

# DAIMLER

---

## Traffic Jam Warning Messages from Measured Vehicle Data with the Use of Three-Phase Traffic Theory

A Review in brief

AMAA 2012

Berlin 31.05.2012





## Overview

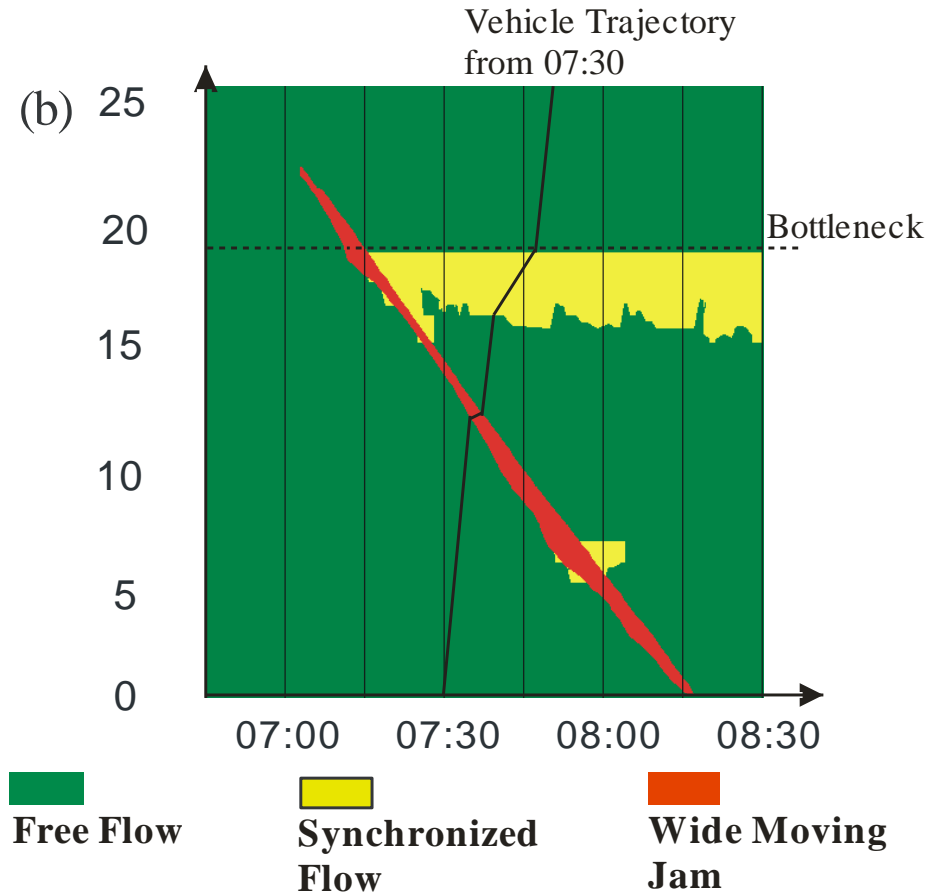
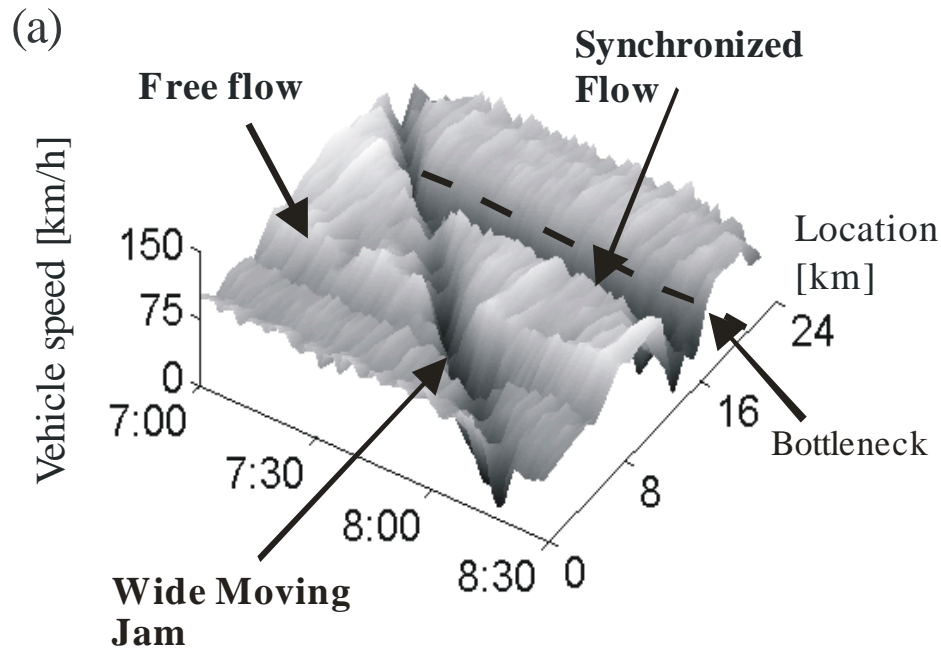
- Some elements of Kerner's three-phase traffic theory
- Methodology for jam warnings based on measured vehicle data
- Results and conclusions



Explanation of three-phase theory: (a) vehicle speed in time and space

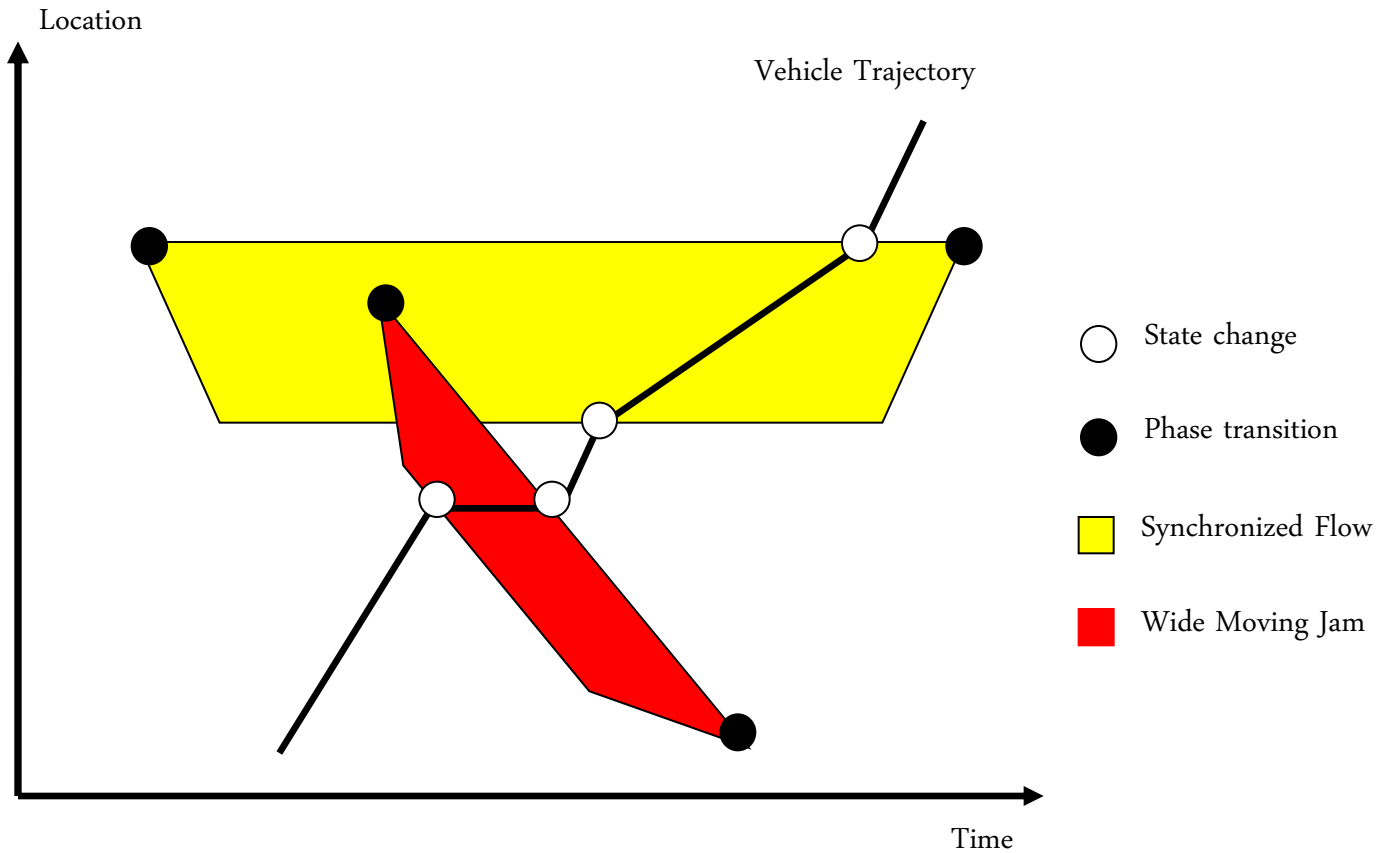
(b) Representation of traffic phases on the time-space plane (data from a))

## Three traffic phases





Traffic state changes and traffic phase transitions a vehicle experiences on its way through a spatio-temporal congested traffic pattern

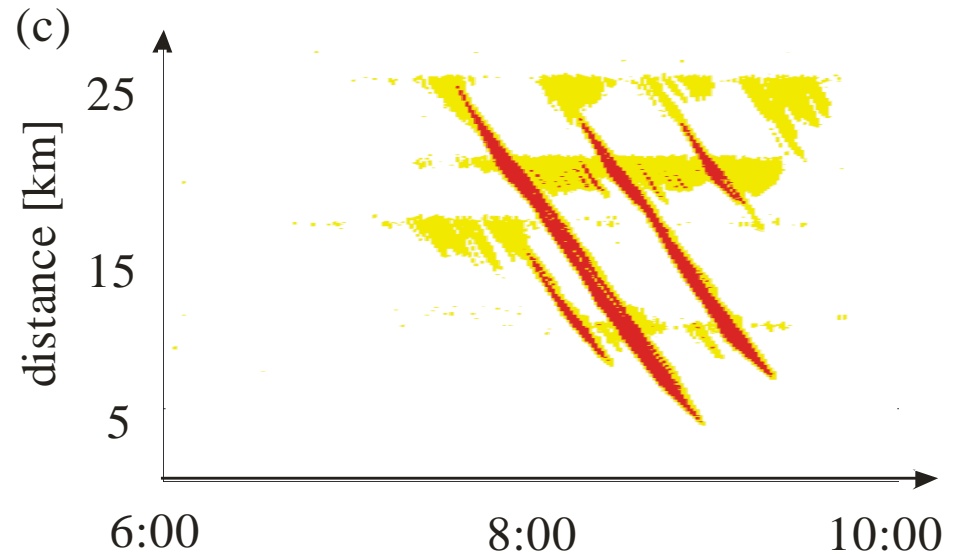
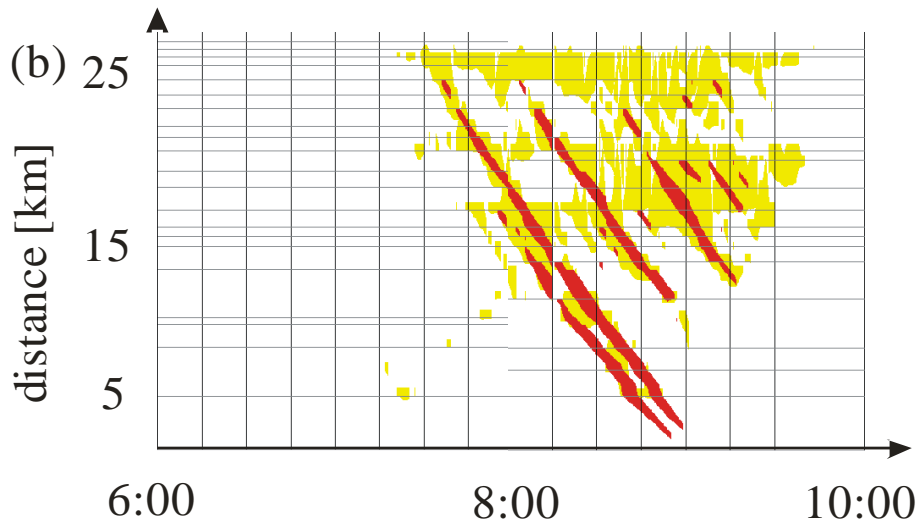
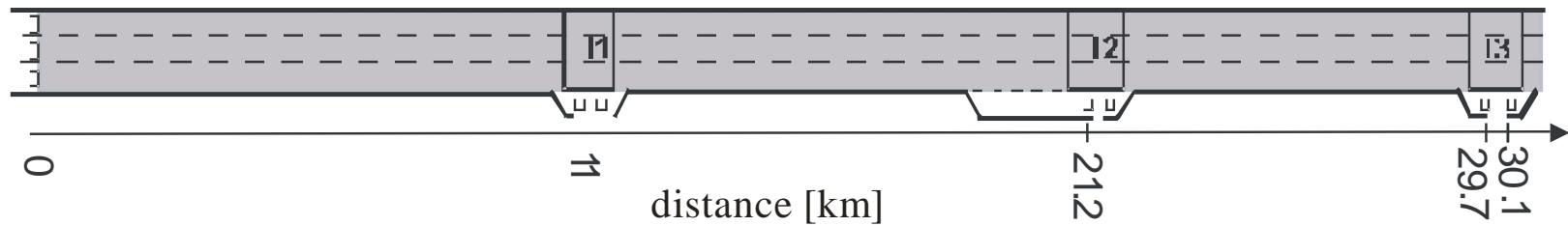




Methodology: (a) A5 highway section. (b) ASDA/FOTO pattern reconstruction based on detector data on 10th Dec, 2009. (c) Simulations of (b) with Kerner-Klenov stochastic microscopic three-phase traffic flow model.

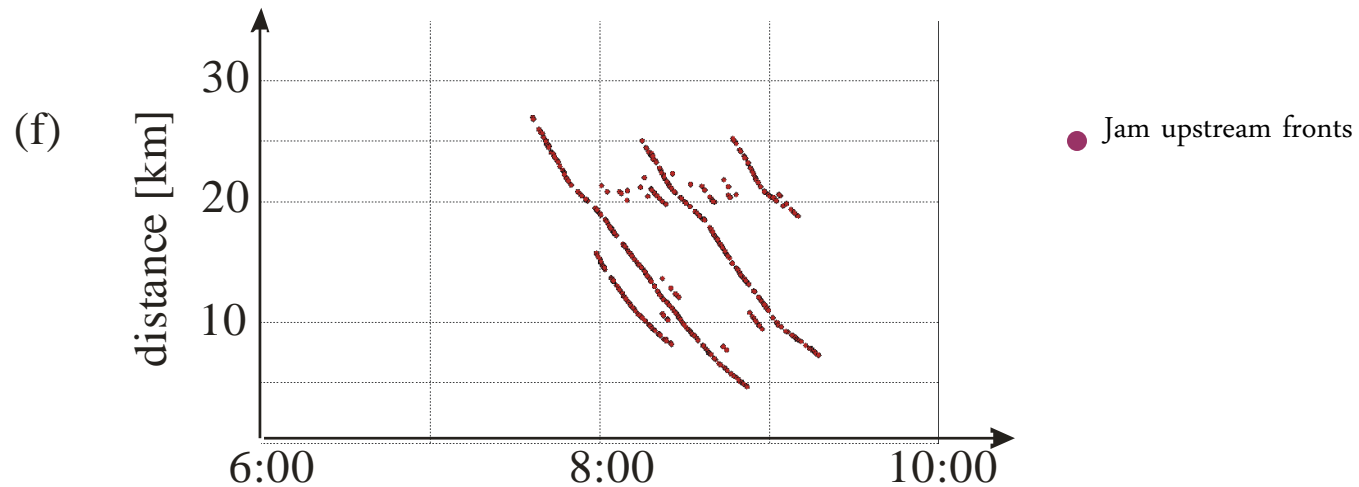
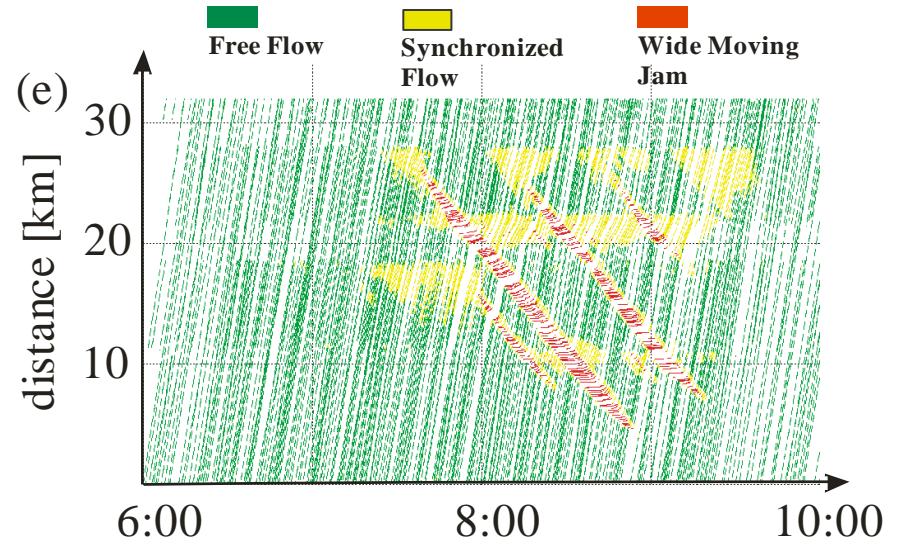
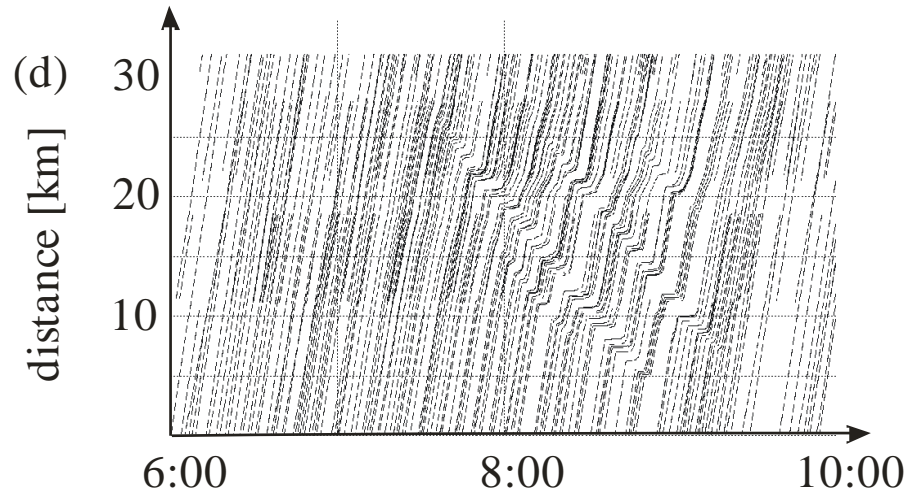
(a) traffic flow

I1: Friedberg  
I2: Bad Homburger Kreuz  
I3: Nordwestkreuz





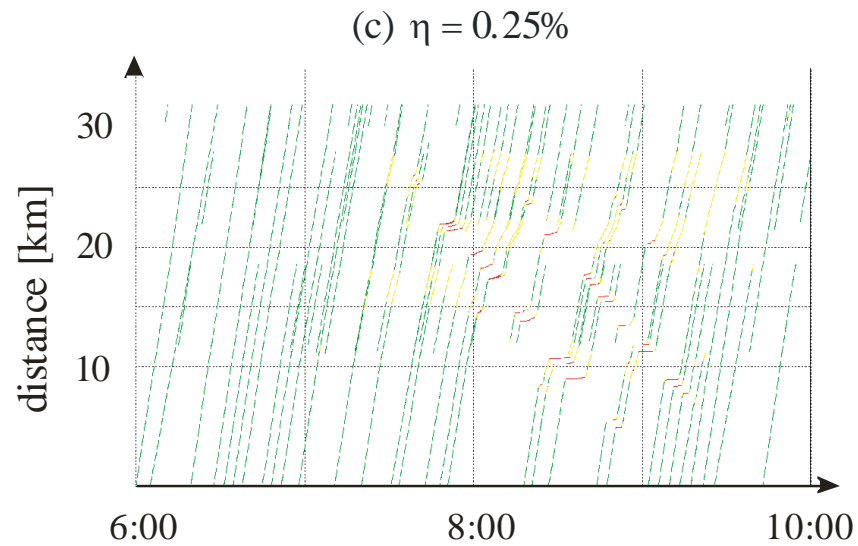
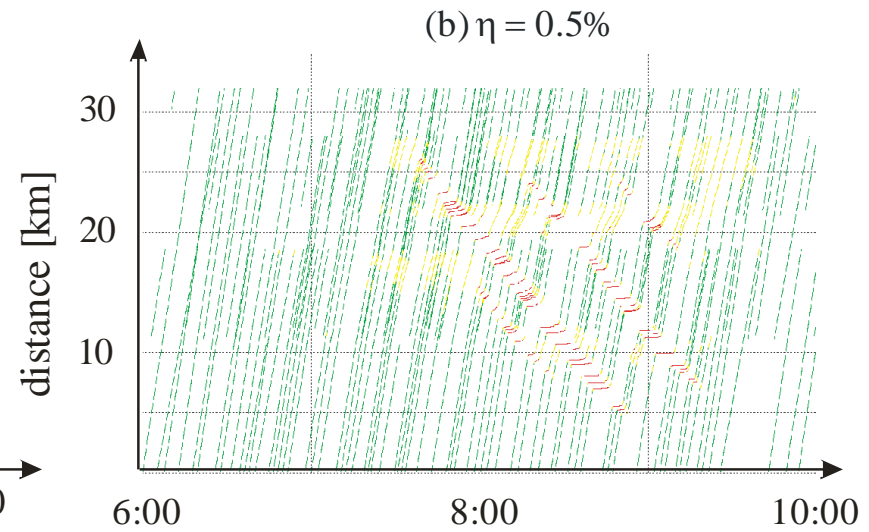
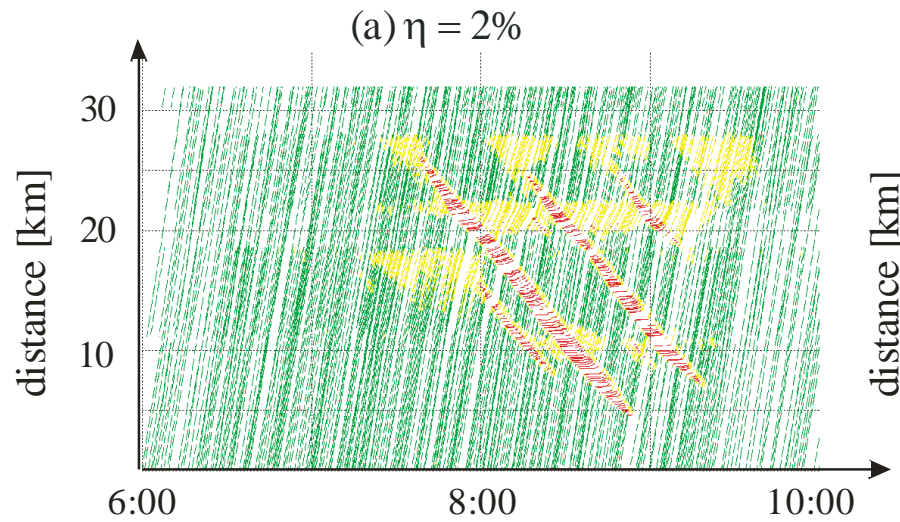
Methodology: (d) Simulated vehicle trajectories of random distributed 2% probe vehicles within the pattern in (c). (e) Traffic state detection for probe vehicles in (d). (f) Jam warning messages by probe vehicles in (d).





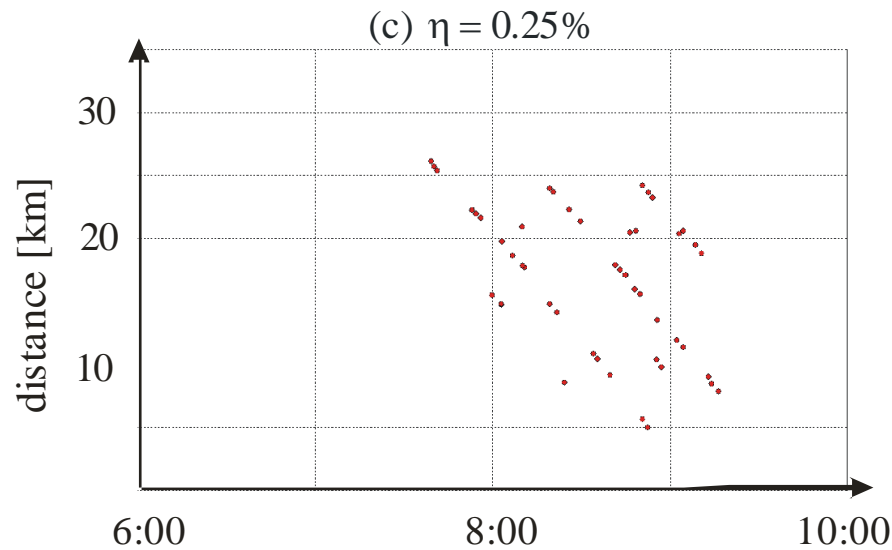
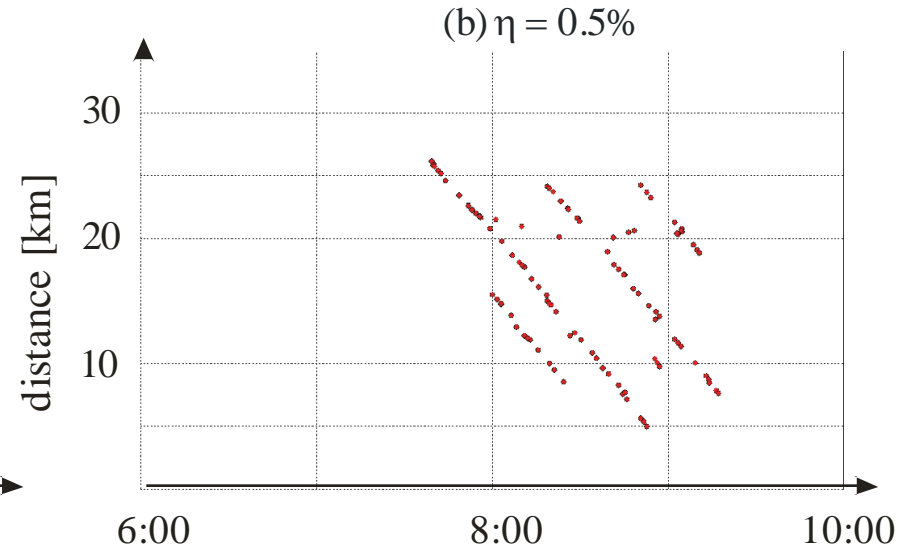
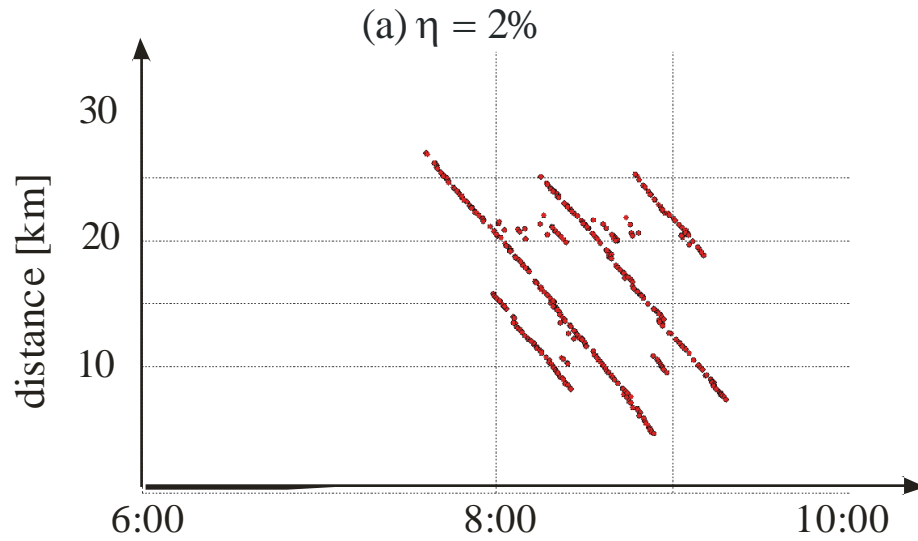
Results of traffic state detection at different percentages of probe vehicles:

(a) 2% (b) 0.5% (c) 0.25%





Detection of upstream jam fronts (“jam warning messages”) with different percentage of probe vehicles: (a) 2% (b) 0.5% (c) 0.25%

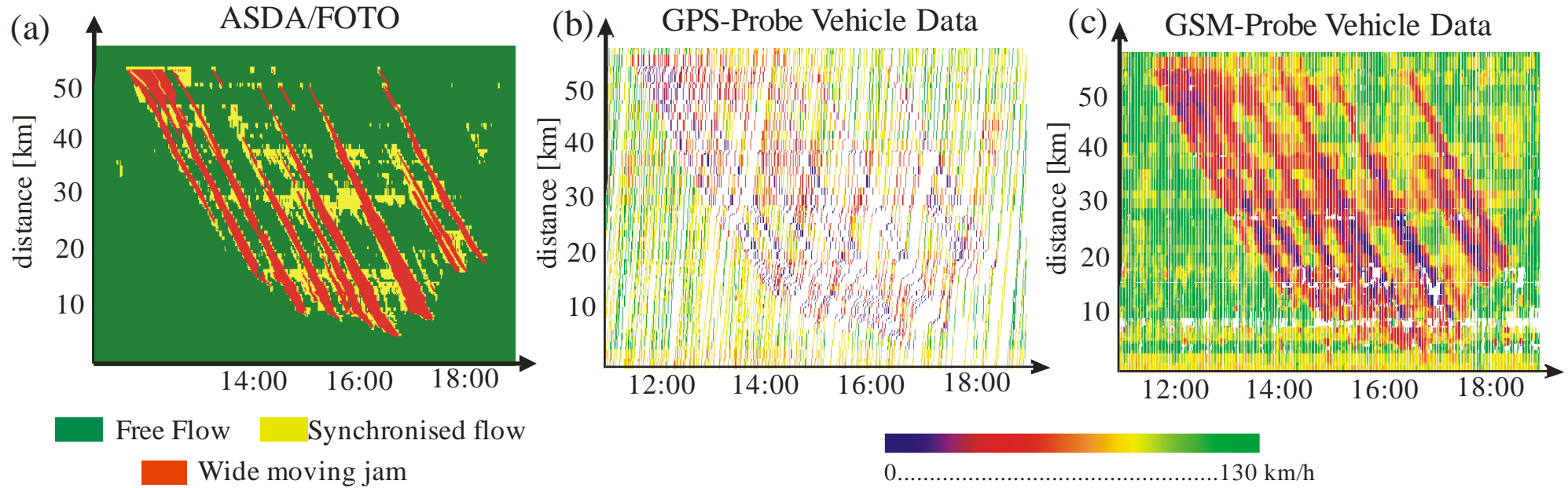






Comparison of congested traffic pattern measured on 12th May, 2010 on A5-North, Germany with detector data processed with (a) ASDA/FOTO models  
(b) with on-line TomTom's GPS and (c) GSM probe vehicle data for this day.

## A5-North, May 12, 2010





## Conclusions

- Three-phase traffic theory allows us to explain, reconstruct, and predict the spatiotemporal picture of traffic breakdown and resulting congested patterns.
- Methods based on three-phase traffic theory can be used for danger messages.
- A model of traffic phase identification along a vehicle trajectory based on three-phase theory allows us to make a reliable generation of jam warning messages already above a penetration rate of 0.5% randomly distributed probe vehicles.
- Penetration rates of 2% probe vehicles might be a boundary condition for a “premium” quality for traffic service messages.
- TomTom’s probe vehicle data allows us to reconstruct structure of traffic patterns (synchronized flow and wide moving jams) with a much greater quality of *spatiotemporal* resolution than has been possible before.
- TomTom’s probe vehicle data opens qualitative new perspectives for the creation of many new ITS applications like traffic jam warning, input data for traffic control, hybrid vehicle strategies, fuel consumption reduction, etc..