional, and global scales, accounting for both natural and anthropogenic contributions. Critical to this effort are approaches that facilitate comparison between so-called "top-down" and "bottom-up" approaches. In conjunction with NASA and Federal partners, these estimates can serve as a rigorous link between emission reductions and climate forcing, which are critical for evaluating U.S. objectives and international needs.
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