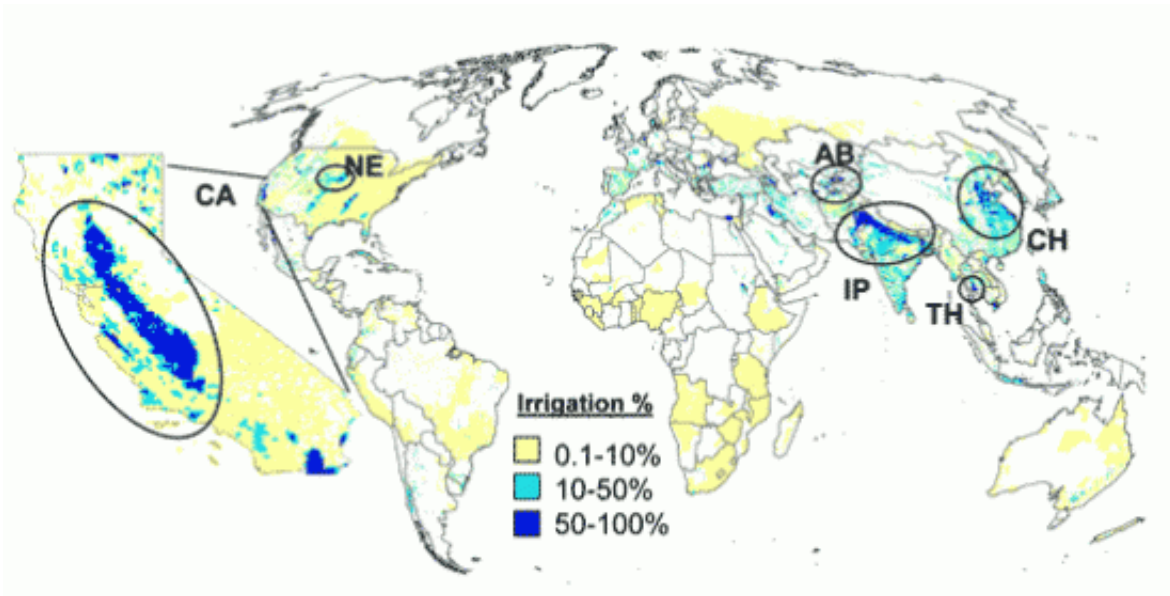


Irrigation may not cool the globe in the future

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Global map of the fraction of each 5' x 5' grid cell equipped from irrigation (percent). Circles indicate major irrigation regions used in the study: Aral Sea Basin, California, Eastern China, Indo-Gangetic Plains of India and Pakistan, Nebraska and Thailand.

Expansion of irrigation has masked greenhouse warming in California's Central Valley, but irrigation may not make much of a difference in the future, according to a new study in the Aug. 13 edition of the *Proceedings of the National Academy of Sciences*.

Irrigation's influence on climate is often overlooked when studying the

human effect on regional climate change. Yet, irrigation has expanded rapidly in many parts of the world and understanding its influence helps to explain historical trends and to improve climate projections in those regions.

“Globally we derive 40 percent of our food from irrigated regions, so we’d like to be able to model future climate changes in these regions,” said Celine Bonfils, lead author of the study from Lawrence Livermore National Laboratory and U.C. Merced.

Based on observations of temperature and irrigation trends throughout the state, the authors demonstrated a clear irrigation-induced cooling in agricultural areas, and showed that this effect has recently slowed down.

“This is not a model result, but something very clearly evident in the data. We also looked at other major irrigated regions in the world, and saw a very similar pattern” Bonfils said.

The team, which included Bonfils and David Lobell at Livermore Lab, first studied the net impact of widespread irrigation on local and regional climate in California, the top irrigating state in the United States (3.3 million hectares). In highly irrigated regions of the San Joaquin Valley, daytime temperatures relative to low irrigated areas have cooled by 1.8 degrees - 3.2 degrees C since the introduction of irrigation practice in 1887.

“In comparison, there was no clear effect of irrigation on temperatures over the 1980-2000 period when there was no net growth of irrigation,” Lobell said.

Irrigation cools the surface of the earth by increasing the amount of energy used to evaporate water rather than heat the land. The more irrigated the land, the more intense the effect. “It was quite surprising

how well we could distinguish a cooling trend that incrementally increases with the amount of irrigation,” Bonfils said.

This study also shows that the rapid summer nighttime warming, well observed in Central California since 1915, cannot be explained by irrigation expansion, as outside research has implied. “Our results show that the expansion of irrigation has almost no effect on minimum temperatures and that irrigation cannot be blamed for this rapid warming,” Bonfils said.

“An increase in greenhouse gases and urbanization would best explain this trend, which exceeds what is possible from natural climate variability alone,” Lobell said.

In other areas of the world where irrigation development has been rapid, including Thailand, the Aral Sea Basin and Nebraska (the second most irrigated state in the United States), the research team found the same cooling effect in summer daytime maximum temperatures. In India, Pakistan and Eastern China, the temperature change due to irrigation is a little less clear because of the presence of aerosols in the atmosphere that also contribute to the observed cooling by reflecting or absorbing sunlight.

In California, irrigation expansion is likely to end because of urbanization and water demand increase. In the United States, irrigation has for the first time decreased by 2 percent from 1998-2003 and growth in irrigation has already slowed down in many parts of the world.

“Throughout the major irrigated regions of the world, the cooling influence of irrigation on daytime maximum temperatures will be much smaller in the next 50 years than in the past century, and will likely not continue to curb the effects of greenhouse warming anymore,” Bonfils said.

Source: Lawrence Livermore National Laboratory

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