EO data and its impacts on operational weather and climate services

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WHY WEATHER MATTERS?

8,835 weather related disasters
1.94 million deaths
$2.4 trillion economic losses
124 million monthly google searches for “weather”

WMO figures for 1970 - 2012
INPUT OBSERVATIONS ALSO GROW IN VOLUME AND VARIETY

One example:
data from commercial aircraft

Satellite data used at ECMWF: about 60 for weather only, with an additional dozen for atmospheric composition applications (Copernicus)
Evolution of ECMWF medium-range weather forecast performance since 1981 (the two lines represent skill in Northern Hemisphere and Southern Hemisphere).
IRMA with / and without satellites

Forecast with satellites

Forecast without satellites
### SCALABILITY: A CHALLENGE FOR NWP

<table>
<thead>
<tr>
<th></th>
<th>OBSERVATIONS</th>
<th>MODELS</th>
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<tbody>
<tr>
<td>TODAY</td>
<td></td>
<td></td>
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<tr>
<td>volume</td>
<td>40 million = 4 x 10^7</td>
<td>10 million grid points</td>
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<tr>
<td>type</td>
<td>98% from 60 different satellite instruments</td>
<td>100 levels</td>
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<tr>
<td></td>
<td></td>
<td>10 prognostic variables = 1 x 10^{10}</td>
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<tr>
<td></td>
<td></td>
<td>physical parameters of atmosphere, waves, ocean</td>
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<tr>
<td>TOMORROW</td>
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<tr>
<td>volume</td>
<td>100-200 million = 1-2 x 10^8</td>
<td>500 million grid points</td>
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<tr>
<td>type</td>
<td>98% from 80 different satellite instruments</td>
<td>200 levels</td>
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<td>100 prognostic variables = 1 x 10^{13}</td>
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<td>physical and chemical parameters of atmosphere, waves, ocean, ice, vegetation</td>
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**FACTOR 5**

**FACTOR 1000**
Climate bulletins

Through our monthly maps, we present the current condition of the climate using key climate change indicators. We also provide analysis of the maps and guidance on how they are produced.

Highlights of the latest monthly summaries

4TH JUNE 2019

May 2019 temperature:

- The global mean temperature in May 2019 was more than 0.5°C warmer than the 1981-2010 May average, ranking among the top three warmest for the month of May since 1979.
- Europe as a whole saw temperatures very close to average, albeit warmer than average over the Iberian Peninsula and the far east of the continent and colder than average in-between.
- Temperatures were well above average over parts of the Arctic (Greenland, Baffin and Ellesmere Islands, Alaska) and over the Weddell Sea, near Antarctica.
Copernicus Climate Change Service: incorporating Space-based (and other) Essential Climate Variables
Copernicus Climate Change Service: measuring impact via tracking users

Registered users: 14,805
Queued users: 179
Running users: 66

From 14/06/2018

Daily downloads

- Total downloads
- 40TB
- 30TB
- 20TB
- 10TB
- 0TB

EU/EFTA

Countries

Datasets Top 8
1. ERA5 hourly data on single levels from...
2. ERA5 hourly data on pressure levels fr...
3. Seasonal forecast daily data on pressur...
4. ERA5 complete
5. Seasonal forecast daily data on single le...
6. Seasonal forecast monthly statistics on ...
7. Seasonal forecast monthly statistics on ...
8. UERRA regional reanalysis for Europe o...

Top 5 (Running or queued)
- European Union/EFTA: 117
- China: 31
- United States of America (the): 20
- Korea (the Republic of): 8
- Canada: 6
Copernicus Climate Change Service: measuring advancements in research via citations scientific papers

Dick Dee
ECMWF
Verified email at ecmwf.int
Climate Change  Data Assimilation  Numerical Weather Prediction

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<thead>
<tr>
<th>TITLE</th>
<th>CITED BY</th>
<th>YEAR</th>
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<tr>
<td>The ERA-Interim reanalysis: Configuration and performance of the data assimilation system</td>
<td>13840</td>
<td>2011</td>
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<tr>
<td>DP Dee, SM Uppala, AJ Simmons, P Berrisford, P Poli, S Kobayashi, ...</td>
<td></td>
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<td>Quarterly Journal of the Royal Meteorological Society 137 (656), 553-597</td>
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The strength of a common goal