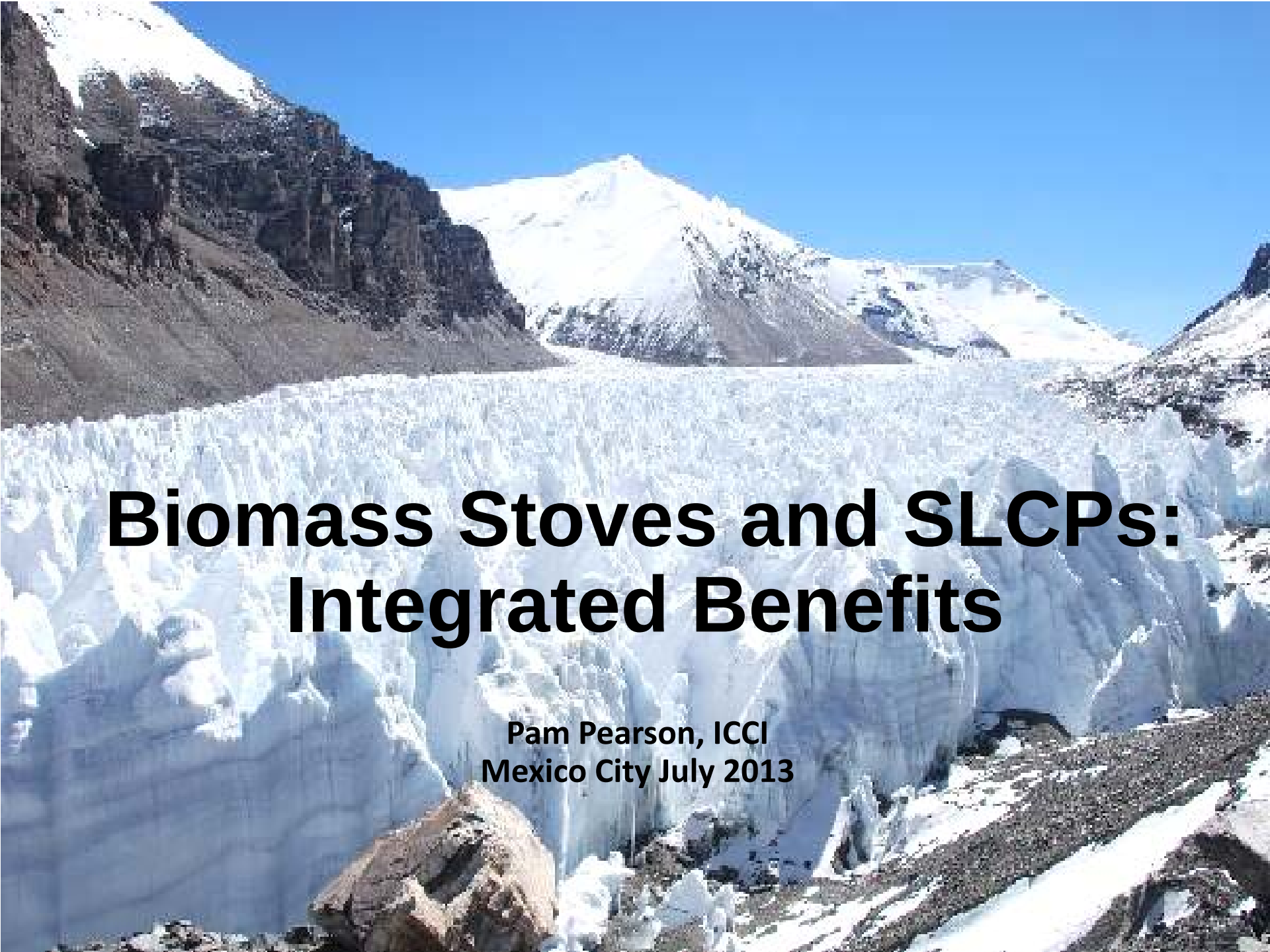


Biomass Stoves and SLCPs: Integrated Benefits

Pam Pearson, ICCI

Mexico City July 2013

Main Take-aways

- Black carbon (and ozone precursors) are ***regional*** air pollutants: both health and climate/water cycle impacts closest to source
- BC impacts from biomass clear in cryosphere regions
- Stoves are stoves: whether for heating, cooking or both; whether fuel is wood, dung or coal
- Not all “improved” stoves reduce BC – most actually do not
- BC and health may be more closely related than we thought: stoves that reduce BC may also be those with greatest health impact

Short-Lived Climate Pollutants/Forcers

Short Lived Climate Forcers

Compound	*Lifetime*	*GWP* 100 yr	*GWP* 20 yr
• **Black Carbon-soot** Regional and local	1-2 weeks	210-1500	690-4700
• **Troposperic Ozone** Regional and global Regulated under ECE-LRTAP	appr. 1 month	20% of methane	
• **Methane** Regulated under KP. Global	12 yrs	25[1] (31)	72 (104)

1) AR 4

Basics of Stove Pollution/BC/Soot

- Produced by incomplete combustion: usually, not high enough temperature or insufficient air/too much fuel

- Main focus of “improved” stoves often lower fuel use, which sometimes means burning at lower temperatures = more soot per unit fuel. Incremental improvements may not change BC at all – may be hardest to address

- Chimneys improve household health but spread the problem!

- Very recent studies seem to indicate smallest carbonaceous particles may cause greatest portion of health issues – bind toxic metals, small enough to cross from lungs into bloodstream, not coughed out

Stove Improvements to Address BC Emissions

- Regulate fuel amount (pellets, coal briquettes) or change fuels entirely (LPG, biogas, ethanol)
- Make sure enough air for complete combustion (fan-assisted/forced draft stoves)
- Proper user operation key! Especially for wood heating stoves, forced draft and biogas stoves

What Can Be Accomplished?

A Cryosphere Action Plan

- ICCI has initiated work on a Cryosphere and Development Report, with support from World Bank
- Using same models as UNEP/WMO to assess regional cryophere impacts- NASA-GISS, EcHAM (JRC) (eventually also Hadley Centre)
- Looks at BC impacts also measure-by-measure and regionally (UNEP Assessment combined all measures and more global)
- New/better estimates of BC impacts, esp from open burning, cookstoves, possibly flaring
- Compare to BAU, SLCP only and SLCP+CO2 (as a 450 ppm alternative)
- Policy conclusions and proposals under development

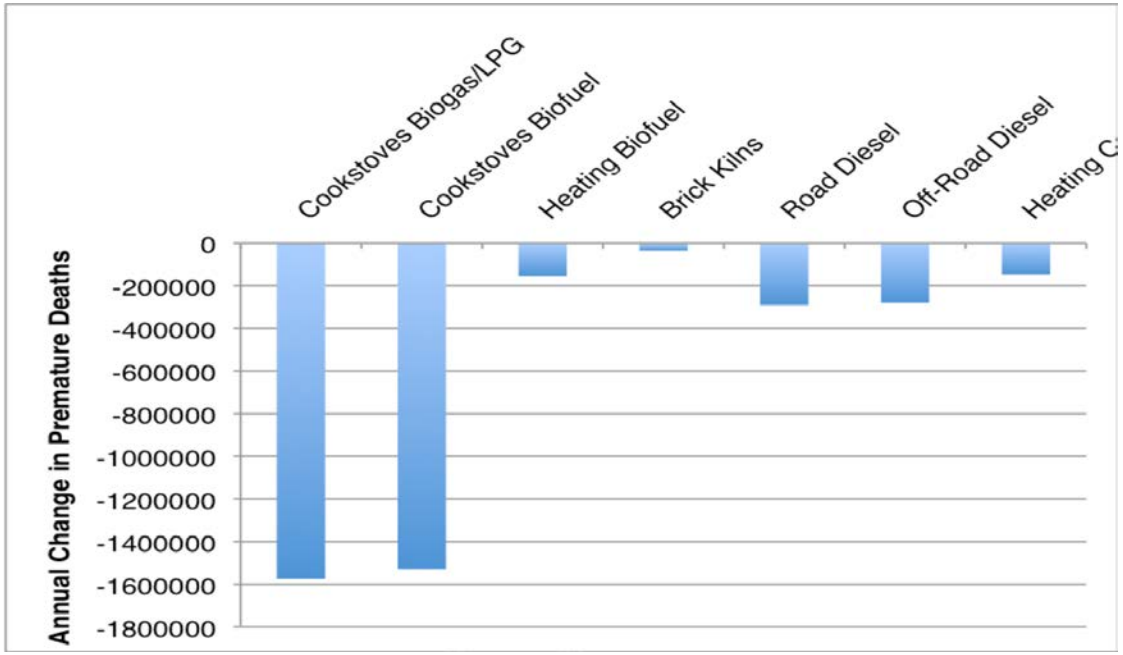
Modeled BC Sources – Applied Measures:

- Cookstoves - Fan Assisted (***new measure definition***)
- Cookstoves - 50%LPG/50% biogas (***new measure definition***)
- Diesel Onroad - EURO IV
- Diesel Offroad - EURO IV
- Biomass heating stoves – Pellets (***with seasonality***)
- Coal heating stoves – Briquettes (***with seasonality***)
- Oil and Gas Flaring (***better spatial resolution***) – BP
- ***Open Burning – 50% reduction globally applied to sat maps***
- *[Diesel generators – BAT/filters]*
- *[Kerosene (wick) lanterns]*

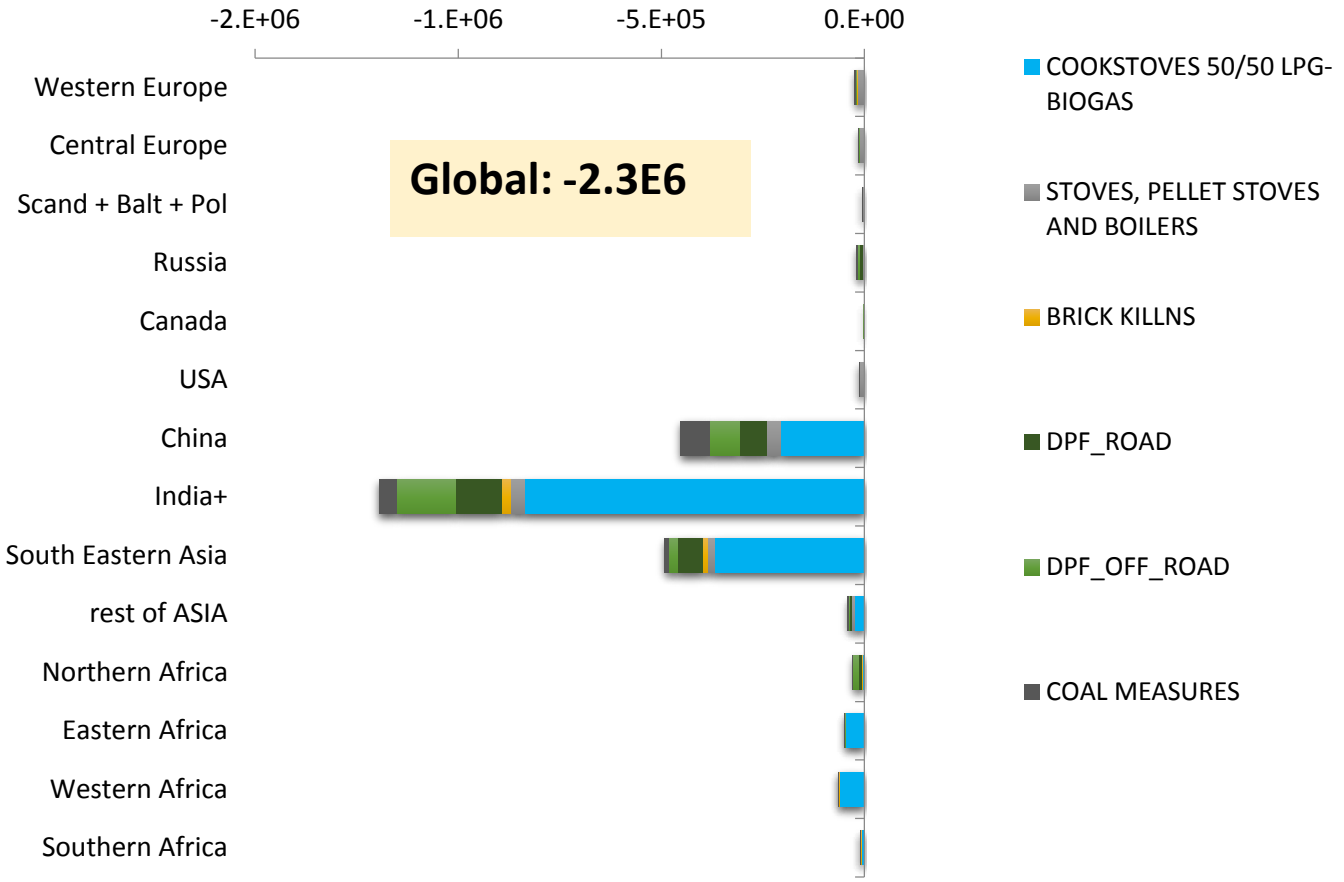
[ ] = proposed, still under IIASA/JRC development

Main Reason to Address Cookstoves: Health and other Social/Gender Benefits

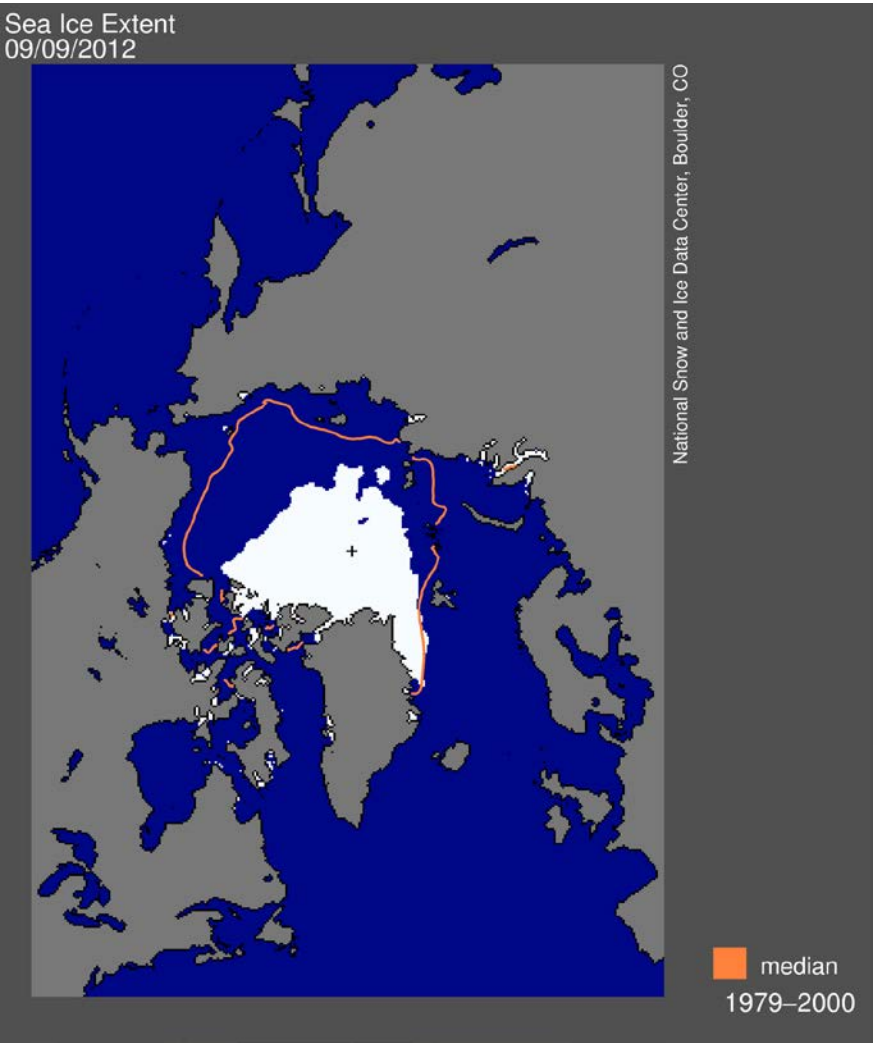
Avoided Mortality – Outdoor Air 1.5 mill
(add 3.5 million household, per WHO GBD: total more than HIV/AIDs, TB, malaria combined)

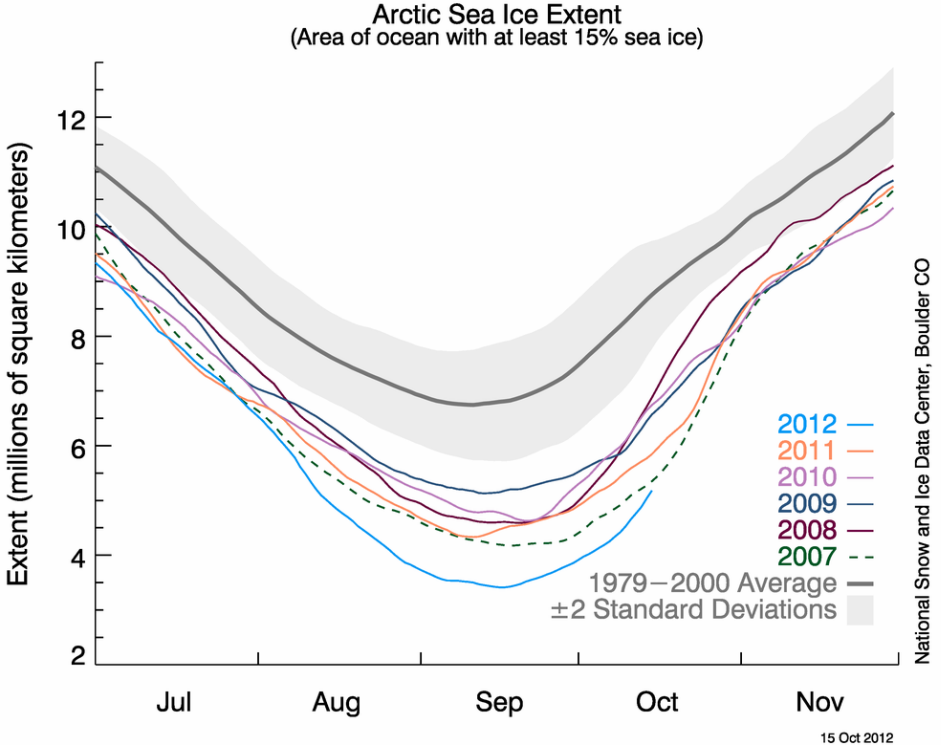


Avoided Premature Death



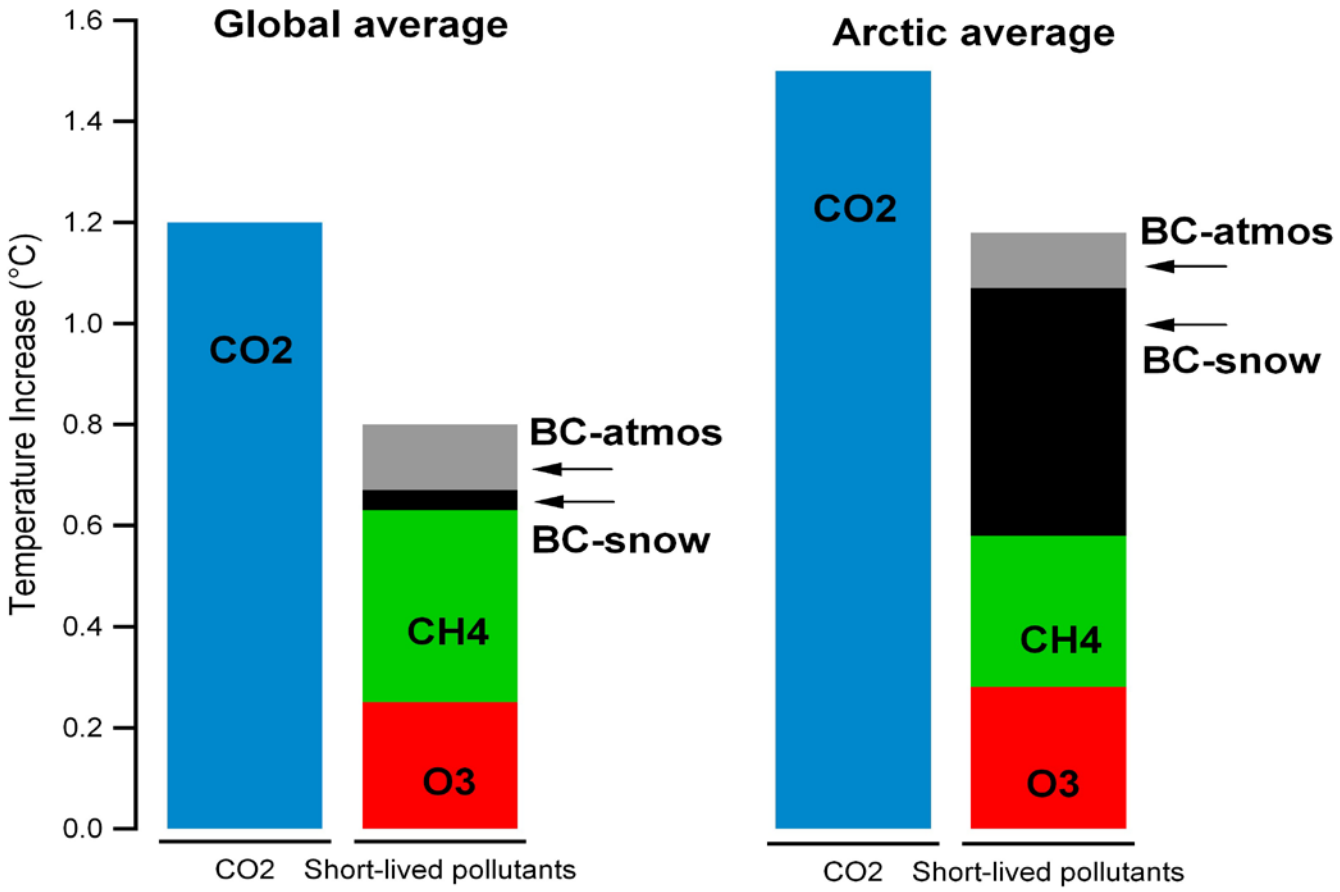
Main Reason to Address Stoves Health+ Development, BUT for regional/climate co-benefits…



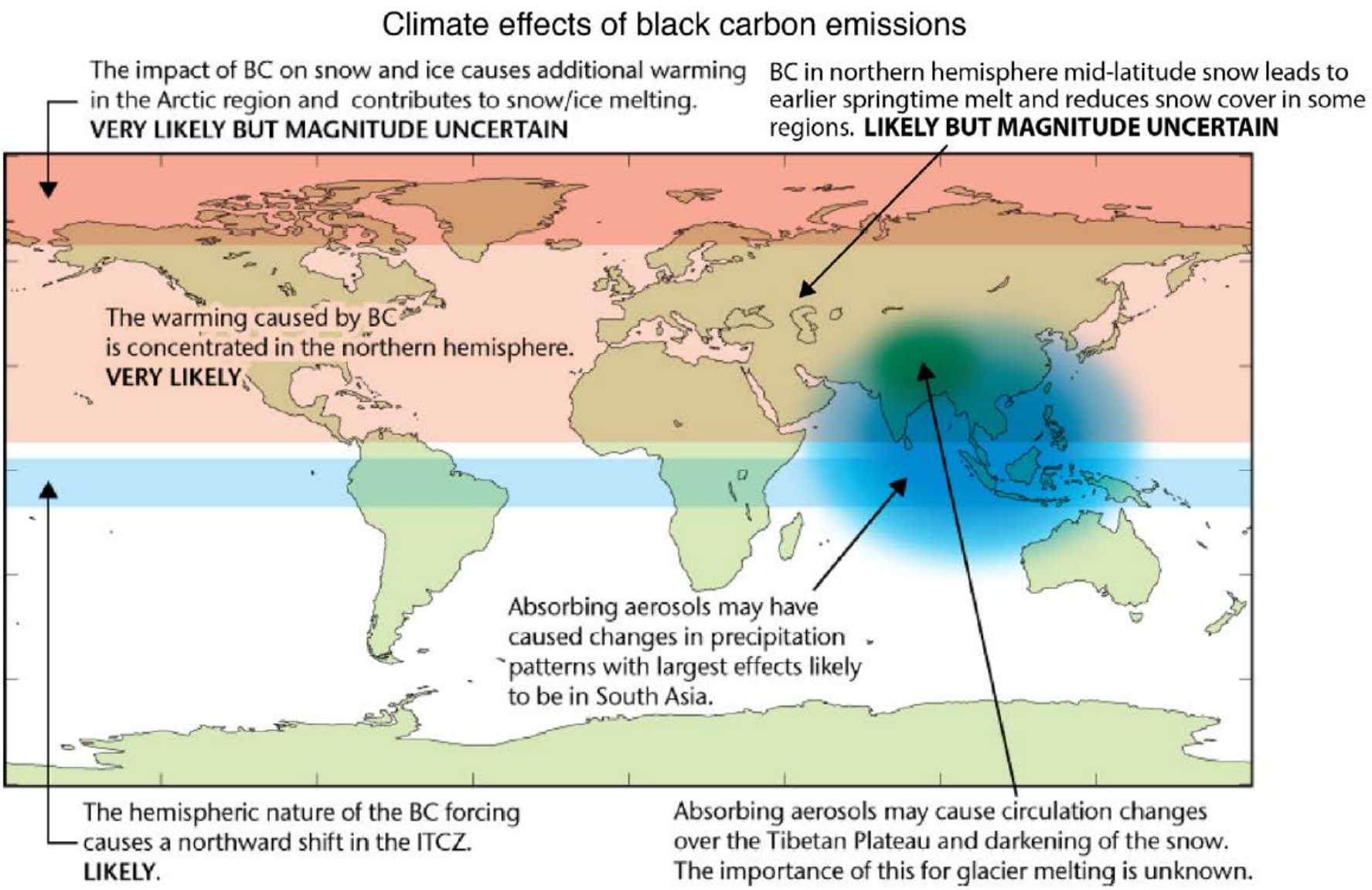


3.29 million square kilometers

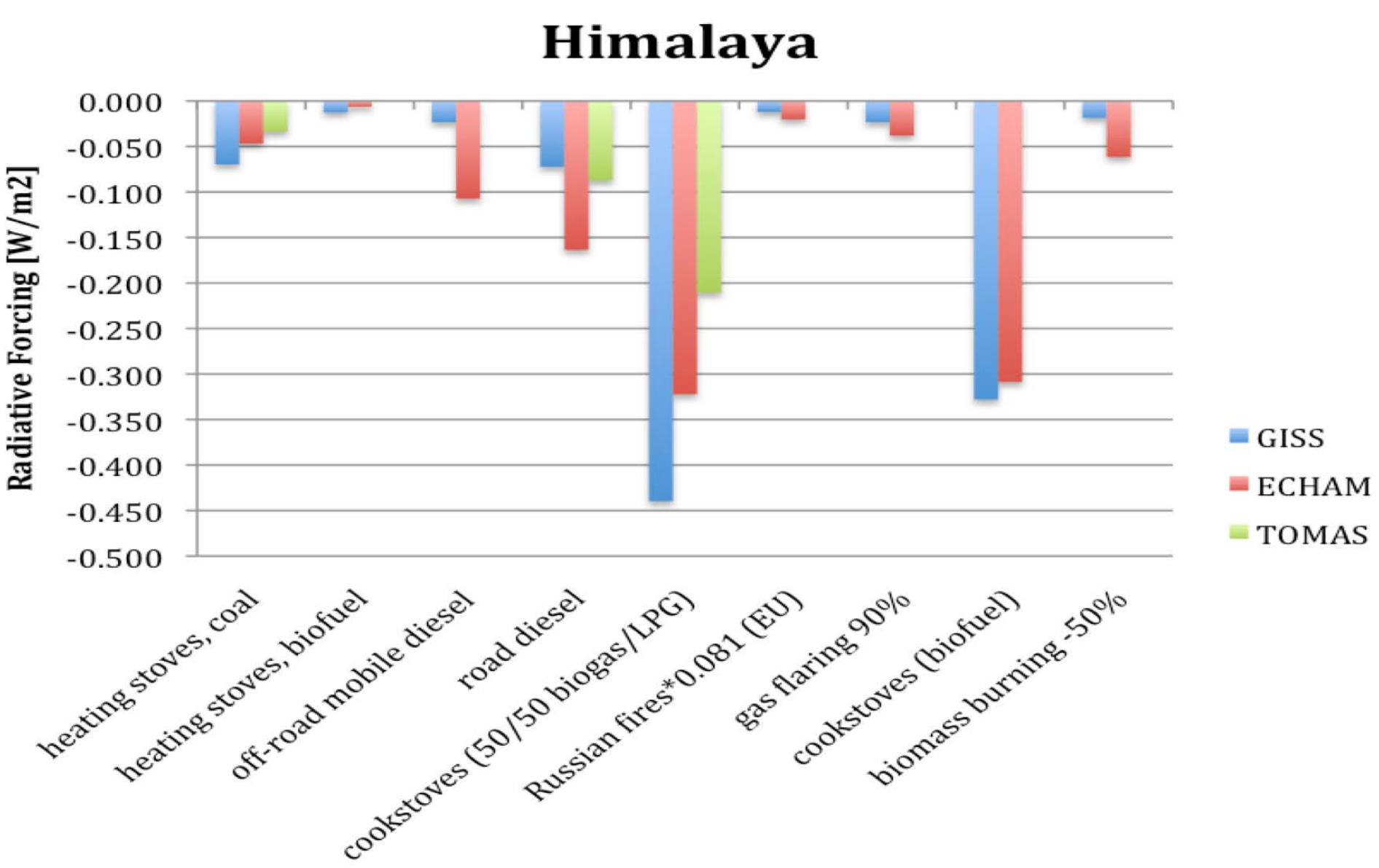
Arctic Council: Greater Impacts from BC on Snow/Ice

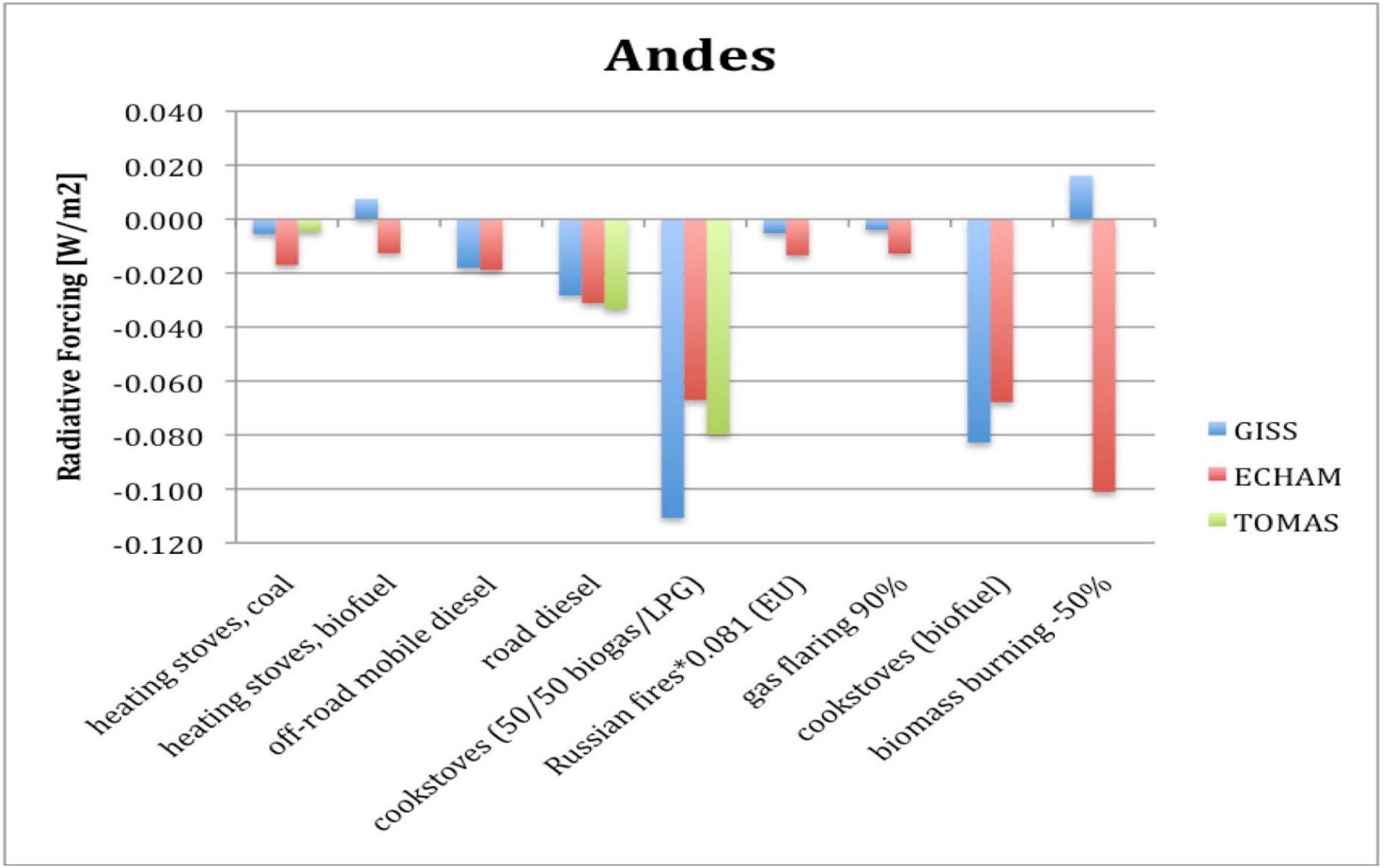


Quinn, Impact of Short-Lived Pollutants on Arctic Climate, presented at AMAP, Oslo, September 15 2008



Bounding BC Study, Bond et al. 2013


Himalaya
Radiative Forcing [W/m2]
0.000
-0.050
-0.100
-0.150
-0.200
-0.250
-0.300
-0.350
-0.400
-0.450
-0.500
heating stoves, coal
heating stoves, biofuel
off-road mobile diesel
road diesel
cookstoves (50/50 biogas/LPG)
Russian fires*0.081 (EU)
gas flaring 90%
cookstoves (biofuel)
biomass burning -50%
GISS
ECHAM
TOMAS


Andes
Radiative Forcing [W/m2]
0.040
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
-0.120
heating stoves, coal
heating stoves, biofuel
off-road mobile diesel
road diesel
cookstoves (50/50 biogas/LPG)
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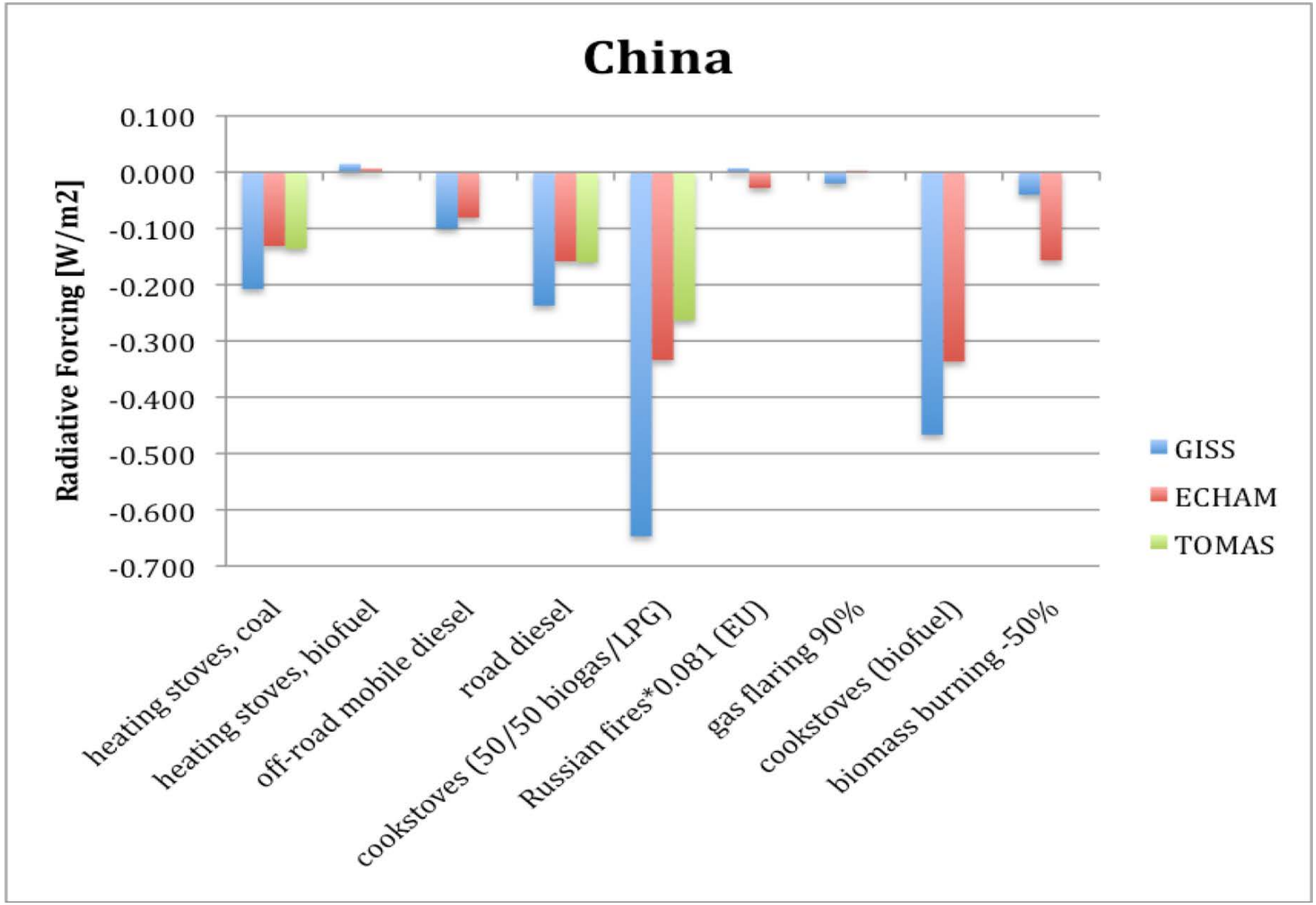
China
Radiative Forcing [W/m2]
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
-0.700
heating stoves, coal
heating stoves, biofuel
off-road mobile diesel
road diesel
cookstoves (50/50 biogas/LPG)
Russian fires*0.081 (EU)
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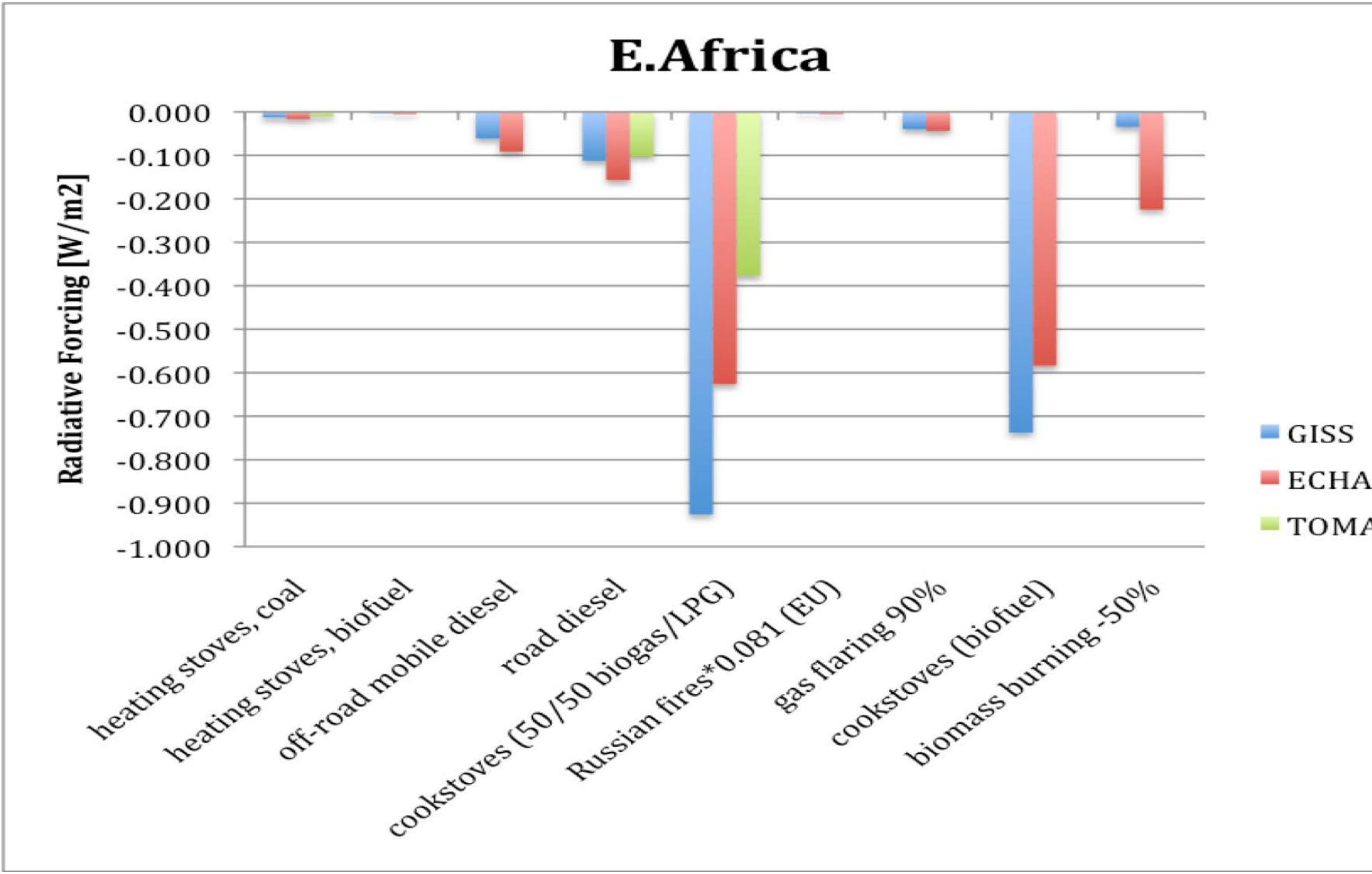
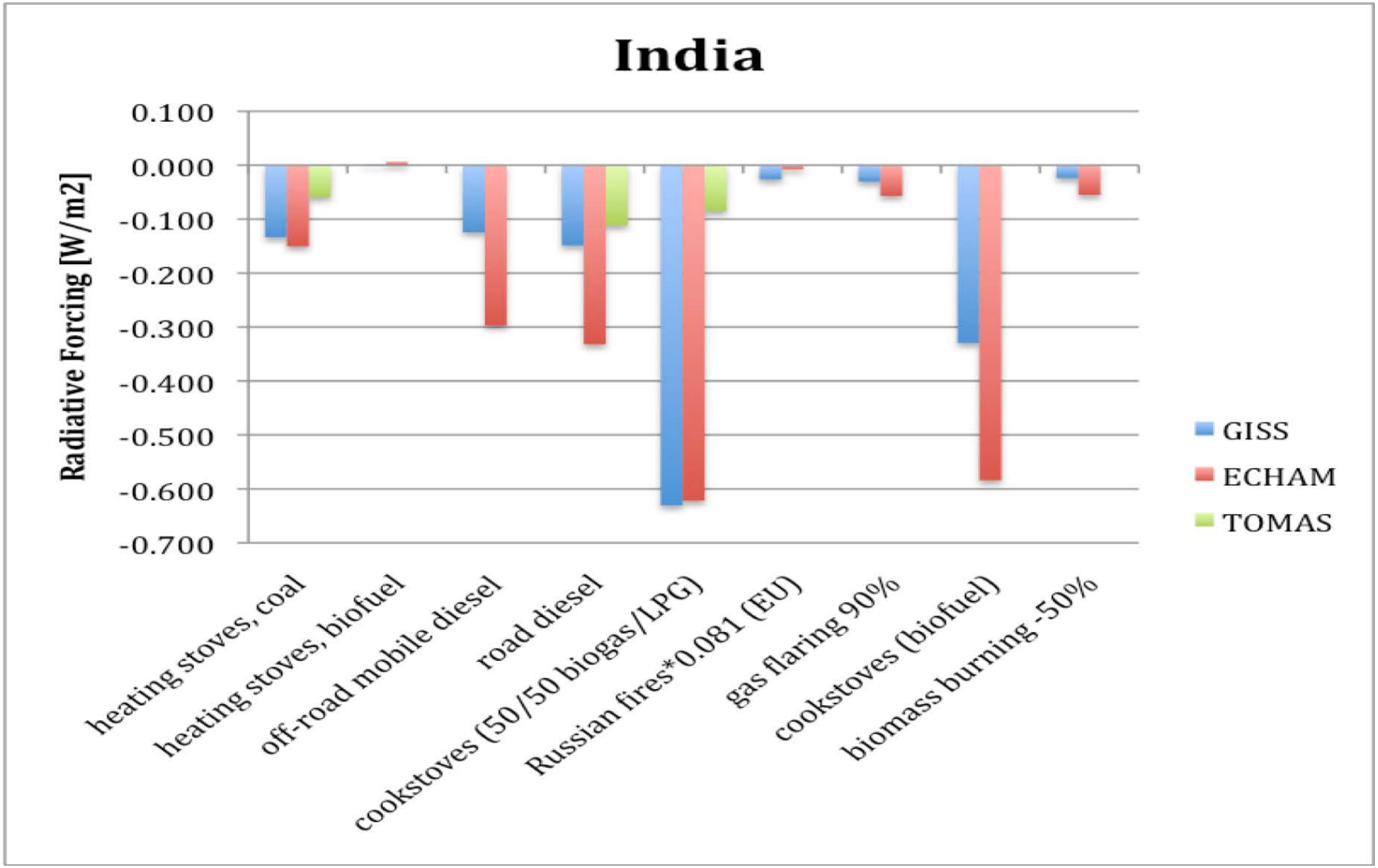
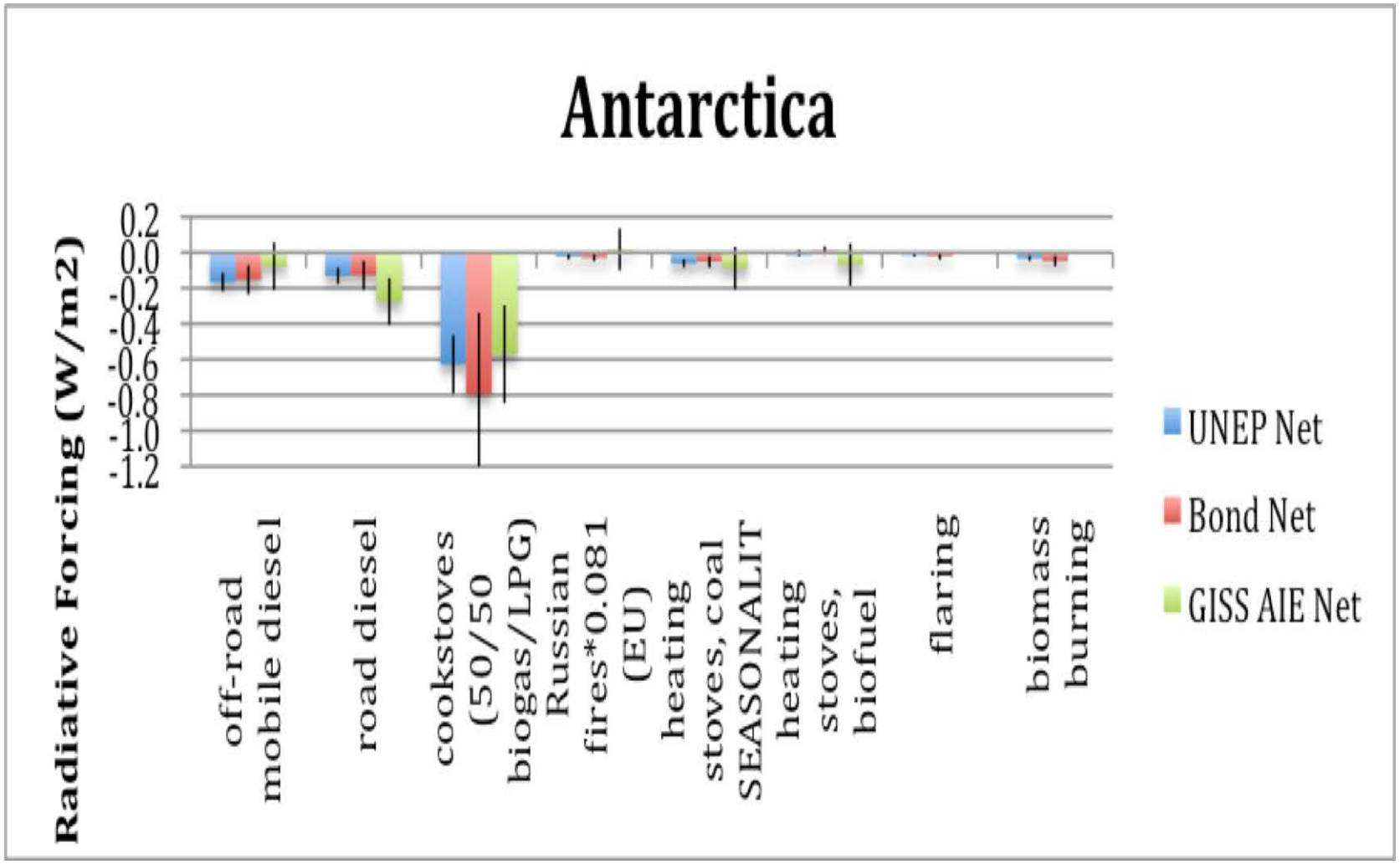
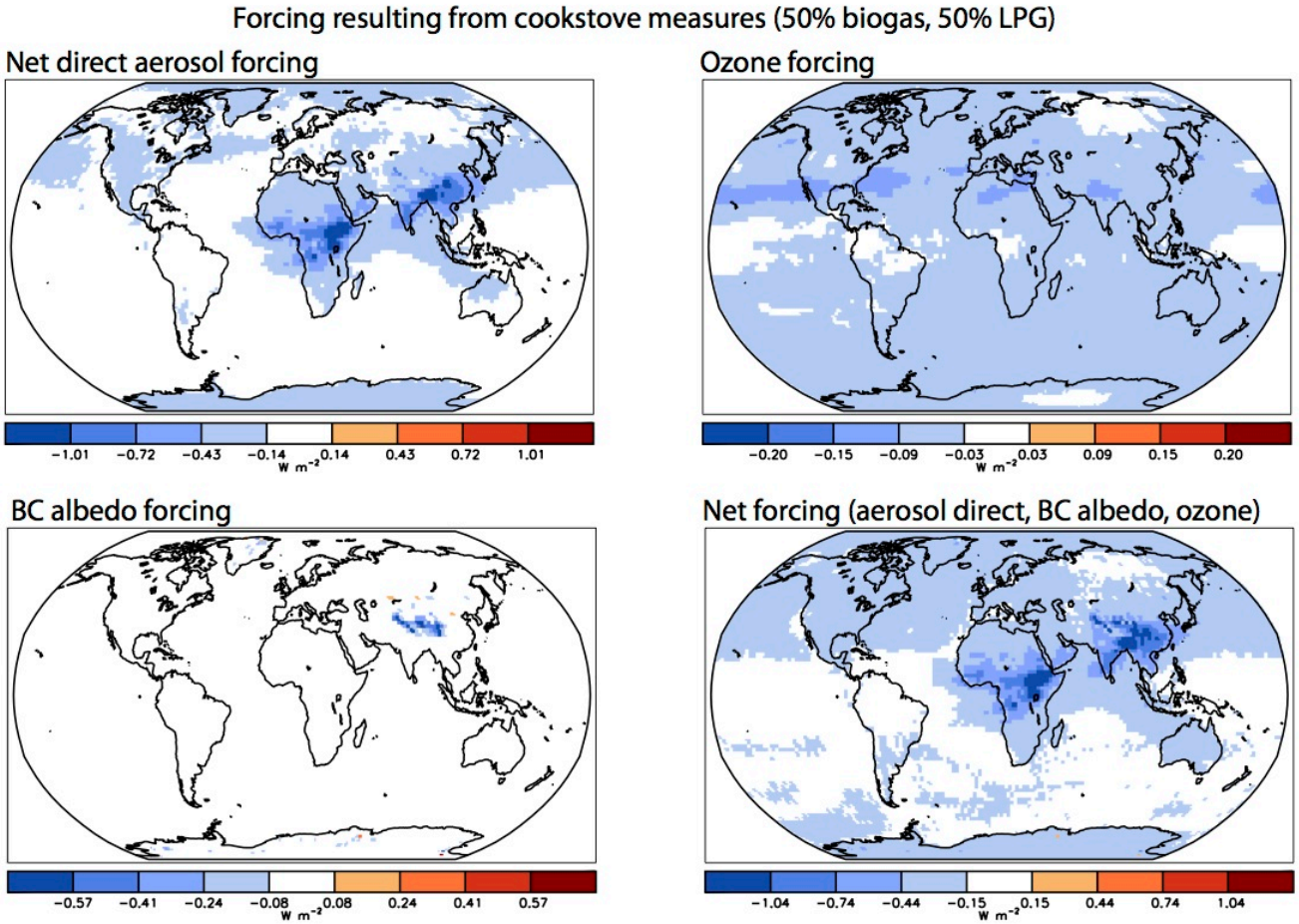
cookstoves (biofuel)
biomass burning -50%
GISS
ECHAM
TOMAS


E.Africa
Radiative Forcing [W/m2]
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
-0.700
-0.800
-0.900
-1.000
heating stoves, coal
heating stoves, biofuel
off-road mobile diesel
road diesel
cookstoves (50/50 biogas/LPG)
Russian fires*0.081 (EU)
gas flaring 90%
cookstoves (biofuel)
biomass burning -50%
GISS
ECHA
TOMA

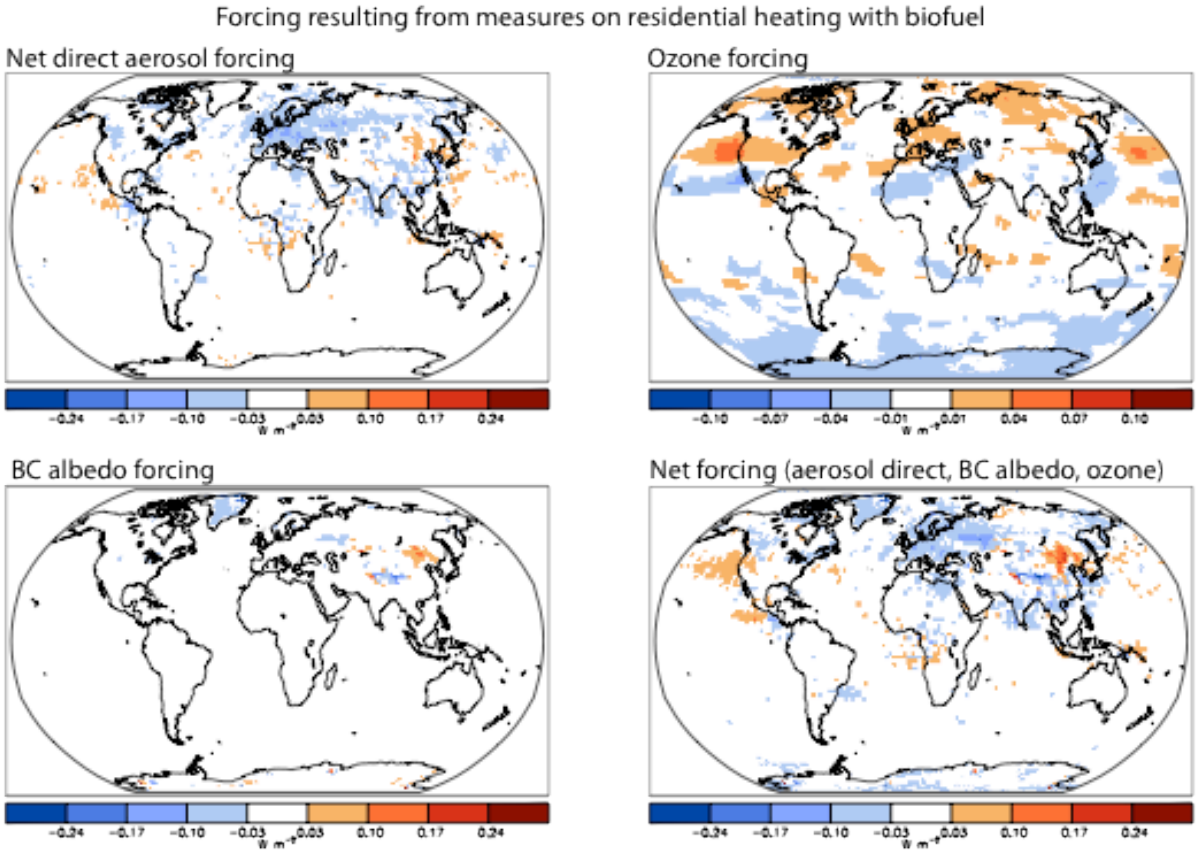

India
Radiative Forcing [W/m2]
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
-0.700
heating stoves, coal
heating stoves, biofuel
off-road mobile diesel
road diesel
cookstoves (50/50 biogas/LPG)
Russian fires*0.081 (EU)
gas flaring 90%
cookstoves (biofuel)
biomass burning -50%
GISS
ECHAM
TOMAS


Antarctica
Radiative Forcing (W/m2)
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
off-road mobile diesel
road diesel
cookstoves (50/50 biogas/LPG)
Russian fires*0.081
(EU) heating stoves, coal SEASONALIT
heating stoves, biofuel
flaring
biomass burning
UNEP Net
Bond Net
GISS AIE Net

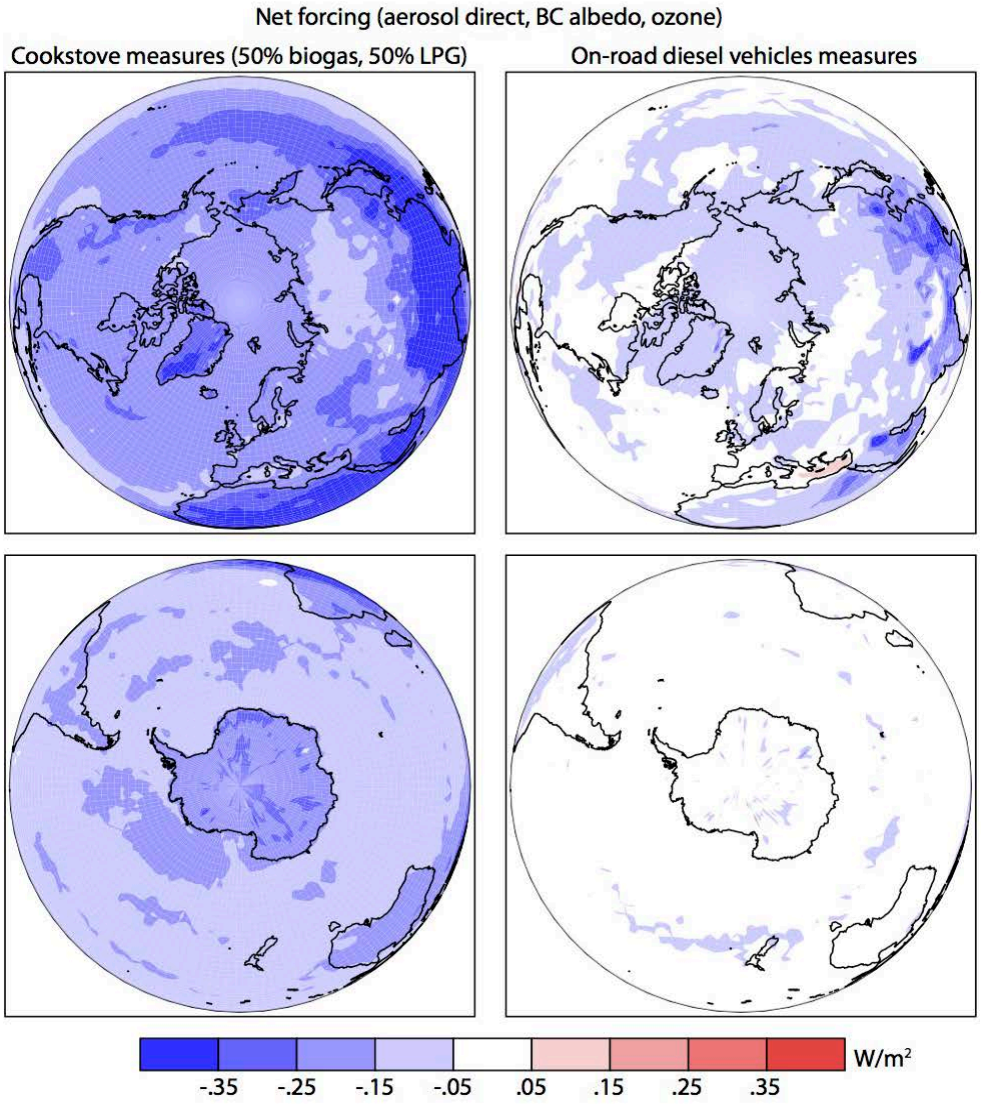
Preliminary GISS Maps: Cookstoves (50%LPG/50% Biogas)



Preliminary GISS Maps: Domestic Biofuel (Woodburning - Pellets)



Net Forcing Polar Comparison – Cookstoves, Diesel



Decreasing BC from Stoves

- Improvements from behavior changes, especially burning practices (enough air, dry wood, proper fuel amount)
- Four current models DO decrease BC and could be widely distributed:
  - Forced draft/fan assisted (esp w/pellets)
  - Biogas
  - LPG
  - Ethanol
- Need further product development for ”whole wood” sticks/logs
- Actual measurements key! BC testing protocols
- Cooperation between woodstove and cookstove product developers on promising ways forward: a Cookstoves-Woodstoves Design ”Summit”?

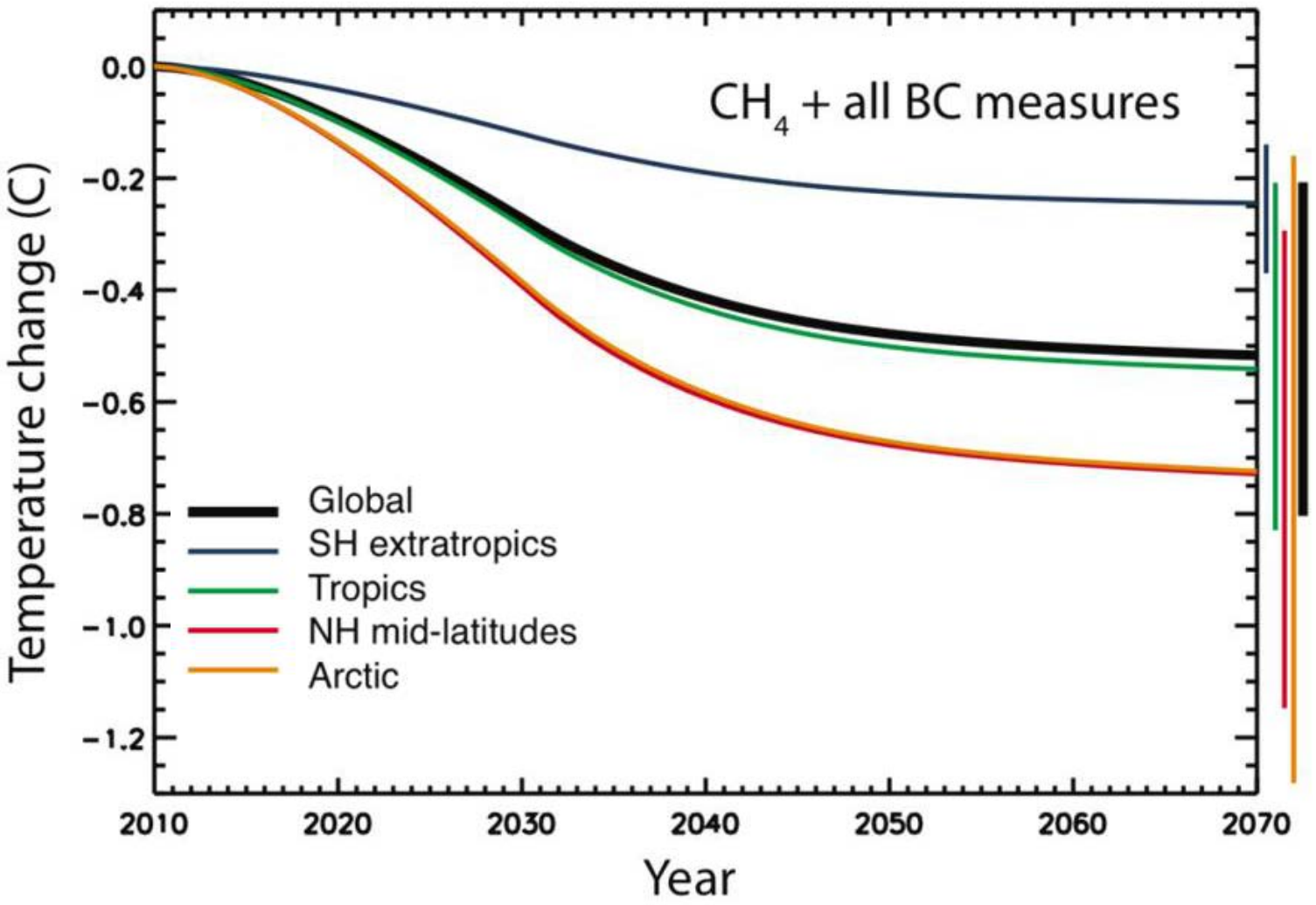
Woodstoves-Cookstoves Synergies

- Similar regional health and climate impacts
- European local health officials increasingly concerned about woodstove pollution
- Stoves used for both heating and cooking most often near cryosphere regions
- Arctic primary climate impact for woodstoves, Himalayas and Andes (and cryosphere globally) for cookstoves
- Similar (to some degree) design and usage challenges


Thank You
More information:
www.iccinet.org

Original UNEP/WMO Assessment: Global Temperature Change

Reduced Arctic warming by over 0.7 ^{o}C by 2040 compared to the reference scenario, with measures taken 2010-2030. **Mitigating ~2/3 of projected rise degrees warming**



Global and Regional Temperature Change Relative to the Reference Scenario (hybrid modelling of GISS, ECHAM informed by the literature)