ESA’s role in providing evidence of a changing climate, including CCI’s achievements

10th ESA Climate Change Initiative (CCI) colocation meeting
9 September 2020

Josef Aschbacher, ESA
Director of Earth Observation Programmes
ESA EO Vision:

Taking the Pulse of our Planet
ESA-Developed Earth Observation Satellites

- 15 in operation
- 40 under development
- 13 under preparation

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European Space Agency
IPCC Special Report: Oceans & Cryosphere

“The best available scientific knowledge to empower governments and communities”

- ca. 50 ESA CCI papers cited
- 5 CCI scientists contributing directly to the report
- Results from Sea Level, Sea Level Budget Closure, Ocean Colour, Glaciers & Ice Sheet projects

Projected Sea Level Rise until 2300
Ice Sheets: ice loss six times faster than expected

Greenland and Antarctica are losing ice six times faster that in the 1990s.

Polar ice sheets are now responsible for a third of all sea level rise.

Losses are currently on track with the IPCC’s worst-case climate warming scenario.
Sea Surface Salinity: essential for ocean modeling

ESA’s Soil Moisture & Salinity SMOS satellite

A key driver of ocean circulation, the water cycle and climate.

ESA/NASA collaboration

Merging SMOS, Aquarius & SMAP satellites has led to the first global view of salinity

ESA’s Soil Moisture & Salinity (SMOS) satellite 2010 tobe The first satellite Sea Surface Salinity (SSS) maps produced by the ESA climate Change Initiative combines SMOS, AQUARIUS & SMAP SSS. Boutin, J. et al. (2019)

http://dx.doi.org/10.5285/0efdebf8471642e62e486838996c41

European Space Agency
A biological climate indicator for the oceans.

Global primary production varied between 38 and 42 gigatonnes C per year between 1998-2018.

Productivity is influenced by El Nino, Indian Ocean Dipole & the North Atlantic Oscillation.
Permafrost thaw in the North

Permafrost CCI, Obu et al., 2019 via the CEDA archive

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A first reliable estimate of NH snow mass change using 1980-2018 snow mass record.

Uncertainty reduced from 33% to 7.4%

Enabled continental trends to investigate with N. America snow mass decreasing by 46Gt per decade
## Space19+ Outcomes for Earth Observation

<table>
<thead>
<tr>
<th>Programme</th>
<th>Proposed (M€)</th>
<th>Subscribed (M€)</th>
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Earth Explorer FORUM is key for Climate Science

By measuring radiation emitted by Earth into space, FORUM will provide new insight into the planet’s radiation budget and how it is controlled.

Launch planned for 2025
New Copernicus missions

CO2M - Anthropogenic CO₂ Monitoring
Identify sources of greenhouse gases

CRISTAL – Polar Ice & Snow Topography
Effects of Climate Change

CIMR – Passive Microwave Radiometer
Sea: Surface Temp. & Ice Concentration

LST – Land Surface Temperature Mission
Agriculture & Water Productivity

CHIME – Hyperspectral Imaging Mission
Food Security, Soil, Minerals, Biodiversity

ROSE-L – L-band SAR Mission
Vegetation & Ground Motion & Moisture
Anthropogenic CO\textsubscript{2} Monitoring Mission (CO2M)

- Analyse man-made CO\textsubscript{2} emissions and overall CO\textsubscript{2} budget
- Assess the effectiveness of the relevant COP21 decisions
- Through the use of CO\textsubscript{2} satellite imagers
- At country and regional/megacity scales

European total CO\textsubscript{2} emissions - Kuenen et al., 2014 and 2015
Digital Twin Earth

Observations
- Public
- Commercial
- NewSpace

AI

Earth System Science

Scientific knowledge

Predictions

Simulations

Intelligent solutions
Thanks for your attention!

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