

► maps of the drainage systems of major cities along the Ganges — the network of discharge outlets that release sewage and commercial waste water into the river. An estimated 600 million people live in the Ganges basin, and rely on water from the river for drinking and bathing. The Ganges is sacred to the country's large Hindu population, who view the river as an embodiment of the goddess Ganga and use its waters in religious rituals.

Although some sources of waste in the Ganges are well known, detailed models of how pollution enters and moves along the river will enable officials to design more-effective reduction strategies. Environmental engineer Vinod Tare of the Indian Institute of Technology in Kanpur says that many current government interventions, such as diverting raw industrial sewage away from the river, are implemented without sufficient information to assess whether they are working. “Right now, we do not even have a simple topography of the basin,” says Tare, who has been involved in Ganges-management research for more than three decades.

Government officials also hope to use the maps to improve understanding of how cities develop along the riverbank, and of how the bank is being eroded. This will help local governments to manage risks such as floods. “We will have a better idea of what industries



and human settlements will be most affected,” says Kumar.

The mapping project (see ‘Mapping Mother Ganges’) will cost 870 million rupees (US\$12.7 million). “It is expensive, but compared to what we will be spending to address the pollution problem, it is hardly anything,” says Tare.

But water-quality researcher Abed Hossain says the benefits of detailed monitoring will go unrealized if researchers cannot access all the information and use it to develop models and interventions. If the mapping doesn’t go

as planned, the government could become worried about negative publicity and restrict access to some of the raw data, says Hossain, who works at the Bangladesh University of Engineering and Technology in Dhaka. In south Asia, he says, “governments are edgy about failures”.

Kumar says that the government has issued guidelines for data sharing and will share the information collected for the project.

The mapping is part of the Indian government’s renewed push to use technology to monitor and clean the Ganges. In 2015, the government approved the 200-billion-rupee National Mission for Clean Ganga, a wide-ranging effort that includes improving the treatment of sewage and reducing industrial pollution.

But as the deadline of 2020 approaches, the government is still a long way from meeting many of its targets. Last year, the independent auditor-general found that the clean-up effort had been delayed by financial mismanagement and poor planning and implementation.

The management of the river is shaping up to be a central issue in the lead-up to the general election next year. Kumar says that the maps will be a crucial resource for future interventions. “Before planning anything, we need a map,” he says. ■

POLICY

Trump finally nominates a science adviser

Meteorologist Kelvin Droegemeier would lead the White House science office.

BY SARA REARDON & ALEXANDRA WITZE

US President Donald Trump has nominated meteorologist Kelvin Droegemeier as his government’s top scientist. If confirmed by the Senate, Droegemeier would lead the White House Office of Science and Technology Policy (OSTP).

Trump, who took office 19 months ago, has gone longer without a top science adviser than has any first-term president since at least 1976. He announced his pick on 31 July.

“My initial reaction is, wow, they found someone,” says Kei Koizumi, visiting scholar at the American Association for the Advancement of Science in Washington DC and a former assistant director at the OSTP under president Barack Obama.

Droegemeier would be the first non-physicist to serve as White House science

adviser since Congress established the OSTP in 1976. “I think he is a very solid choice,” says John Holdren, who led the OSTP for eight years as Obama’s science adviser. “He is a respected senior scientist and he has experience in speaking science to power.”

An expert on extreme-weather events, Droegemeier has been vice-president for research at the University of Oklahoma in Norman since 2009. Last year, Oklahoma Governor Mary Fallin, a Republican, appointed him as the state’s secretary of science and technology. The meteorologist has also served on the National Science Board (NSB), which oversees the National Science Foundation, under presidents Obama and George W. Bush. Droegemeier led NSB committees on hurricane science and research administration, among other topics, and was the board’s vice-chairman from 2012 to 2016.

“He combines a lot of qualities in somebody

you’d like to see in public service,” says Roger Pielke Jr, a political scientist at the University of Colorado Boulder who has studied the history of US science advisers and who worked with Droegemeier in the 1990s and early 2000s. “He is, in the most positive way, a nerdy meteorologist who loved working on weather technology. And he also has a knack for administration and working his way around the system.”

If confirmed, Droegemeier will take control of an office radically reshaped by the Trump administration. The president has reduced the number of OSTP staff members to about 50, well below the 130 employed by Obama. The Trump team has also placed greater emphasis on technology issues, and has repeatedly sought to cut or eliminate high-profile science programmes — including a public-health-preparedness fund at the Centers for Disease Control and Prevention, climate-change

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programmes at the Environmental Protection Agency and NASA's Wide-Field Infrared Survey Telescope.

PLAYING CATCH-UP

Some of Droegemeier's colleagues hope that he would help to shift the Trump administration's thinking on climate change. "I'm certain he believes in mainstream climate science," says Rosina Bierbaum, an environmental-policy expert at the University of Michigan in Ann Arbor who has held multiple presidential-advisory roles. Bierbaum and Droegemeier worked on climate-change issues together while on the board of the University Corporation for Atmospheric Research in Boulder, Colorado. "He's an excellent communicator and really good at distilling complex issues," she says.

The OSTP has managed to keep working without a permanent director, developing strategies to monitor space weather and boost science, technology, engineering and mathematics education. But Koizumi says that Trump would benefit from having a science adviser to consult when making decisions on issues such as natural disasters.

Because the position has remained vacant for so long, "they'll be filling from behind" to get the OSTP fully staffed, says Phil Larson, a senior adviser in Obama's OSTP who is now assistant dean of engineering at the University of Colorado Boulder. "Now the question will be, will his voice be represented around the table in the discussions that are going on at the highest levels of the government?"

And serving as the top scientist in an administration that has been criticized for its science policy could be difficult in other ways. "Droegemeier's going to get all sorts of



Kelvin Droegemeier is an expert in extreme-weather events.

questions," says Pielke. "There's going to be a tremendous amount of pressure." He sees a probable analogue in the experiences of John Marburger, the physicist who advised president George W. Bush.

Marburger was sharply criticized for supporting government policies that were unpopular with the scientific community — such as Bush's decision to withdraw from the Kyoto Protocol on climate change and to restrict federally funded research on embryonic stem cells. "It's going to get tough pretty

quickly for [Droegemeier]," Pielke says.

It is not clear whether the White House intends to appoint Droegemeier as an assistant to the president, a position held by several recent White House science advisers — including Holdren. The title, which is separate from that of OSTP director, essentially signals close ties to the president and his top aides. An OSTP spokesperson says that any decision about whether to give Droegemeier an additional title would be made after his confirmation by the Senate. ■

TOPOLOGY

Trove of exotic matter thrills physicists

Thousands of new 'topological' materials are emerging as researchers exploit new algorithms to scour databases.

BY ELIZABETH GIBNEY

The already buzzing field of topological physics could be about to explode. For the first time, researchers have systematically scoured entire databases of materials in search of ones that harbour topological states — exotic phases of matter that have fascinated physicists for a decade. The results show that thousands of known materials probably have topological properties — and perhaps up to 24%

of materials in all. Previously, researchers knew of just a few hundred topological materials, and only around a dozen have been studied in detail.

"I'm shocked by the number," says Reyes Calvo, an experimental physicist at the nanOGUNE Cooperative Research Center in San Sebastián, Spain.

In July, several teams posted preprints^{1,2,3} online detailing their scans of tens of thousands of materials and their predicted topological classifications, which are based on algorithms that

use a material's chemistry and symmetry to calculate their likely properties. Two teams have already integrated their algorithms into searchable databases. "You can put in a compound name and, with one click, get whether there is topology or not. For me, this is wonderful," says Chandra Shekhar, a condensed-matter physicist at the Max Planck Institute for Chemical Physics of Solids in Dresden, Germany.

The resulting haul of topological materials could bring scientists closer to practical applications for these exotic phases, which could revolutionize electronics and catalysis. "The more materials with unusual properties we know, the more chance there will be of a breakthrough," says Oleg Yazyev, a physicist at the Swiss Federal Institute of Technology in Lausanne.

These materials derive their unusual features from their topology. In mathematics, topology is the study of objects with properties that remain unchanged when they are smoothly deformed and not torn. In materials, topology applies not to the shape of a solid object, but to the geometry of an abstract description of its electrons' quantum states. Their topology ▶