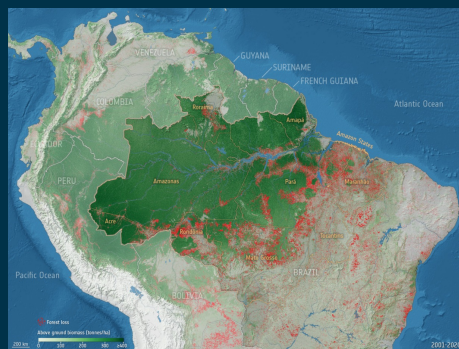


ESA CLIMATE CHANGE INITIATIVE: NEW INSIGHTS AND GLOBAL DATASETS FOR CLIMATE MONITORING



Climate change is arguably the greatest environmental challenge we face in the 21st century, requiring a global coordinated response. The UNFCCC delegated a public consultation to the Global Climate Observing System to define variables that represent the climate and its variability, and 54 **Essential Climate Variables (ECVs)** have been defined. The ESA Climate Office's flagship programme, the **Climate Change Initiative (CCI)**, supports this global view for monitoring and understanding the climate system. It exploits over 40 years of archived and emerging satellite observations, turning them into user-ready datasets. Today it hosts 23 projects, developing datasets for 21 ECVs. These are used by the scientific community to track changes across the cryosphere, ocean, atmosphere and land environments, and to improve models predicting the climate's evolution.

MONITORING FOREST CARBON FROM SPACE

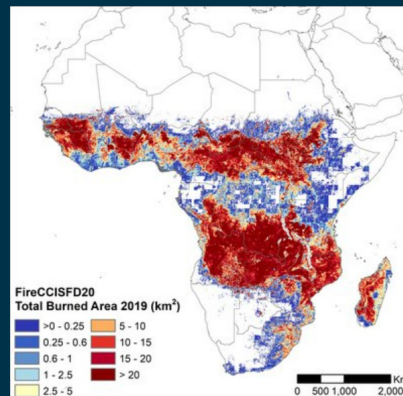


The **CCI RECCAP-2** project combines CCI data on Land Cover, Biomass, Greenhouse Gases and Fire to **monitor terrestrial carbon dynamics**.

CCI RECCAP-2 recently supported a study of Amazon carbon from 2010-2019, finding that forest degradation brought on by hot and dry conditions contributed three times more to biomass loss than deforestation.

Qin, Y. *et al.* Carbon loss from forest degradation exceeds that from deforestation in the Brazilian Amazon. *Nat. Clim. Chang.* 11, 442–448 (2021). <https://doi.org/10.1038/s41558-021-01026-5>

CARBON EMISSIONS FROM SMALL FIRES

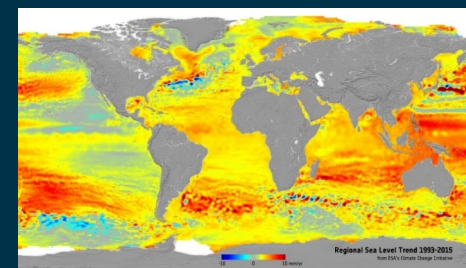


Small fires of 100ha or under are **a critical driver of emissions from biomass burning**

The **CCI Fire** project recently updated the **Small Fire Database (SFD)** for sub Saharan Africa. This dataset was able to detect 80% more burned area than the coarse-resolution global product.

Ramo, R. *et al.* African burned area and fire carbon emissions are strongly impacted by small fires undetected by coarse resolution satellite data. *PNAS*, 118(9) (2021). <https://doi.org/10.1073/pnas.2011160118>

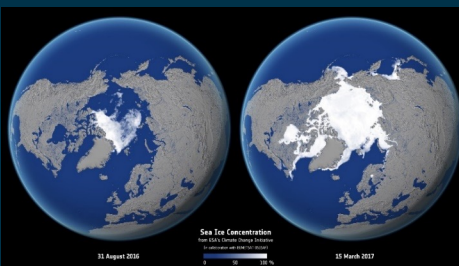
ASSESSING THE TRUE IMPACT OF SEA LEVEL RISE



Sea level rises at **2.6mm yr⁻¹**, in response to rising temperatures and increased water mass from ice loss. Coastal communities experience **up to four times the global mean sea level rise, 7.8 to 9.9 mm yr⁻¹** as coastal inhabitants are preferentially located in subsiding locations. Impacts and adaptation needs for these communities are therefore much higher than reported global sea-level rise measurements suggest.

Nicholls, R. J. *et al.* A global analysis of subsidence, relative sea-level change and coastal flood exposure. *Nat. Clim. Chang.* 11, 338–342 (2021). <https://doi.org/10.1038/s41558-021-00993-z>

VALIDATING MODELS WITH SEA ICE OBSERVATIONS



A **CCI Sea Ice** project-led study combined results from numerical models with satellite observations of **sea ice thickness** to investigate winter sea ice growth. The satellite observations of **sea ice thickness** in the Barents and Kara Seas indicate a negative trend in thermodynamic ice growth **leading to thinner sea ice** which, if continued, will result in further loss of Arctic sea ice.

Ricker, R. *et al.* Evidence for an Increasing Role of Ocean Heat in Arctic Winter Sea Ice Growth. *Journal of Climate*, 1-42 (2021). <https://doi.org/10.1175/JCLI-D-20-0848.1>

UNDERSTANDING GLOBAL GLACIER MASS BALANCE



The **CCI Glaciers** project has developed methods that allow researchers to study the accelerated loss of glacier ice. Findings published in Nature report that mass loss of glaciers has increased further over the past 20 years. This trend suggests glacier extents are still out of balance with the current climate and will continue to shrink in the future even if global temperatures were not to increase any further.

Hugonnet, R. *et al.* Accelerated global glacier mass loss in the early twenty-first century. *Nature* 592, 726–731 (2021). <https://doi.org/10.1038/s41586-021-03436-z>

OUTLOOK

ESA's Climate Change Initiative forms part of the excellence base that underpins all further activities towards addressing the effects of climate change.

Key to this effort is coordinated, targeted EO-derived information to support climate adaptation and mitigation efforts set out in the Paris Framework.

