SCIENTIFIC AMERICAN

ATMOSPHERIC

I was eating breakfast casually watching the local five-day weather forecast on a television screen behind the counter. Wednesday had a friendly-looking cloud and a few raindrops, and Thursday had a dark, threatening cloud with heavier drops. I knew Thursday's conditions would be much rougher than the symbol conveyed. I had been studying detailed satellite data and weather models, and they indicated that a major atmospheric river (AR) was likely to hit the city.

Struck by the inadequacy of the TV weather icons, I pledged to finish an intensity scale for ARs. I envisioned a square, yellow box on the screen for Thursday with a storm system's ranking in bold, black characters, similar to how hurricanes are characterized as categories 1 to 5. This ranking would allow weather forecasters, emergency planners, safety personnel and reservoir managers—as well as the public—to better prepare for potential flooding, transportation disruptions, downed power lines, debris flows or evacuations.

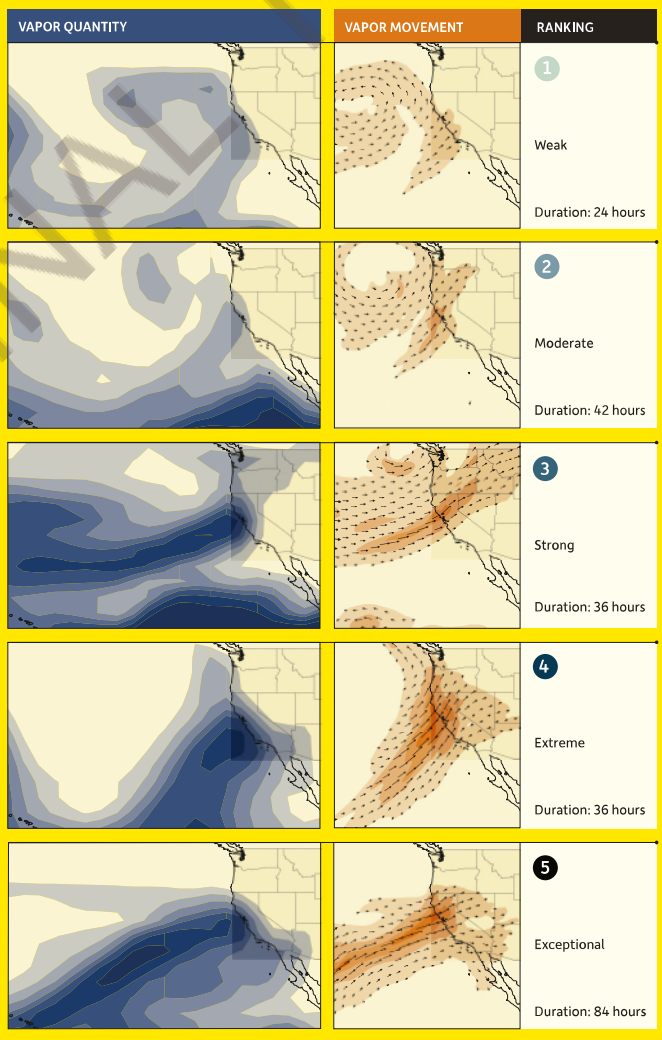
ARs are essentially rivers of water vapor in the sky that are pushed along by strong, low-altitude winds, sometimes at hurricane speeds. An average AR brings far greater rainfall than a typical rain or thunderstorm in those parts of the world, transporting enough vapor to equal 25 times the flow rate of the Mississippi River where it pours into the Gulf of Mexico.

These storms can produce disastrous flooding, including the biggest floods that some areas may see in a century. They can occur in families—a series of storms, as if rolling in on a treadmill. Several times a year they pummel the western coasts of the U.S., Canada, Europe, Africa, South America and New Zealand.

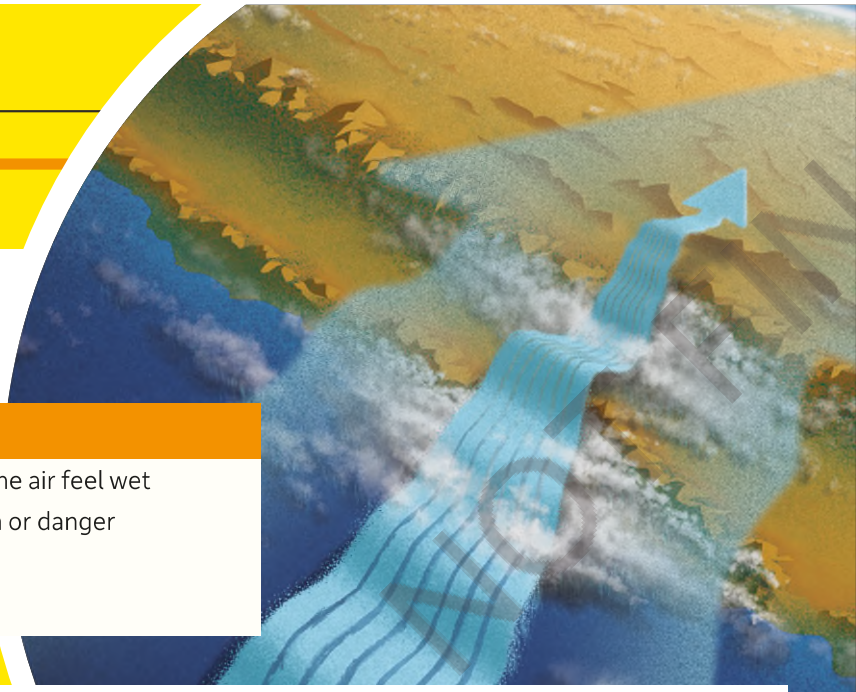
ARs are not always destructive; sometimes they bring welcome rain to parched regions. They can beneficially boost snowpack and help fill natural and human-made water reservoirs. It's hard to know more than a few days ahead where exactly a storm will make landfall, however. As big as they are, they can be fickle because numerous forces can affect their progression, from ocean-surface temperatures to pockets of cold air aloft.

Researchers and weather forecasters have gotten better at informing emergency planners and water managers on whether a storm will bring rain that is good for replenishing water supplies or crosses a threshold into floods and landslides. With greater preparedness, officials can lessen risk to property and lives and know how to maximize water storage.

by F. Martin Ralph



RIVERS



GLOSSARY

vapor (n) very small drops of water in the air that make the air feel wet
threat (n) a situation or an activity that could cause harm or danger
aloft (adj) high up in the air
replenish (v) to make something full again

INTEGRATED SKILLS

You will read a passage about atmospheric rivers and analyze a diagram. You will then hear a short podcast related to the topic. There are some questions to help you with language and the main ideas. Finally, you will summarize the points in both texts.

CLOSE READING

Read the Scientific American text about atmospheric rivers and analyze the diagram. Answer the questions.

1 An atmospheric river (AR) is a **thunderstorm** / **vapor storm** / **hurricane**.
2 ARs are damaging because they arrive **in groups** / **on treadmills** / **every century**.
3 **Changing air temperatures** / **falling land** / **big storms** affect how ARs move.
4 The **quantity** / **movement** / **weight** of vapor is measured in kilograms per meter per second.
5 A typical beneficial AR lasts **24** / **36** / **84** hours.

READING ANALYSIS

Work with a partner. Discuss the questions about the passage and the diagram.

1 What problems could be prevented by using a ranking system for ARs?
2 How could a ranking system for ARs be used to benefit water managers?

CLOSE LISTENING

Listen to the podcast. Complete each sentence with one or two words.

1 Atmospheric rivers deliver water vapor and strong _____ .
2 An AR can carry similar amounts of _____ as 15 to 20 Mississippi rivers.
3 Almost 50% of the most extreme storms in the world's _____ are due to ARs.
4 ARs are the most common type of storm that result in huge costs to _____.
5 Future climate change might cause more _____ atmospheric rivers.

LISTENING ANALYSIS

Work with a partner. Discuss the questions about the podcast.

1 Why did the scientists decide to study the historical data of atmospheric rivers?
2 What kind of problems did the data show were caused by atmospheric rivers?

INTEGRATED WRITING

Summarize the points made in the podcast and explain the benefits of using historical data and a ranking system for ARs. Write between 150 and 225 words for your answer.