

SUMS Progress Report: Measuring stove and temperature use with temperature sensors

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Why Monitor Stove Use?

- Delivering stove is not enough – need to know that it is being used
 - Almost all stove benefits/impacts will only occur if it is being used
- Adoption process is complex
- Performance in the field is consistently over estimated by current lab tests
 - Operator behavior and fuel variation
 - Deterioration
 - Assumption of 100% usage in field



Photo: Ilse Ruiz-Mercado, CRECER Project



Current Monitoring Methods

- Household surveys are the standard practice, but they are:
 - Expensive – field workers, transport, etc.
 - Slow – weeks to obtain data and cannot repeat too often
 - Imprecise – people do not remember details of usage
 - Biased – people respond to please researcher



What are SUMS**? (1)

- “Devices to quantify stove usage objectively and unobtrusively by directly measuring temperature, light, electrical current, gas concentrations, etc. in stoves or kitchens...”
- “A SUM-System is the set of processing algorithms, software, device readout, database management and reporting required for the systematic study of stove adoption and use”

**Stove Use Monitors (SUMs) to quantify adoption and sustained use of improved cookstoves. Ruiz-Mercado, I., Canuz, E., Acevedo, R., Smith, K. R. Biomass and Bioenergy. Forthcoming. 2011.

What are SUMS? (2)

- Logging temperature sensors that can be affixed to stoves
- Resulting temperature trace indicates when stove was used
- Can be placed for weeks/months at a time
- Objective and non-intrusive

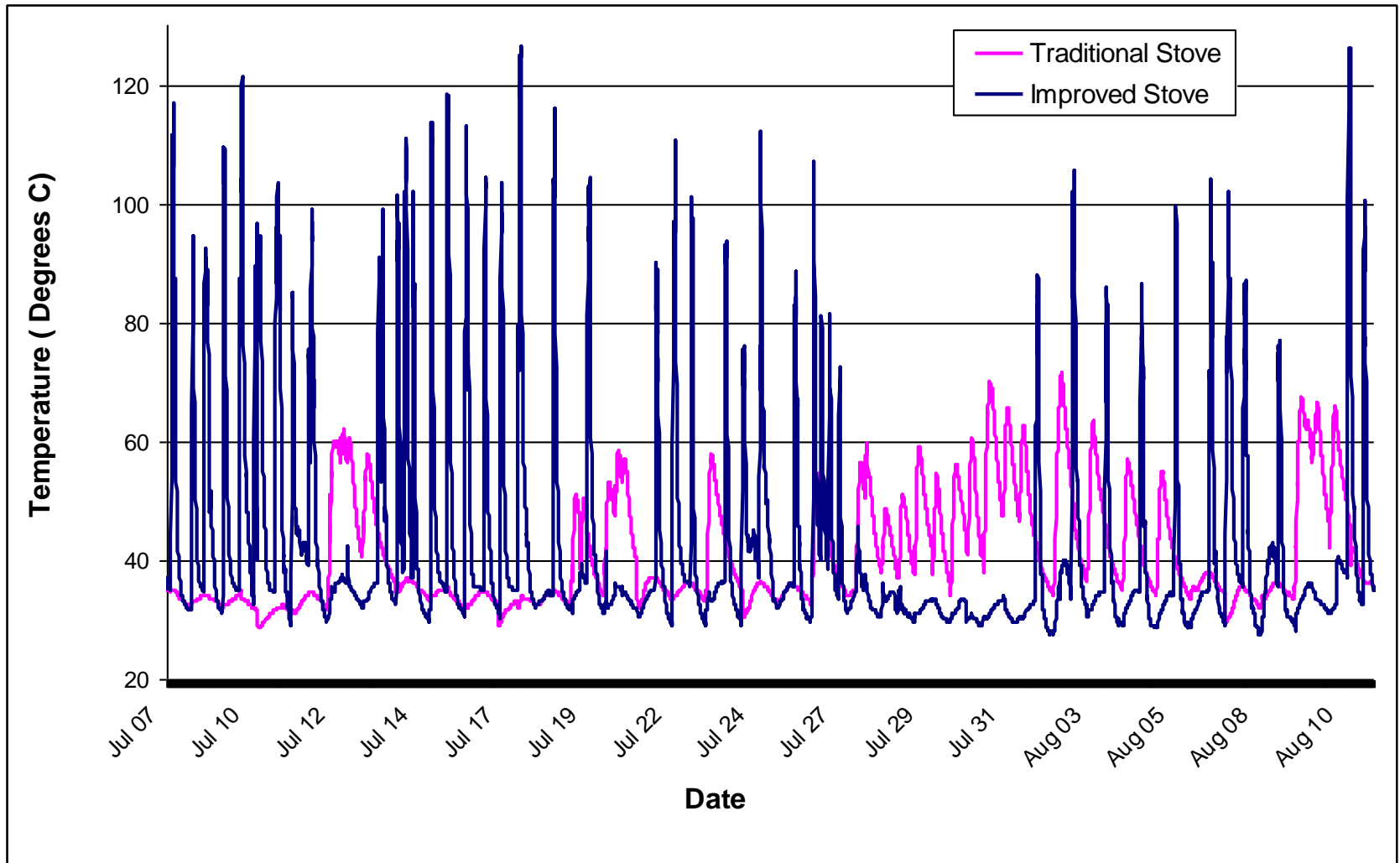


Photo: Ilse Ruiz-Mercado, CRECER Project

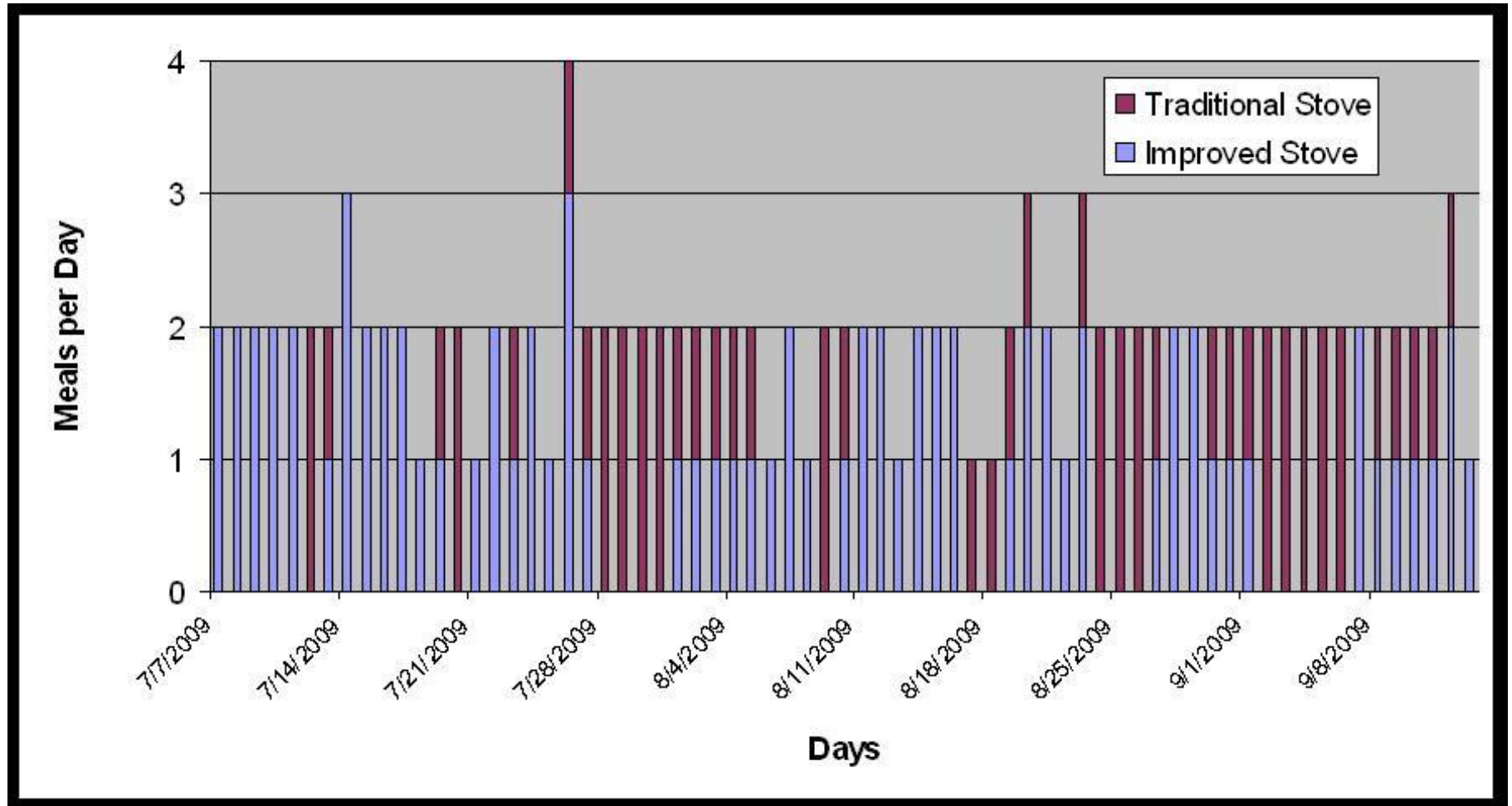


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Example SUMS Output



Uses per Day



Patterns of Stove Use from Around the World Captured with the UCB-SUMS

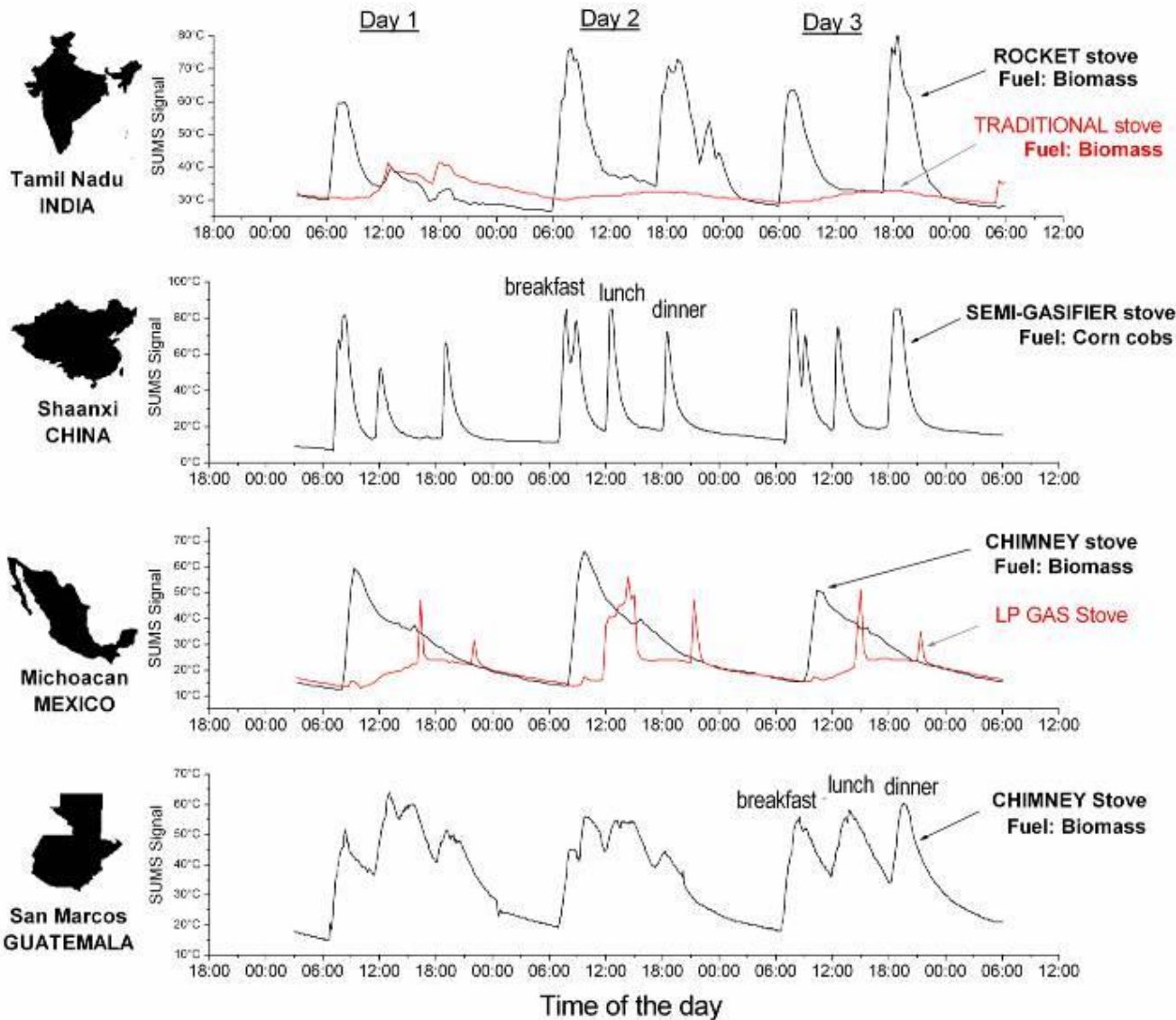
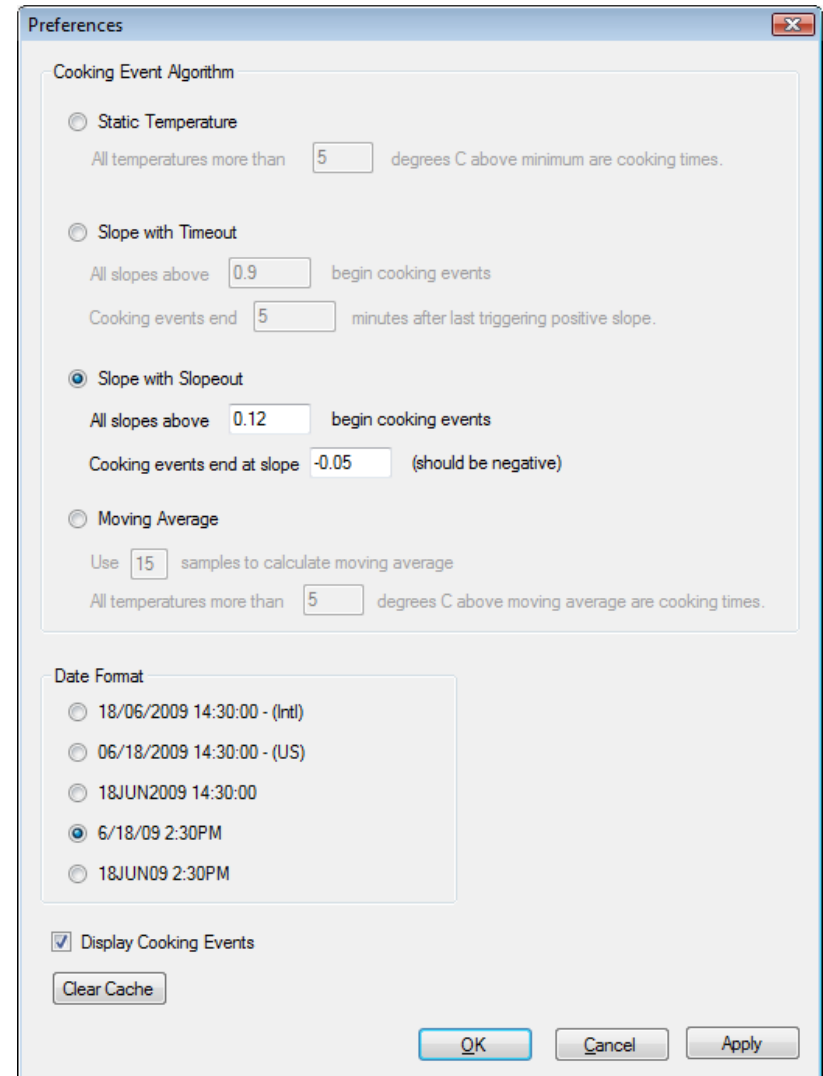


Image from Ruiz-Mercado. Data shown above were not collected or analyzed with the software presented here.

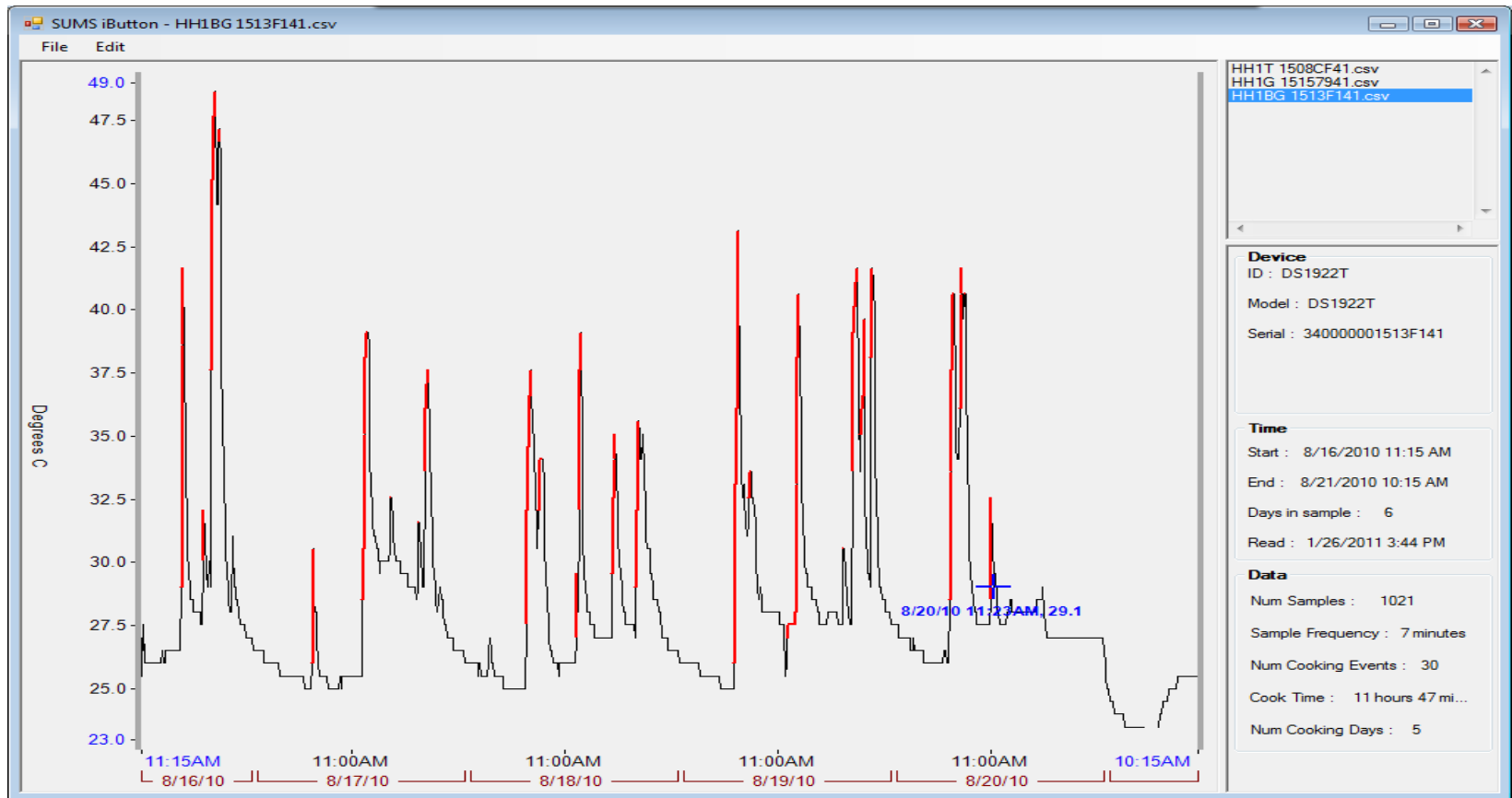
SUMS Software

- New tool for processing temperature data
- View data from multiple stoves side-by-side
- Counts number of stove uses and cooking time according to several algorithms
- Export usage statistics

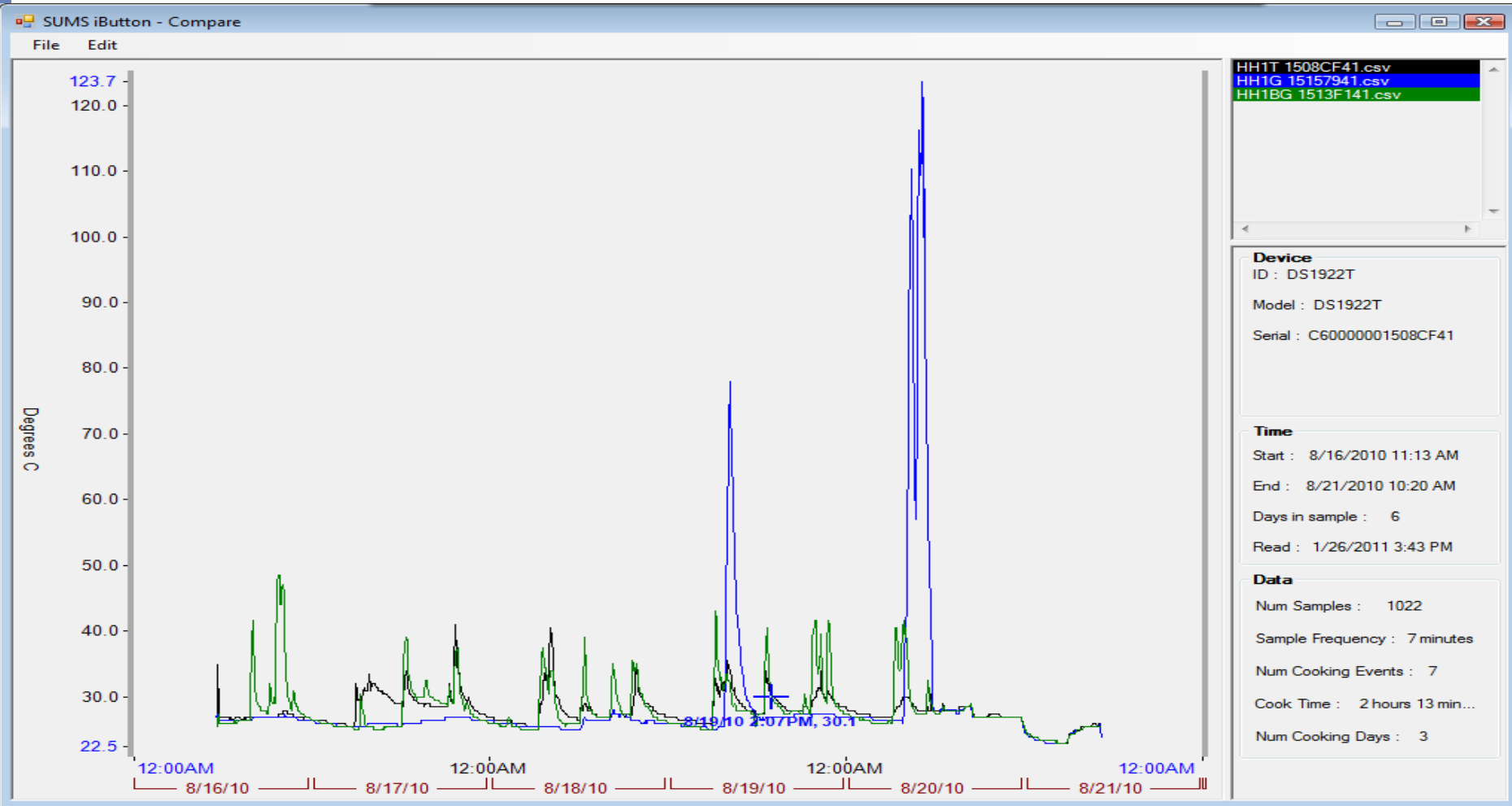


The screenshot shows the 'Preferences' dialog box for the SUMS software. It is divided into two main sections: 'Cooking Event Algorithm' and 'Date Format'. In the 'Cooking Event Algorithm' section, there are four radio button options: 'Static Temperature', 'Slope with Timeout', 'Slope with Slopeout', and 'Moving Average'. The 'Slope with Slopeout' option is currently selected. Each option has associated input fields for numerical values. For 'Slope with Slopeout', the 'All slopes above' field is set to 0.12 and the 'Cooking events end at slope' field is set to -0.05. The 'Moving Average' option has a 'Use' field set to 15. Below this section, there is a 'Date Format' section with five radio button options: '18/06/2009 14:30:00 - (Intl)', '06/18/2009 14:30:00 - (US)', '18JUN2009 14:30:00', '6/18/09 2:30PM', and '18JUN09 2:30PM'. The '6/18/09 2:30PM' option is selected. At the bottom of the dialog, there is a checked checkbox for 'Display Cooking Events' and a 'Clear Cache' button. The bottom right corner contains three buttons: 'OK', 'Cancel', and 'Apply'.

View of Cooking Time



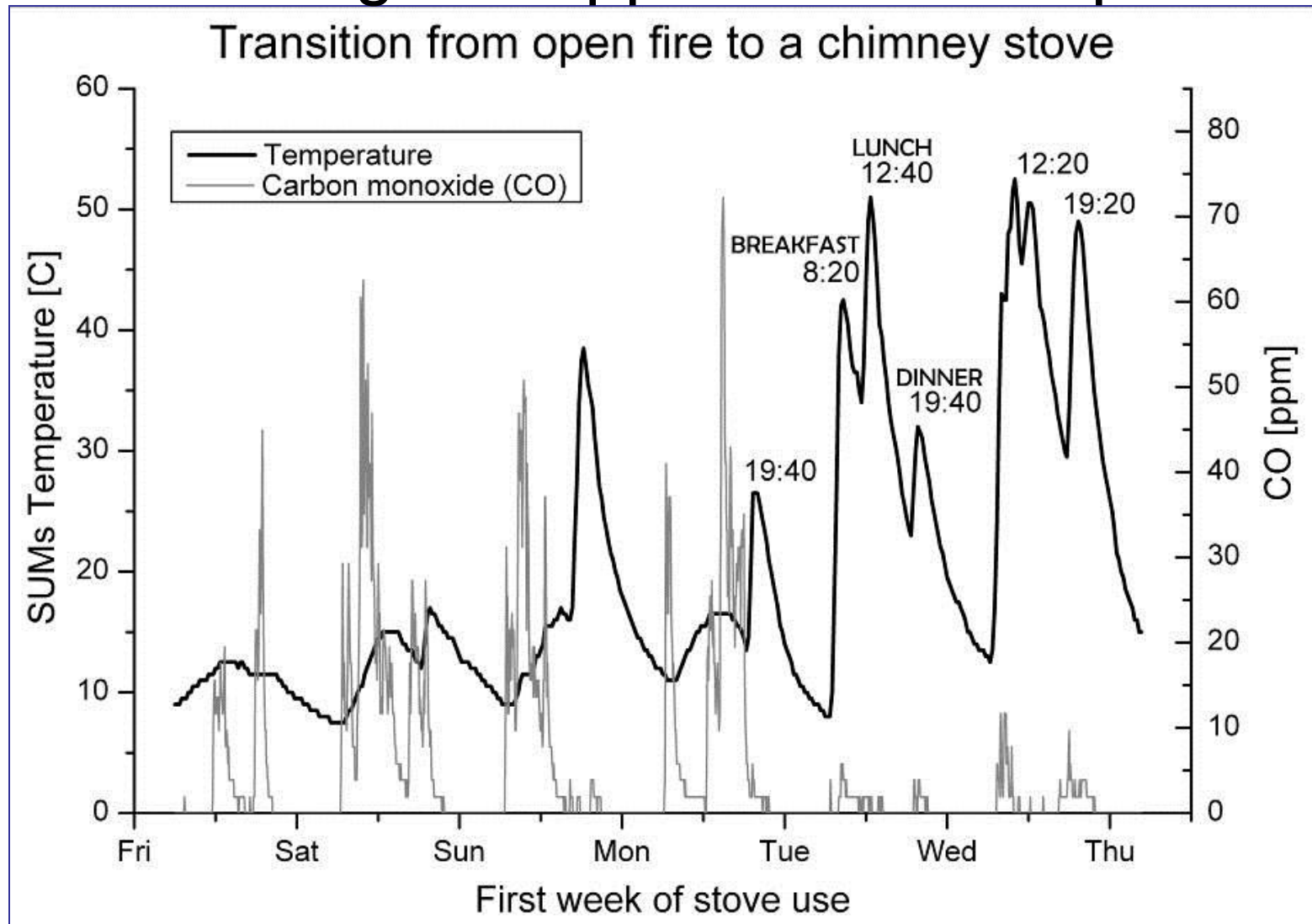
Side by Side View



Stove Program Applications for SUMS

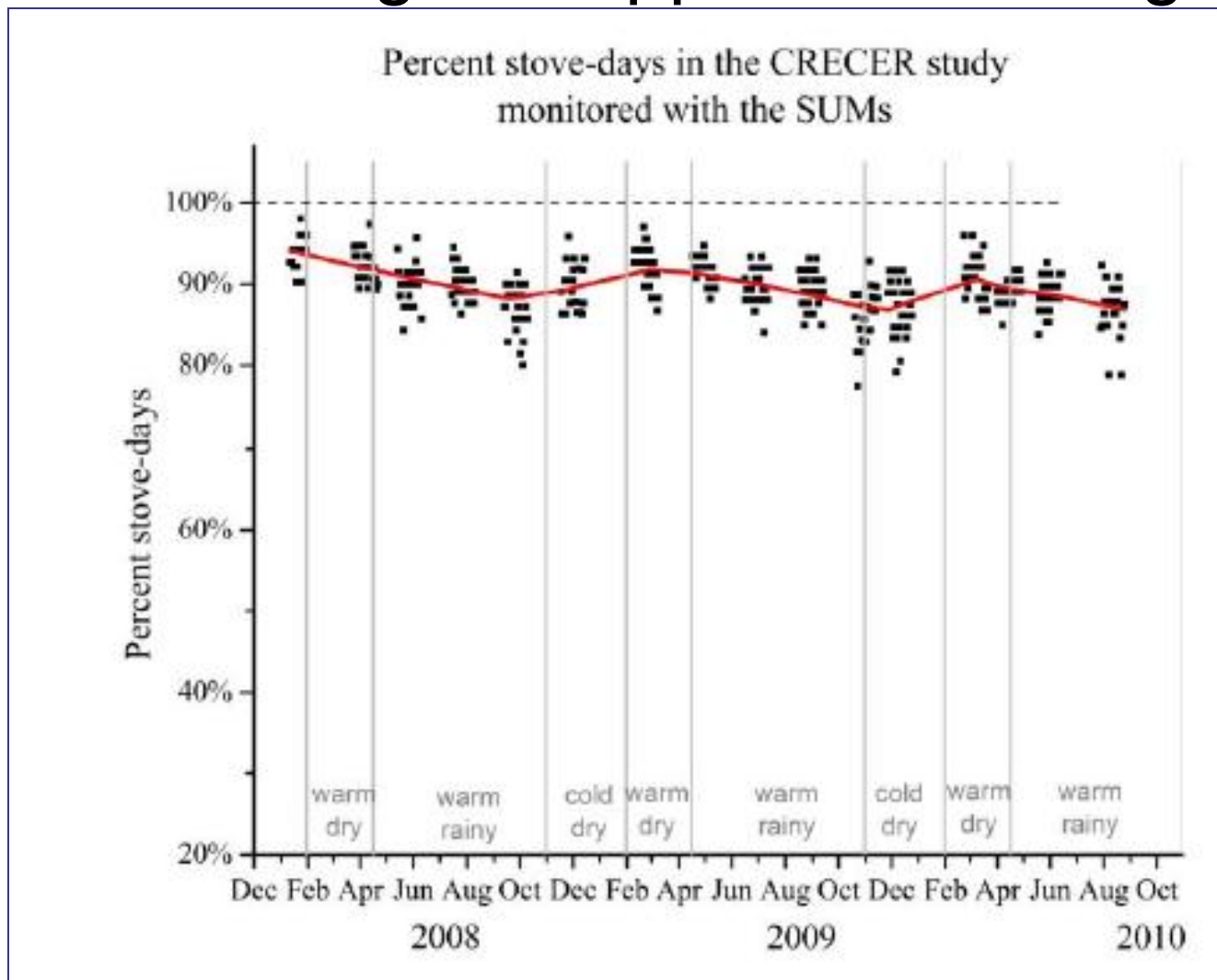
- Check how well people like new stoves and how well they are integrated into kitchen
- Compare cooking habits among households, across seasons or regions
- Estimate fuel use (in development)

Stove Program Applications: Adoption



Low-cost temperature dataloggers as Stove Use Monitors (SUMs). Ruiz-Mercado, I., Lam, N., Canuz, E., Davila, G., Smith, K. R. Boiling Point. 55:16-18. 2008. Data shown above were not collected or analyzed with the software presented here.

Stove Program Application: Usage



Stove Use Monitors (SUMs) to quantify adoption and sustained use of improved cookstoves. Ruiz-Mercado, I., Canuz, E., Acevedo, R., Smith, K. R. Biomass and Bioenergy. Forthcoming. 2011. Data shown above were not collected or analyzed with the software presented here.

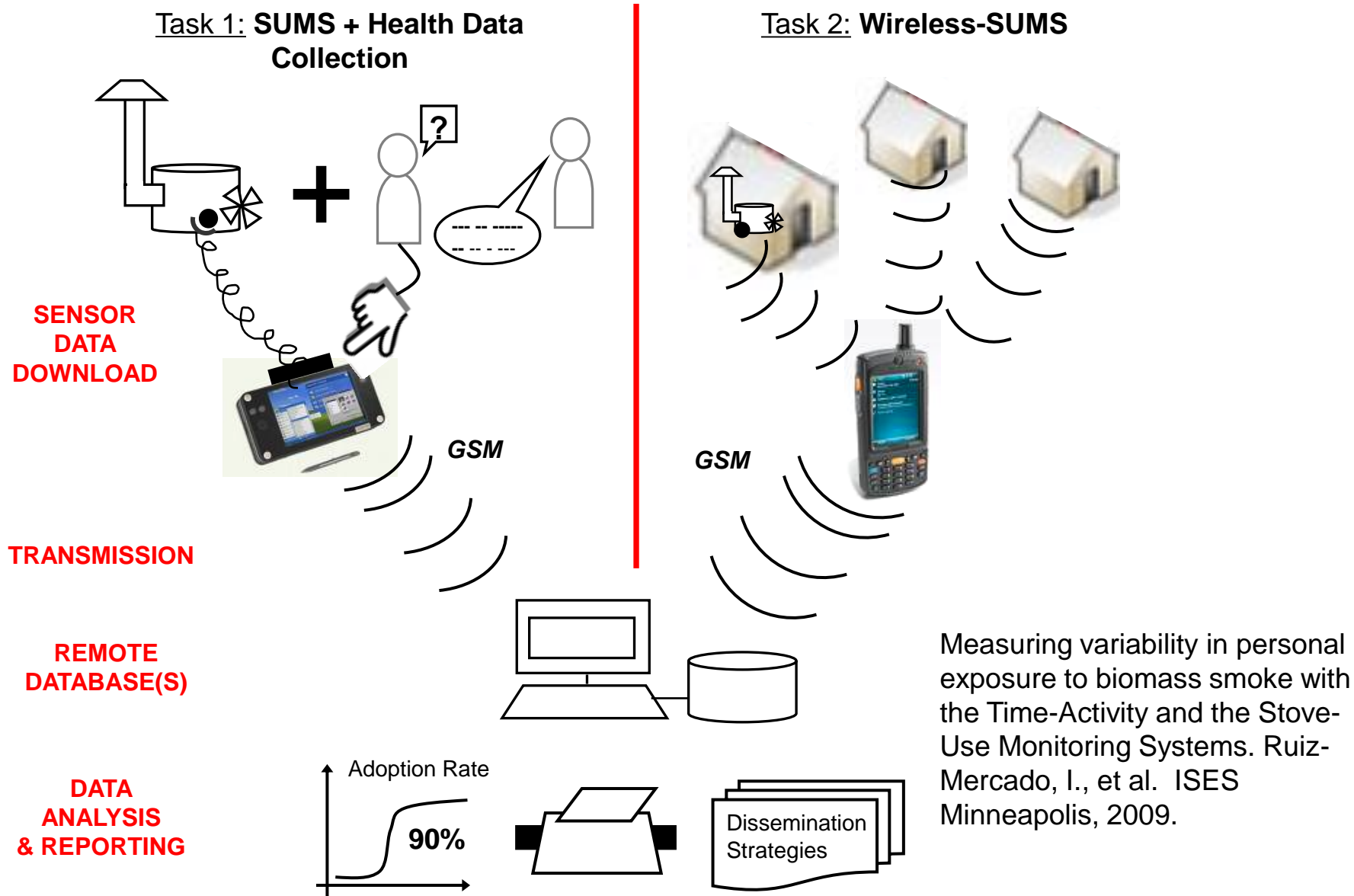
Stove Program Application: Fuel Use

- Conducted Kitchen Performance Test (KPT) with SUMS in place on traditional and Ernakulam wood stoves in 20 households in India
- Currently working to develop correlations between stove and fuel use
- Would allow calculation of fuel savings directly from SUMS data
- Will have to repeat to get correlations for other stoves and fuels



Berkeley Air intern Anoop Muniyappa

Next Steps – UC Berkeley Developing Wireless SUMS



SUMS Availability

- Berkeley Air is now an authorized reseller of iButtons
 - iButtons are one brand of temperature sensor that works well for cookstoves
- Together with colleagues at UC Berkeley, we have developed software to facilitate analysis of temperature data from cookstoves
- Our aim is to provide sensors more affordably to the stove community together with customized tools and support
- Please give us your feedback on the SUMS kit!



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