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Look back in wonder

The launch of the first Sentinel satellite heralds an era in which detailed data on everything from earthquakes to urbanization will be freely available to anyone interested in Earth's future.

The Copernicus Earth-observation programme, whose first Sentinel satellite launched last week, is a rare example of a coherent and ambitious Europe-wide vision backed up with the funds needed to achieve it. It shows that Europe can accomplish great things when its politicians and institutions put their minds to it.

The Copernicus programme — a joint initiative between the European Union and the European Space Agency (ESA) that also involves the intergovernmental meteorological agency EUMETSAT — is remarkable in many ways. By the end of the decade, it aims to combine data from satellites and ground-, air- and sea-based sensors to deliver a dizzying array of imagery and information. Policy-makers, water experts, disaster responders, farmers, fishermen and the interested public all stand to benefit. The satellites will make Earth observation as routine a public service as weather forecasting and satellite navigation, and will also be a boon for science.

Dedicated missions will always be needed to seek specific answers, but routine observations are at the heart of a better understanding of the processes taking place in, on and above Earth. The six families of Sentinel satellites will generate almost real-time data on many of the key components of the Earth system (see page 160). And because the satellites will be routinely replaced, the programme should provide decades of continuous data. The value of such data has been amply demonstrated by the US Landsat satellites, which have delivered a priceless 42-year record of changes in Earth's land surface.

Recognizing Copernicus's scientific potential, the European Commission last year decided to extend the scope of the programme beyond practical applications and include academic scientists as a formal user group. This is a wise move, because the scientific community can help to optimize the systems to make the data more useful for research, and also provide expertise to help the programme evolve.

The European Commission has also made the right call in providing all Sentinel data free of charge. This is essential but was far from a given; the free-market-oriented commission was initially keen to charge for the data, but that would have greatly limited their use. Only after a long battle with scientists and ESA officials did the commission agree to making the data free. Helping to sway the argument were studies showing that making data free could generate a proliferation of downstream commercial applications (some of which are likely to come to a smartphone near you), potentially creating billions of euros in economic benefits and tens of thousands of European jobs.

Like Copernicus, the US Landsat programme has at times been hamstrung by free-market ideology. Landsat images used to cost thousands of dollars before the United States decided to make them free in 2008 to maximize the value of the satellite data. As a result, the number of Landsat images downloaded each year rocketed from 15,000 to more than 4 million by 2013.

Copernicus has not been immune to problems, and budgetary wrangling between the European Commission and member states

delayed the launch of Sentinel-1 by three years. But it now has guaranteed funding of €4.3 billion (US\$5.9 billion) until 2020. Although short of the €5.8 billion sought, the situation contrasts with that in the United States, where budgetary instability and other problems continue to plague the planning and launch of new missions.

Copernicus highlights the continuing political recognition in Europe that proper stewardship of the planet demands the routine collection of data. It makes sense, too, for different programmes to work more

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closely together. Coordination between satellite programmes — including Copernicus and Landsat — could bring many benefits: the increased frequency of imaging could, for instance, allow the monitoring of changes that occur on short timescales, such as variations in soil moisture.

Indeed, single large satellites such as Landsat may ultimately become a relic of the past. The trend now — and one vaunted by a US National Research Council report last year on the future of Landsat — is for constellations of smaller, cheaper satellites that provide faster revisits and that minimize the impact of satellite failures.

A new breed of Earth-observation start-up firms are taking the 'constellation' route. The instruments carried by their satellites are often rudimentary compared with those of scientific satellites, but they are good enough for many practical applications and for some scientific purposes. Better Earth observation can only increase awareness of the need for action to protect the planet. There is little point in scientists unravelling the mechanisms of the planet's processes if the knowledge cannot be translated into better management of Earth's environments. ■

Political science

Russia deserves to be sanctioned, but halting scientific collaboration is not the way to do it.

As European Union foreign ministers gathered in Athens at the weekend to discuss a way out of the Ukrainian crisis, violent pro-Russian activists were occupying local administration buildings and hoisting Russian flags in Donetsk, eastern Ukraine. Analysts fear that the riots might have been deliberately launched to provoke Russian troops to move farther into eastern Ukraine, where a large proportion of the population is ethnic Russian.

Western governments have warned the Kremlin and its increasingly unruly leader, Vladimir Putin, off further military adventures. As we