

***Cool Cities, CITRIS Mini-conference  
Feb. 25, 2011***

***White Roofs to Cool your Buildings, and Cities and  
(this is new) Cool our Planet***

**Arthur H. Rosenfeld, Former Commissioner  
California Energy Commission.**

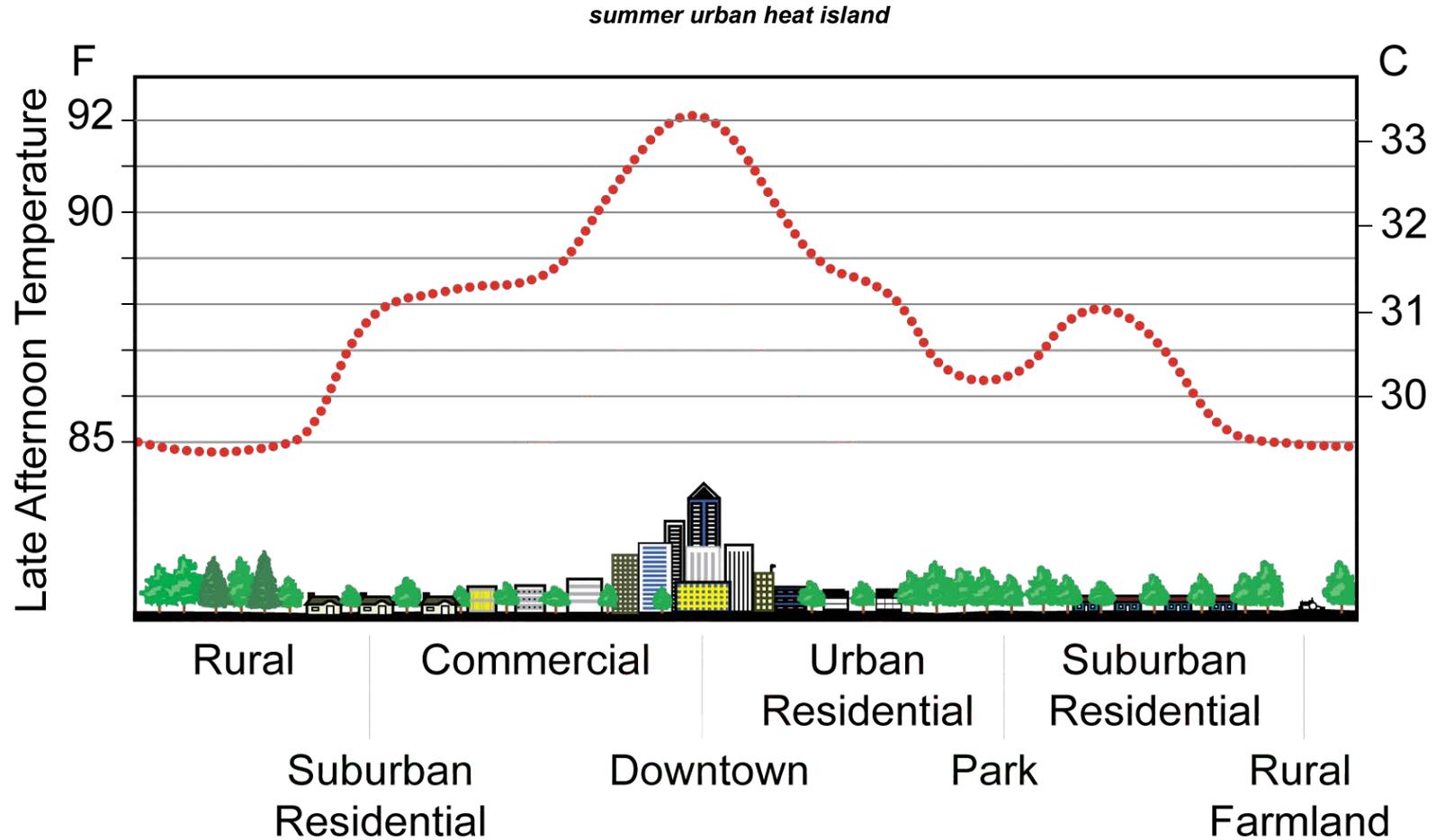
**Distinguished Scientist Emeritus  
Lawrence Berkeley National Lab.**

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**Presentation available at [www.ArtRosenfeld.org](http://www.ArtRosenfeld.org)**

# Summer in the city

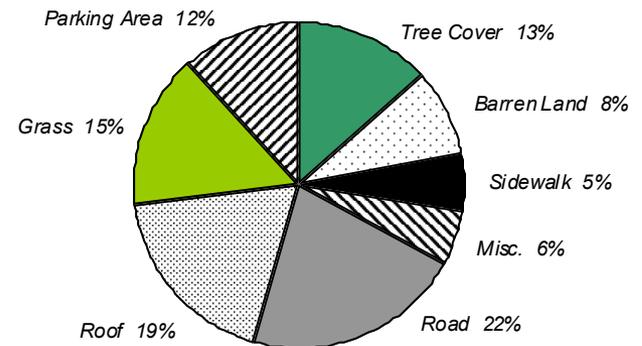


# Bird's eye view of urban land use



The surface of Sacramento, CA is about

- **20% roofs**
- **30% vegetation**
- **40% pavement**



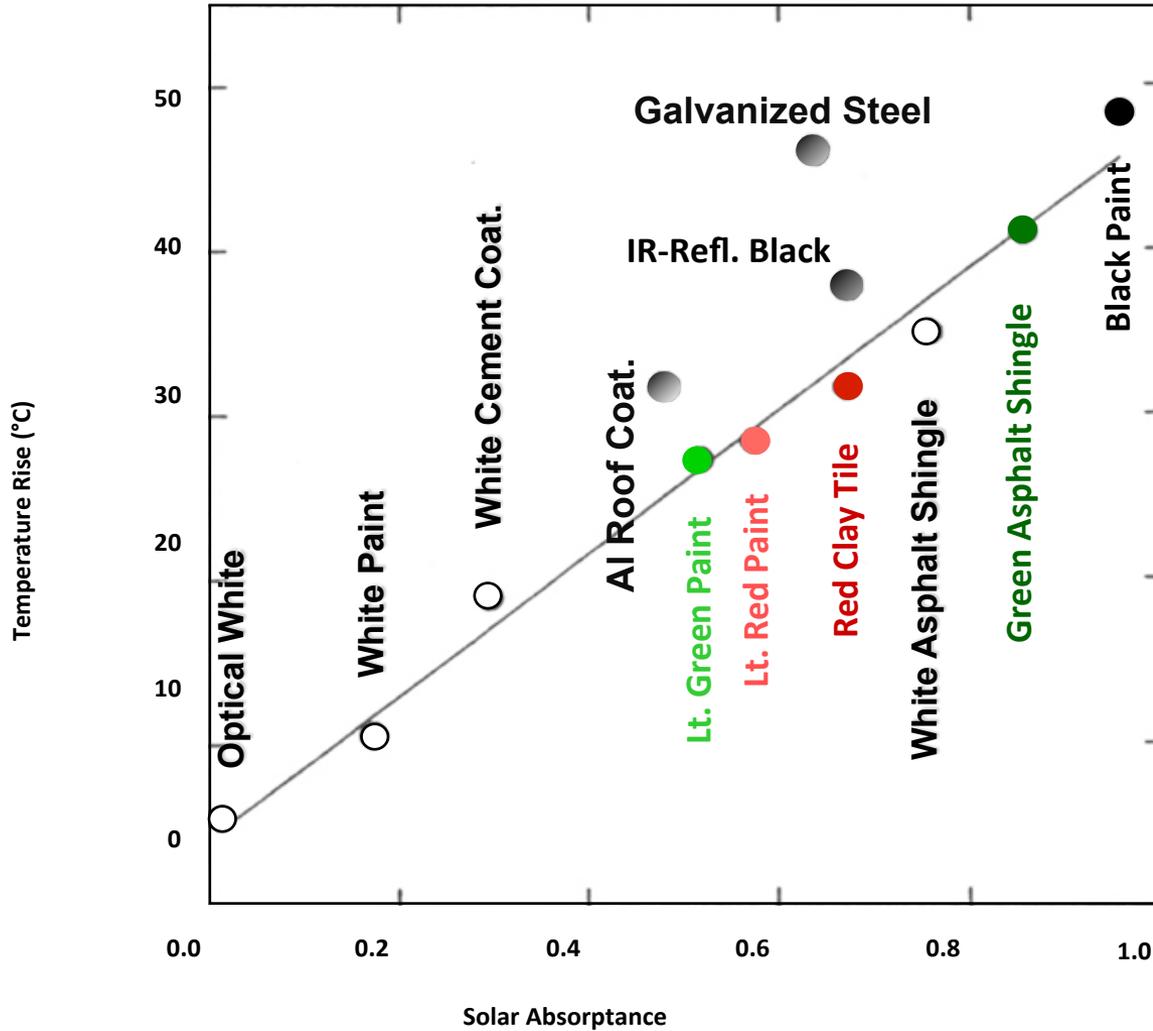
Area by Land-Cover Category Above the Canopy

# Chicago Heat Wave 1995, 739 Deaths

Virtually all of the deaths occurred on the top floors of buildings with black roofs

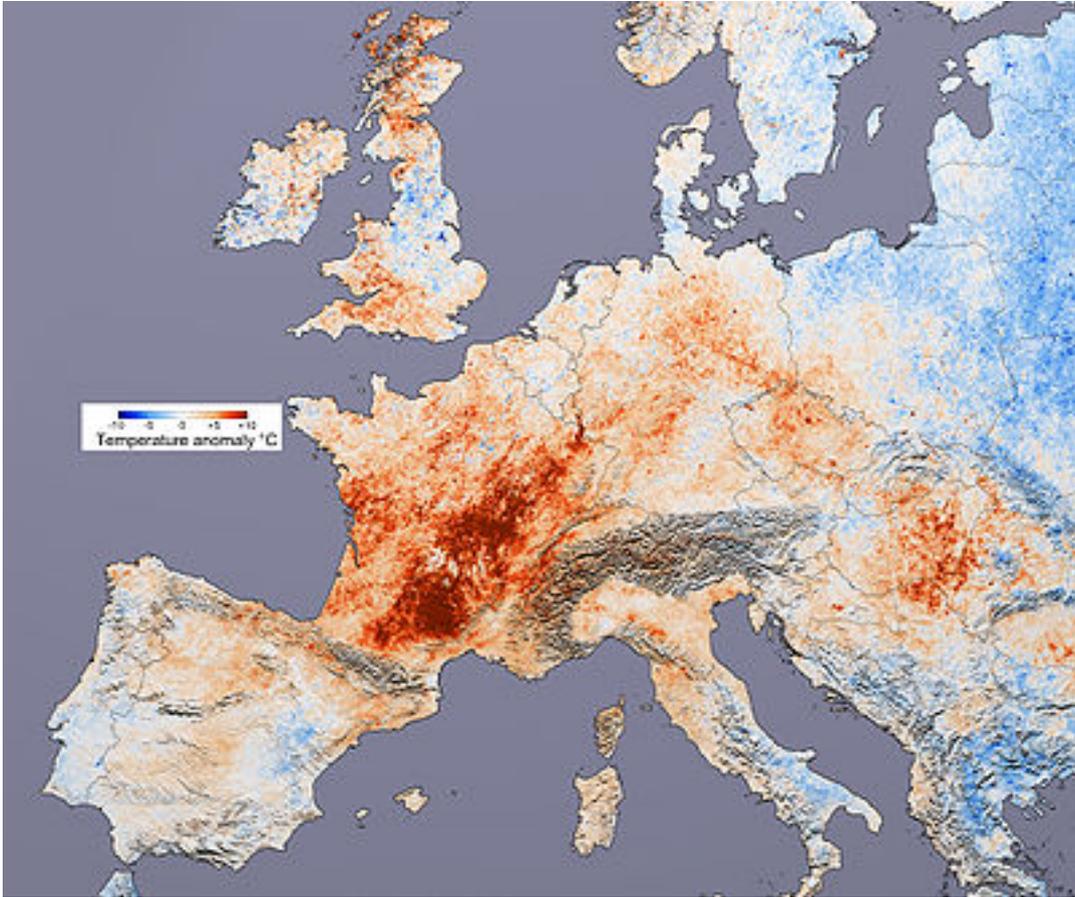


# Reflective roofs stay cooler in the sun



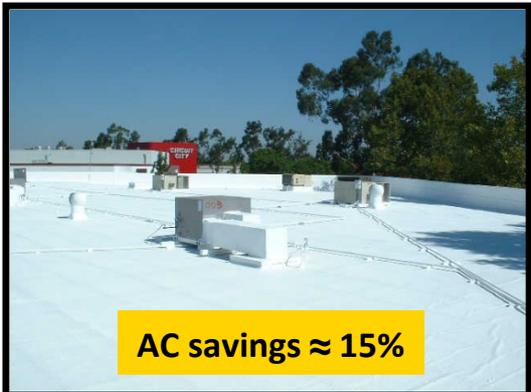
# European Heat Wave 2003, 30,000 Deaths

## France July 2010, Few Deaths



# White roofs, cool-colored roofs save money

**OLD**



**flat, white**



**pitched, white**

**NEW**



**pitched, cool & colored**

White roofs around the world

...in Santorini, Greece



...in Hyderabad, India

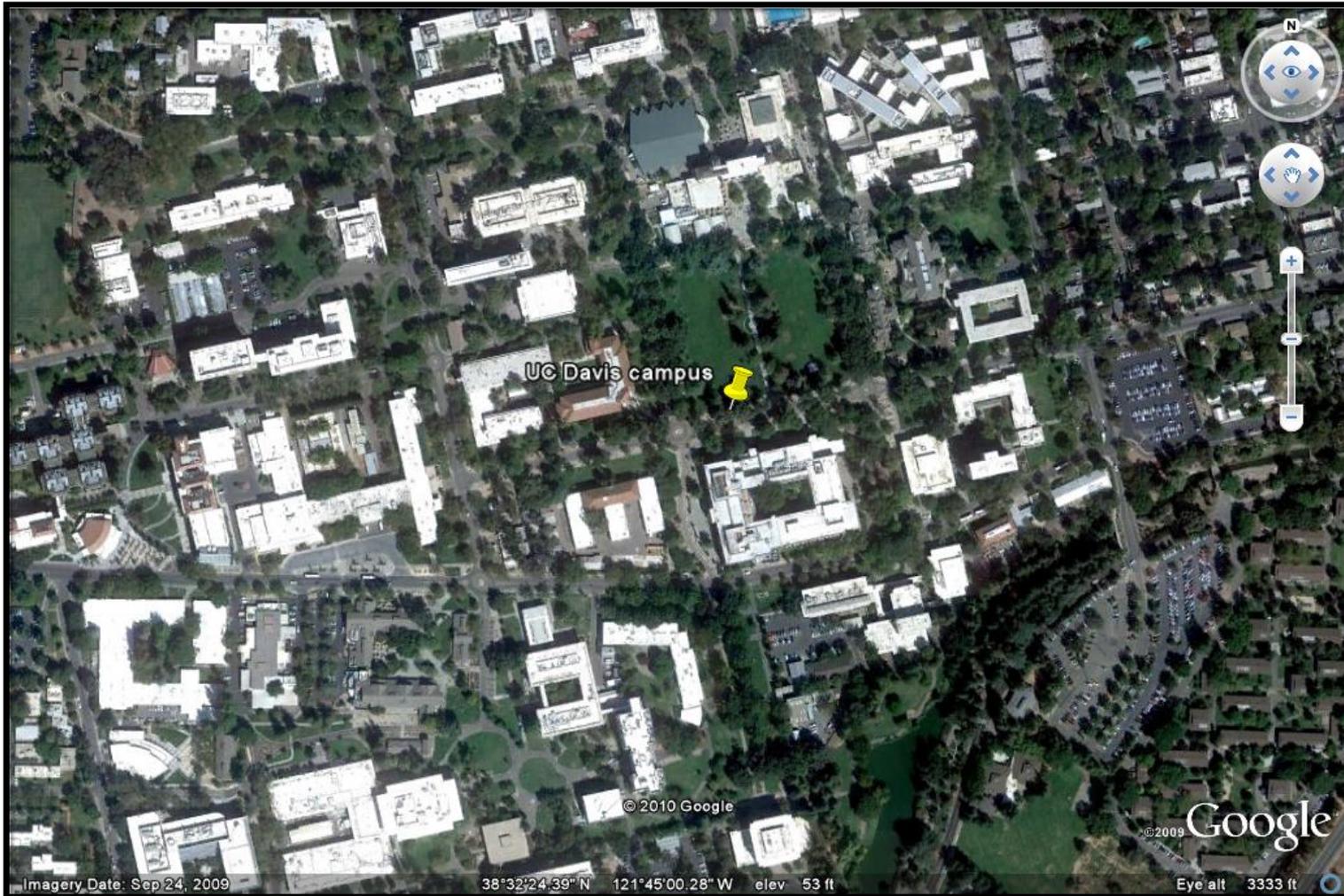


**...and widely  
in the state of  
Gujarat, India.**

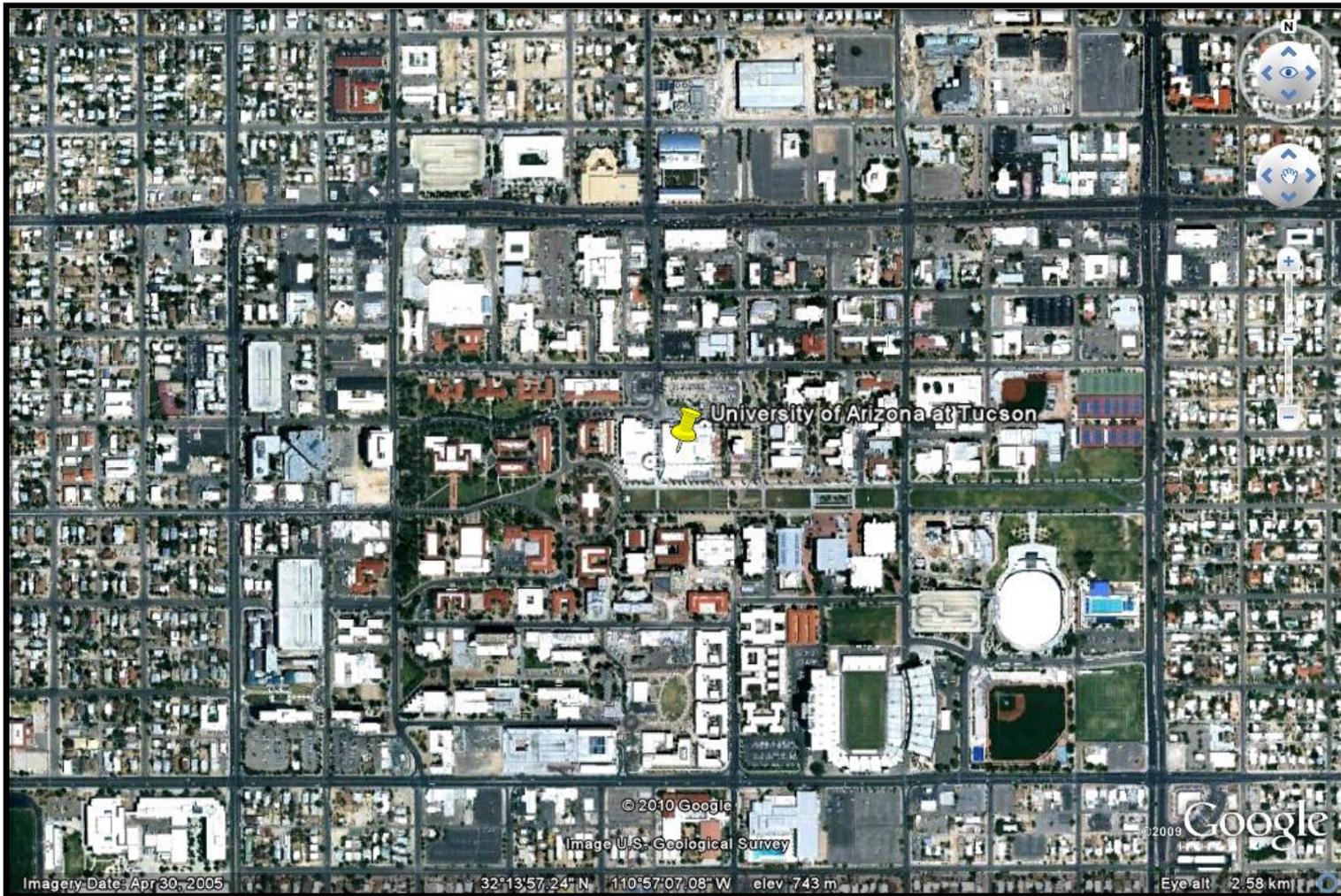
# Walmart store in northern California



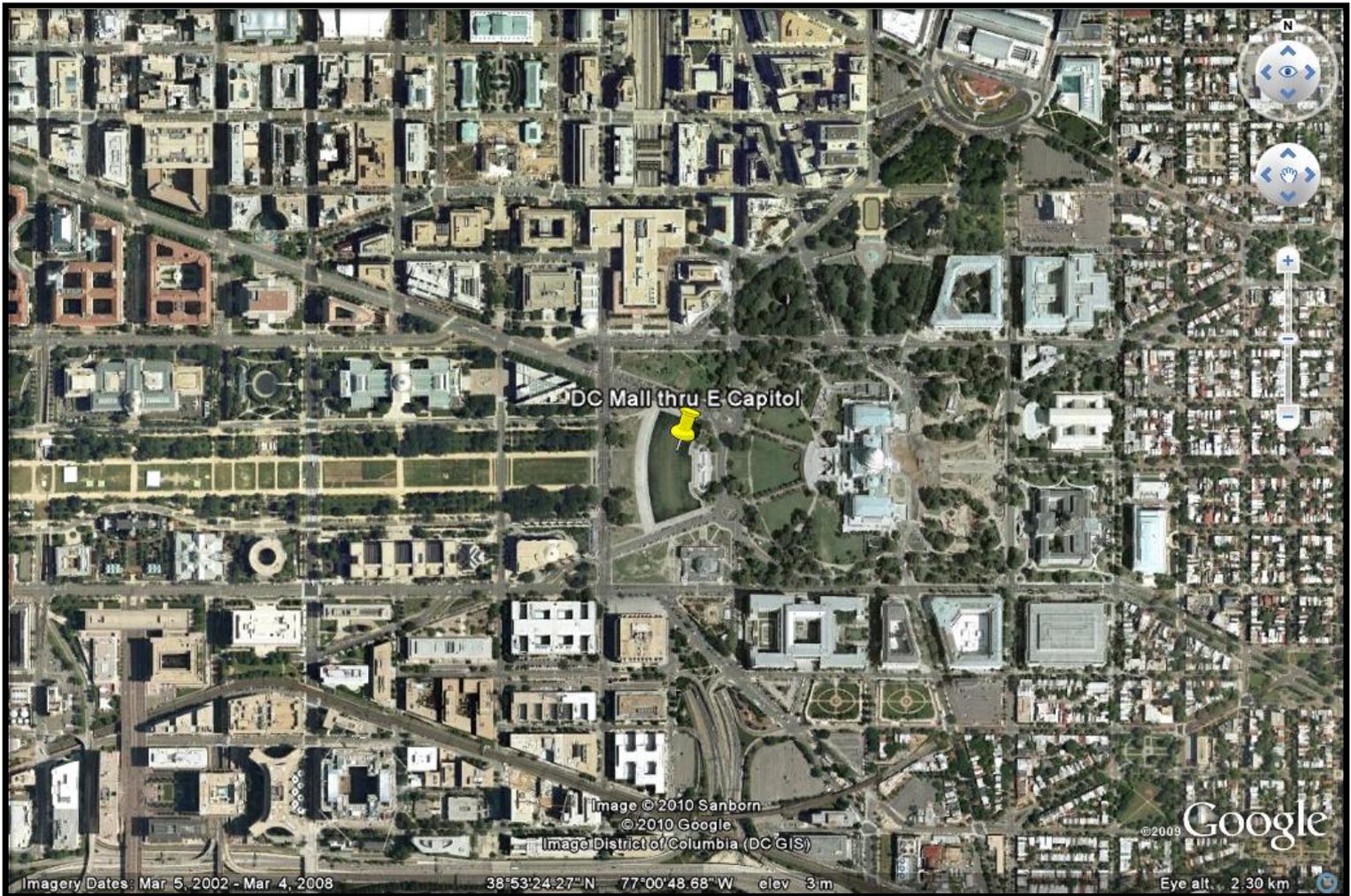
# Congratulations to UC Davis



# White roofs are popular in Tucson, AZ



# Washington, DC (Federal) has problems

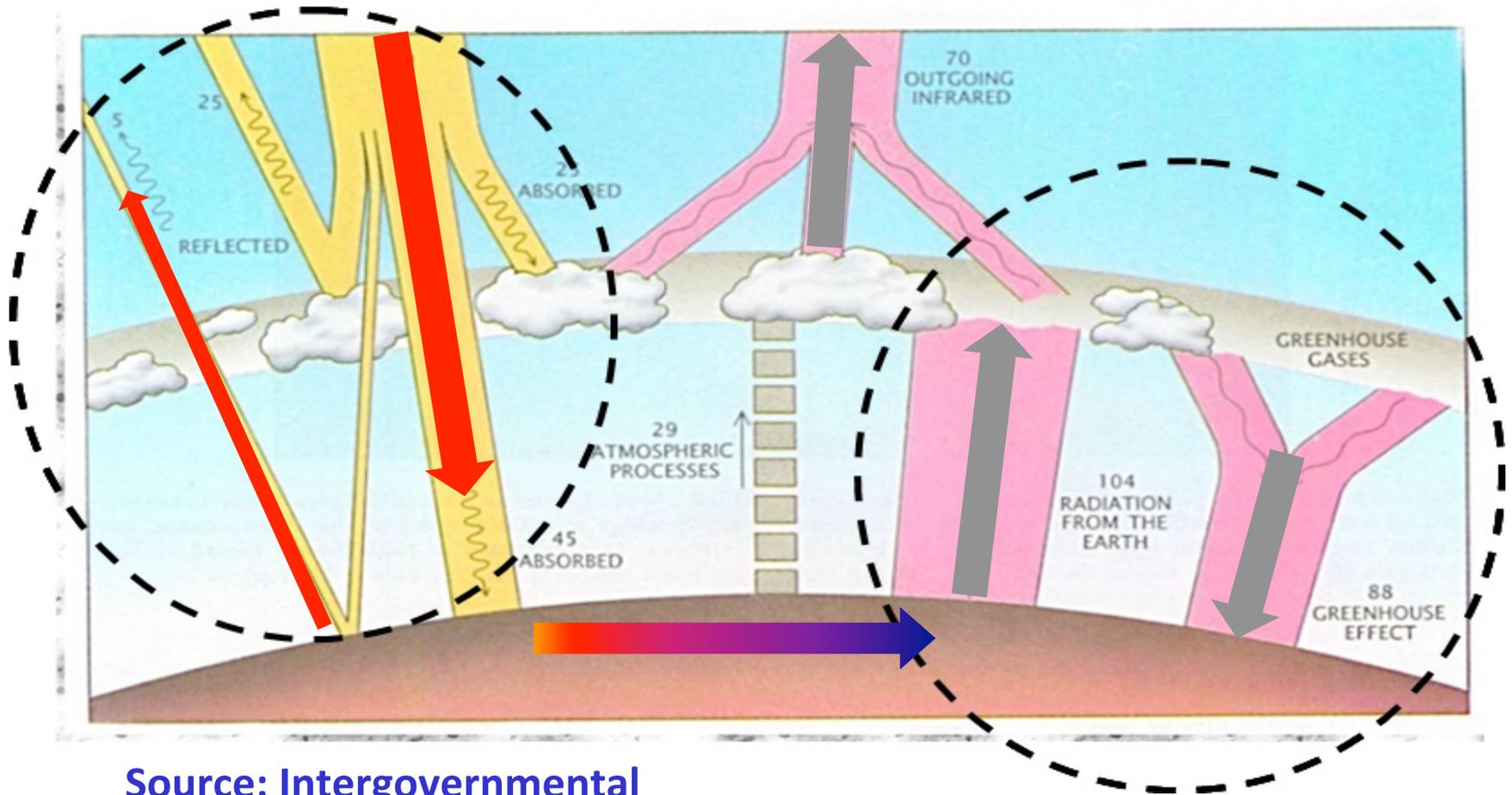


# Pentagon



Cooling our planet

# Solar-reflective surfaces cool the globe via “negative radiative forcing”



Source: Intergovernmental Panel on Climate Change (IPCC)

**GLOBAL COOLING:** making 100 m<sup>2</sup> (1000 ft<sup>2</sup>) of gray roofing white offsets the **emission** of 10 t of CO<sub>2</sub>



How much CO<sub>2</sub> equivalent is offset if we whiten all eligible urban flat roofs worldwide? (i/ii)

- Answer: **24 Gigatonnes (Gt)**
  - 2/3 of a year's worldwide emission
  - Gigatonne = billion metric tons
- If implemented over 20 years (the life of a roof or a program) this is  $\approx$  1.2 Gt/year.

# How much CO<sub>2</sub> equivalent is offset if we whiten all eligible urban flat roofs world-wide? (ii/ii)

- Offset is equivalent to **taking 300 million cars off the road for 20 years.**
  - There are about 600 million passenger cars world wide, and they each emit  $\approx 4$  t CO<sub>2</sub>/year.





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# **COOL CITIES, COOL PLANET**

# **What to do now**

## Progress in energy efficiency standards

- In 2005, California's "Title 24" energy efficiency standards prescribed white surfaces for low-sloped roofs on commercial buildings. Several hot states are following.
- In 2008, California prescribed "cool colored" surfaces for steep residential roofs in its 5 hottest climate zones.
- **Other U.S. states & all countries with hot summers should follow.**

# Recent cool roof progress (2005 – 2011)

- 2005
  - California Title 24 – “Flat roofs shall be white” (15 out of 16 climate zones). Walmart adopts white roofs for ALL stores.
  - EPA ENERGY STAR lists Cool Roof Materials
- 2010
  - June 1<sup>st</sup>, 2010 – Memo from U.S. Energy Secretary Steven Chu calls for all DOE Buildings to have white roofs, if cost-effective
  - June 16<sup>th</sup>, 2010 – Marine Corp follows suit, Pentagon following slowly
  - June 19<sup>th</sup>, 2010 – *RetroFIT Philly* announces winner of “coolest block” contest to white-coat black roofs of row houses.
- 2011

Cool Cities launched – see [GlobalCoolCitiesAlliance.org](http://GlobalCoolCitiesAlliance.org)

  - Spring 2011 – US will launch, at G20 Energy Ministers meeting, a voluntary Cool Roofs initiative and may even offer technical assistance to developing countries who join early.

## To come 2012...

- Model codes will be modified to prescribe “flat roofs shall be white”
  - ASHRAE for commercial buildings
  - EECC for residential buildings
- But states and cities still must adopt model codes

# Global Cool Cities Alliance could unite many initiatives and trade associations



ClimateWorks



EMERALD CITIES COLLABORATIVE  
GREEN • FAIR • DEMOCRATIC



American Council for an Energy-Efficient Economy

THE CLIMATE GROUP

## Resources on the web

- **Art Rosenfeld's website**
  - [ArtRosenfeld.org](http://ArtRosenfeld.org)
- **Cool Colors Project**
  - [CoolColors.LBL.gov](http://CoolColors.LBL.gov)
- **Heat Island Group**
  - [HeatIsland.LBL.gov](http://HeatIsland.LBL.gov)
- **Cool Communities Project**
  - [CoolCommunities.LBL.gov](http://CoolCommunities.LBL.gov)
- **Roof Savings Calculator**
  - [RoofCalc.com](http://RoofCalc.com)
- **Global Cool Cities Alliance**
  - [GlobalCoolCitiesAlliance.org](http://GlobalCoolCitiesAlliance.org)
- **Cool Roof Rating Council**
  - [CoolRoofs.org](http://CoolRoofs.org)
- **Cool California**
  - [CoolCalifornia.org](http://CoolCalifornia.org)
- **EPA Heat Islands**
  - [epa.gov/heatisland](http://epa.gov/heatisland)
- **Energy Star Cool Roofs**
  - [EnergyStar.gov](http://EnergyStar.gov)