

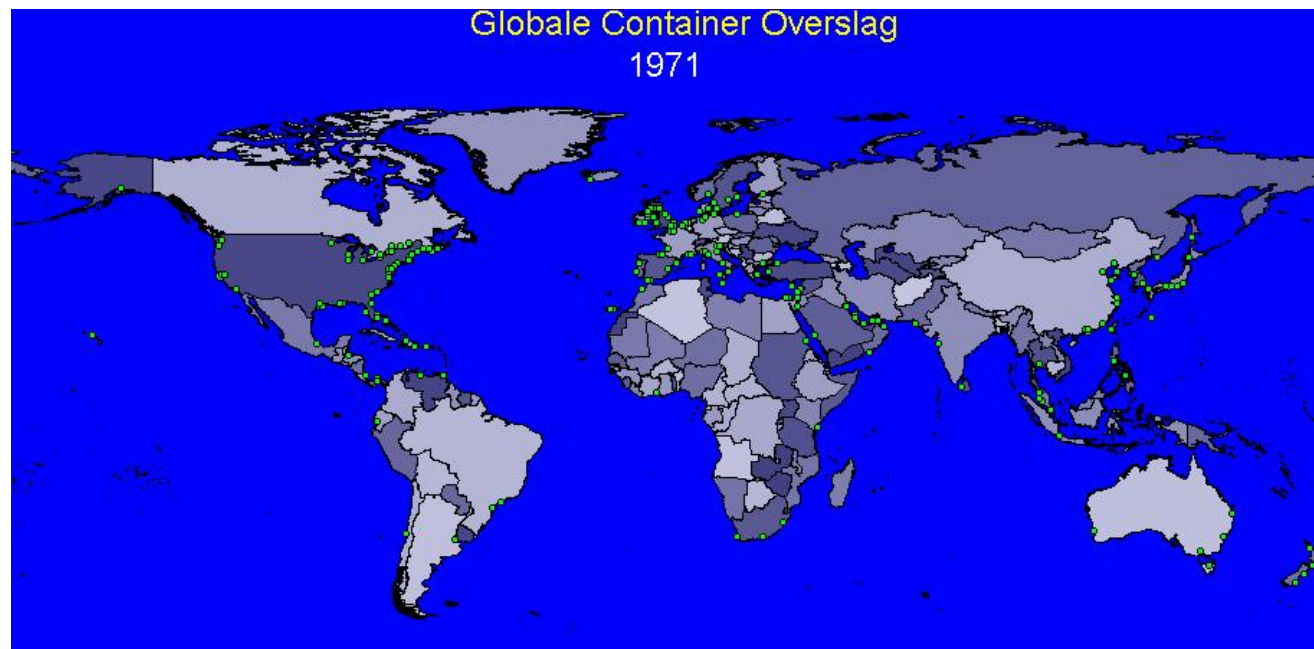
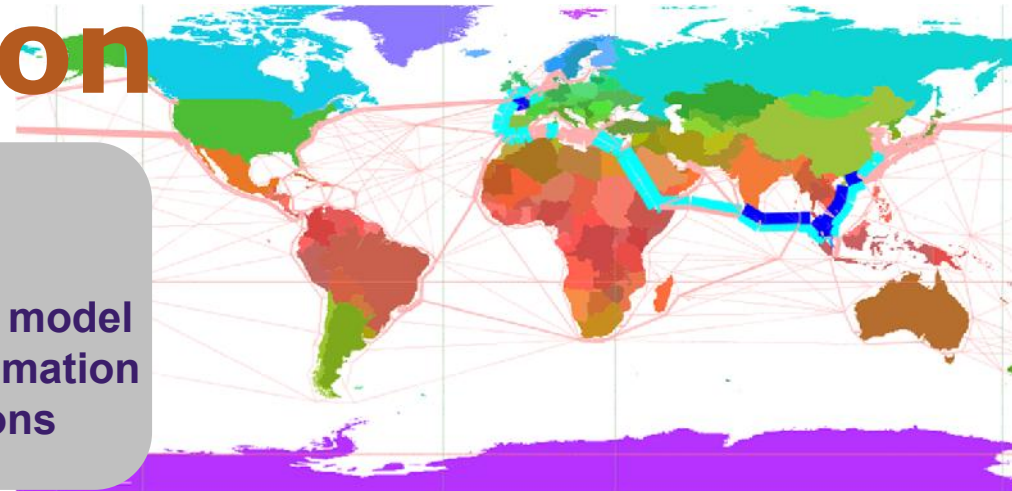
Worldwide Container Network Model

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Delft University of Technology)**

Introduction

Contents:

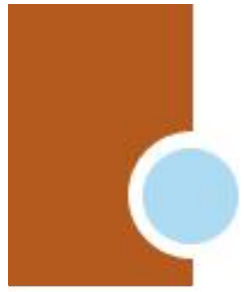
- Purpose of global container model
- Model specification and estimation
- Example of model applications





World Container Model: challenges

- Routing alternatives may lead over different continents.
- Can a simplified model be made consistent with:
 - basic principles of shipper and carrier behavior?
 - publically available data on worldwide freight trade and transport?
- Provide model capabilities for answering strategic policy questions (new routes, increased costs, etc..)



World Container Model: summary

- Model of global multimodal transport chains including port choice, mode choice and route choice

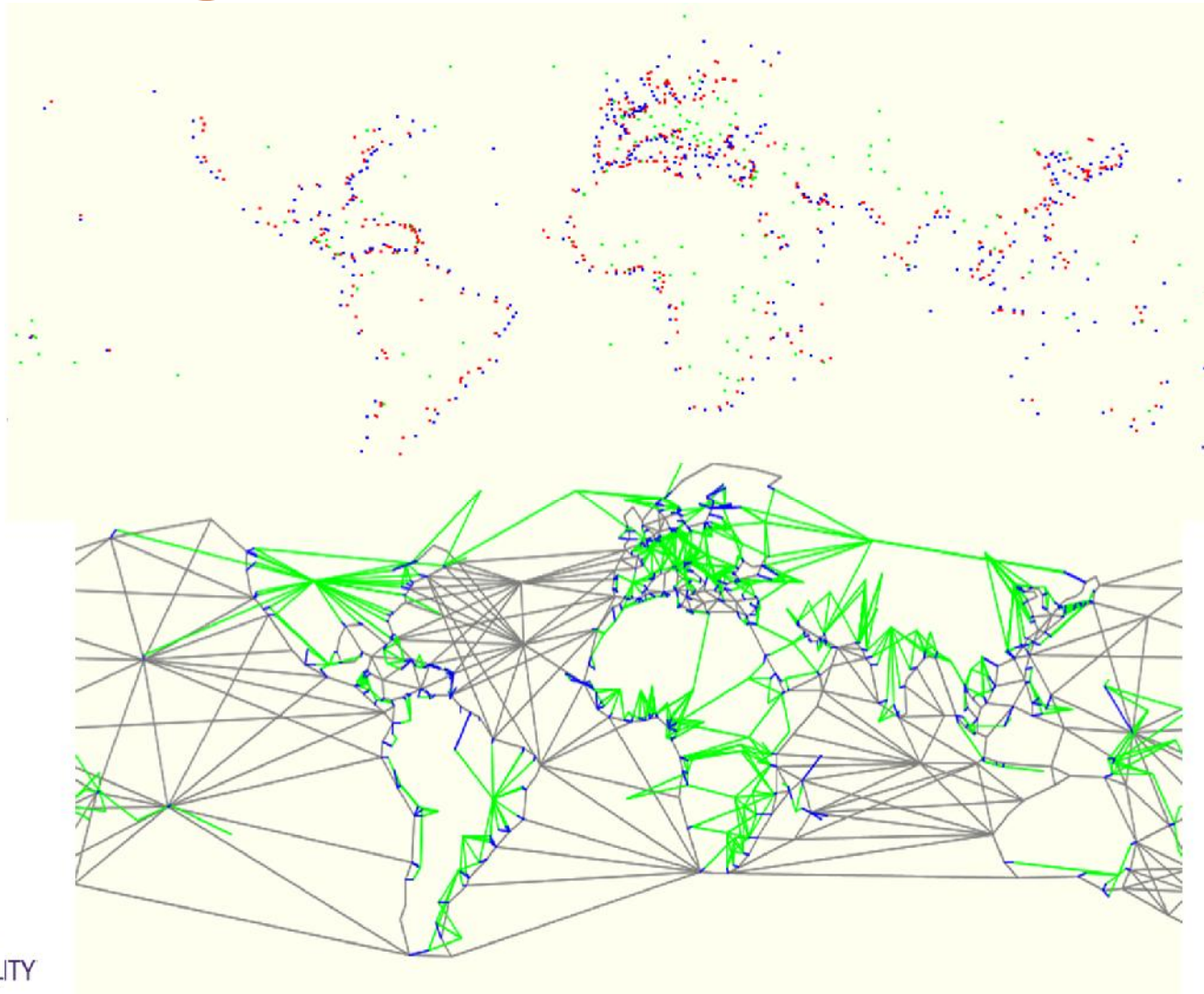
[country S] - [port A] - [service X] - [port B] - [service Y] - [port C] - [country E]

- Door-to-door: maritime flows and flows over land
- Model for comparative static analysis
- Linkage to detailed multimodal network models and world trade model

Some figures:

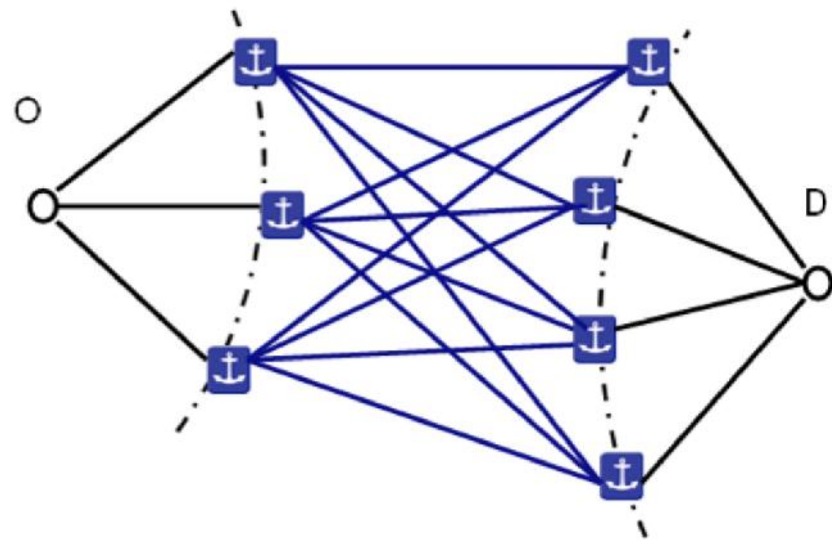
- 236 countries
- 437 container ports around the world
- 848 container line services

Network nodes and links



Network coding

- Services
 - Service network (lines)
 - Maritime and inland network
 - Door-to-door
 - Transshipment possibilities
 - Landbridges
- Parameters
 - Generalized costs
 - Transport rates and speeds (sea and land)
 - Value of time: commodity specific



Choice model: route costs, times and probabilities

- Technique: logit route choice based on generalized transport costs

$$C_r = \sum_{p \in r} A_p + \sum_{l \in r} c_l + \alpha \cdot \left(\sum_{p \in r} T_p + \sum_{l \in r} t_l \right)$$

$$P_r = \frac{e^{-\mu(C_r + \ln S_r)}}{\sum_{h \in CS} e^{-\mu(C_h + \ln S_h)}}$$

P_r	choice probability of route r
CS	choice set
S	overlap indicator
μ	scale parameter
C_r	generalized costs of route
C_l	cost of link l
T_p	time spent at port p
t_l	time spent in transport over link l
α	value of the time (VOT)
r	route
p	ports used by the route
L	links used by the route
A_p	cost at port p

Input Origin-Destination flows

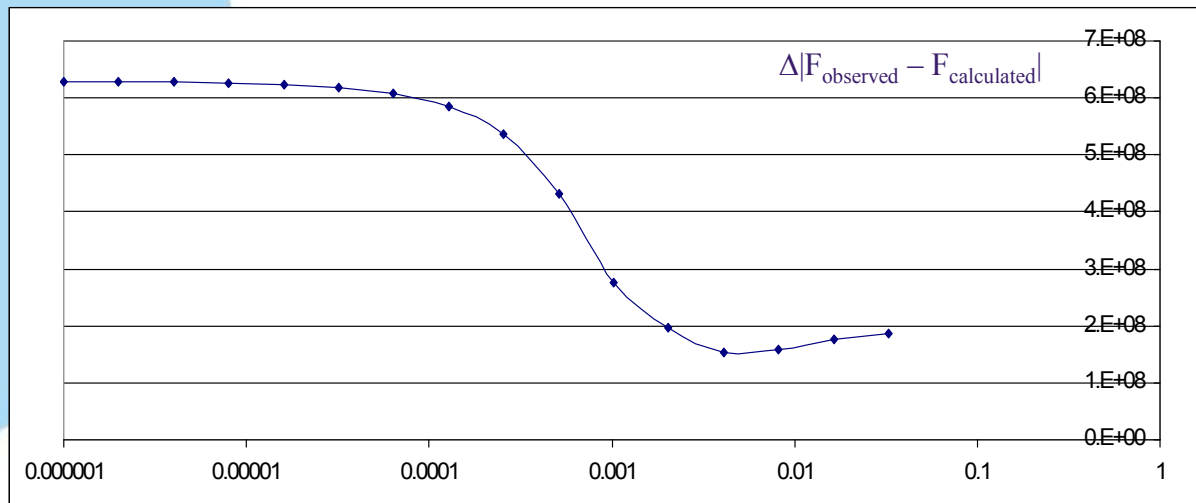
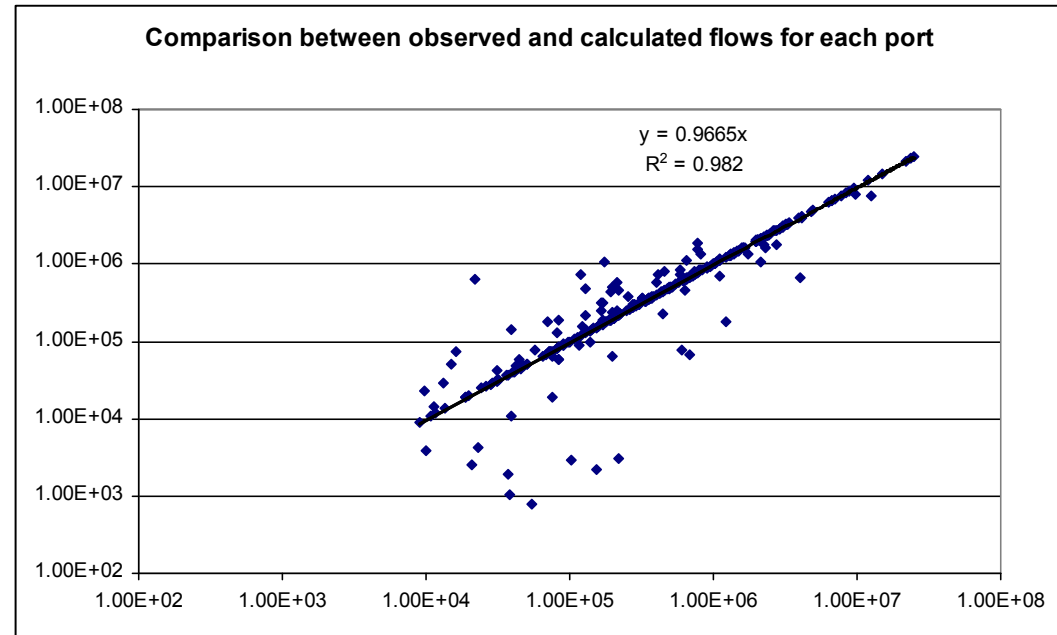
Database	1	2	3
Source	UNCTAD	Eurostat	Eurostat
Area	World	Europe-World	Europe-World
Type	Trade	Trade	Maritime
Units	ton, \$	ton, U ton, TEU	TEU
Categories	Yes	Yes	No
Empties	No	No	Yes

- Public data sources
- Statistics UN Comtrade, Eurostat on trade and transport
- Published data from shipping companies and ports
- Processing to obtain O/D flows in TEU/year, if not available

Result: Volume of container transport in TEU/year between all countries world wide, loaded and empty.

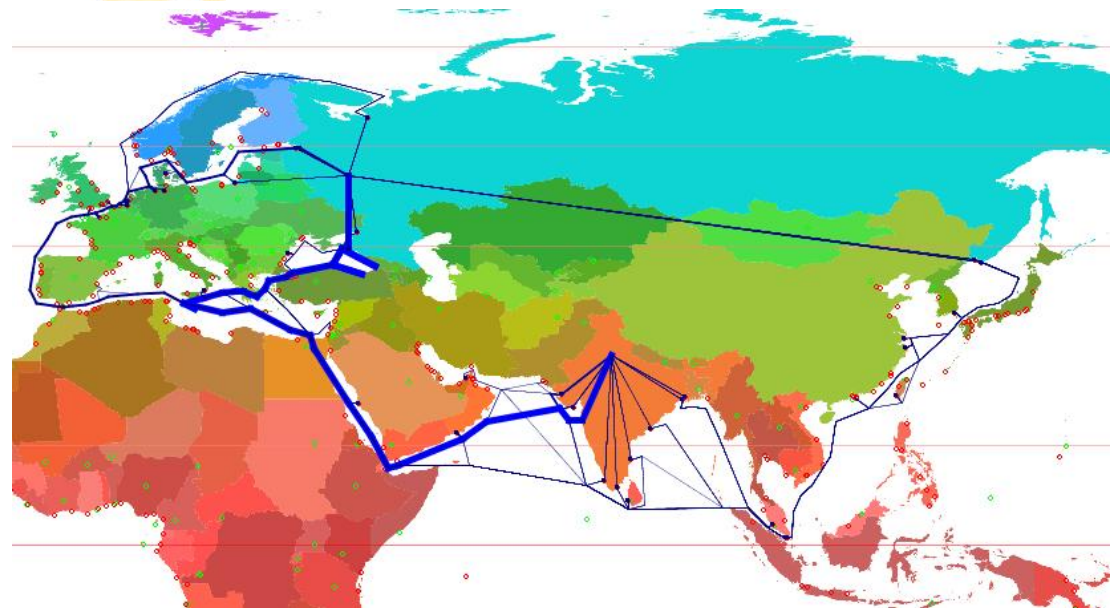
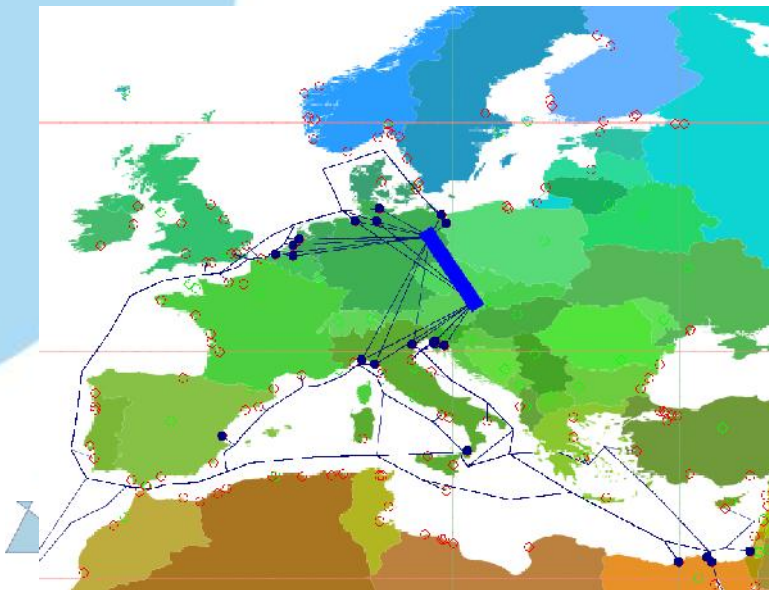
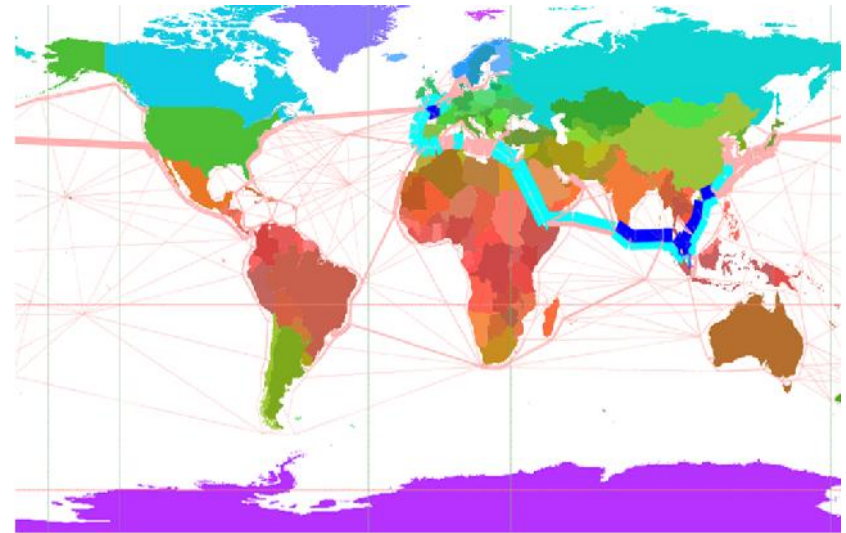
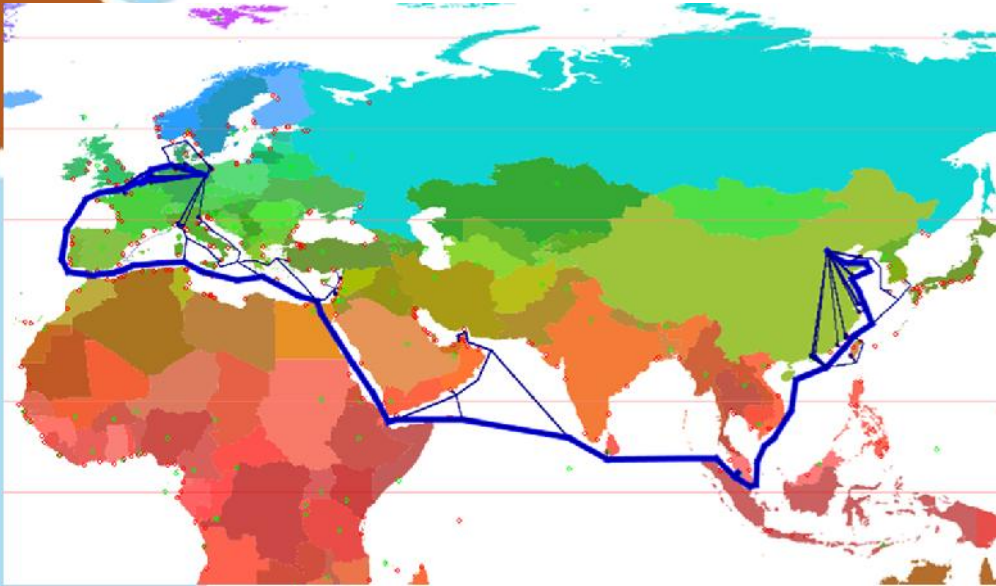
Calibration: results

Comparison between observed and calculated flows per port:
high R^2



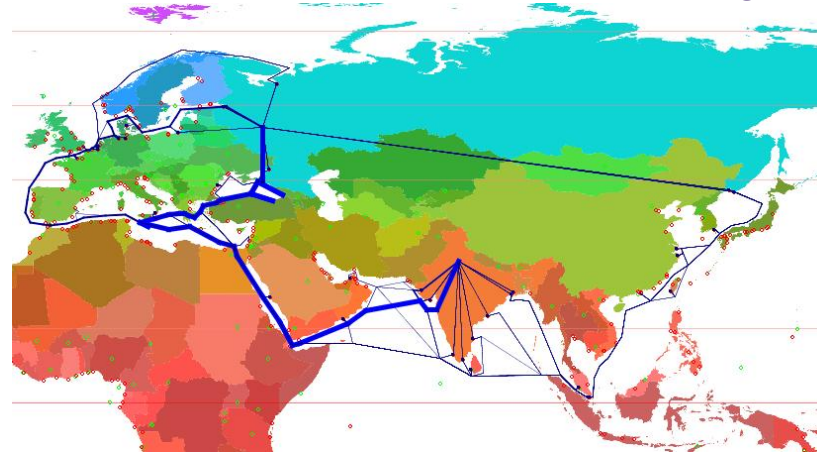
Decent behavior of spread parameter:
Comparison of observed and calculated flows for different values of μ

Alternative routes – some examples

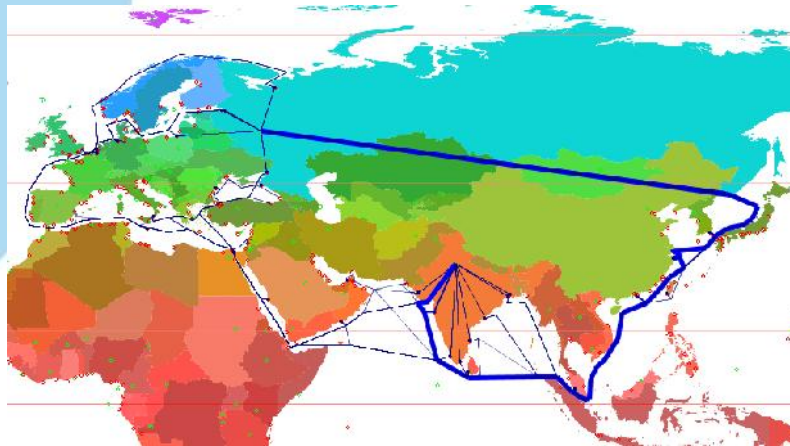


Example: effects of cost increases in transport

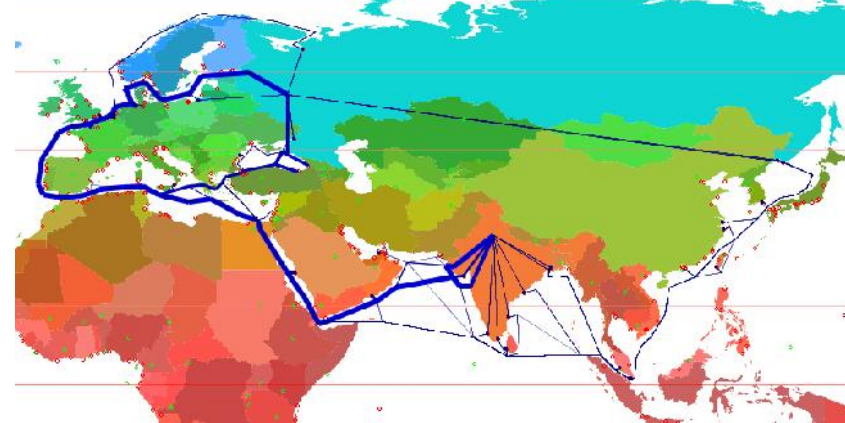
Baseline situation (selected regions)



Scenario 1: port costs increase



Scenario 2: inland costs increase



Recent developments (TML-TNO)

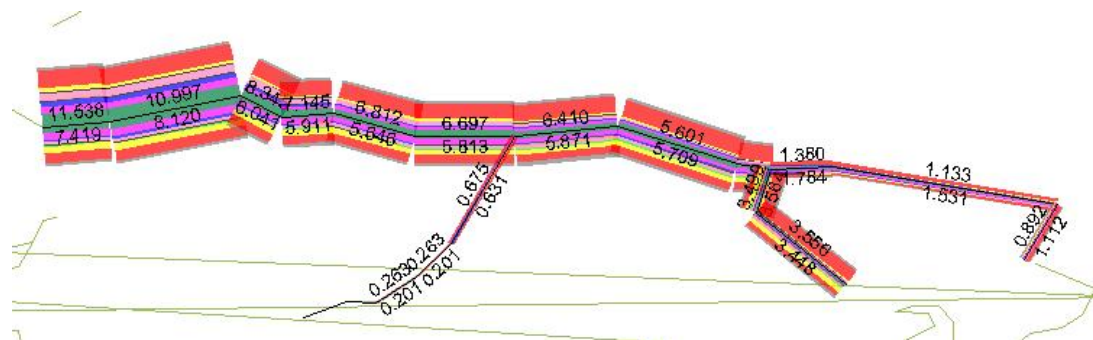
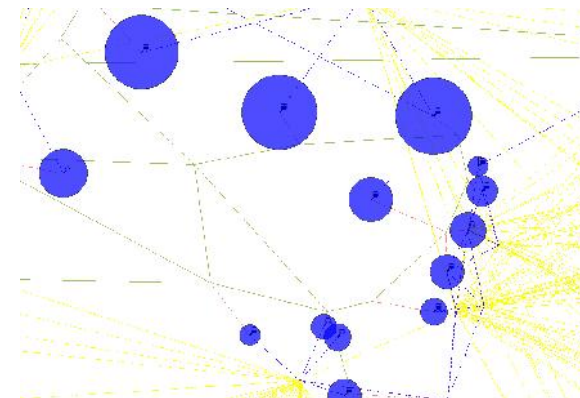
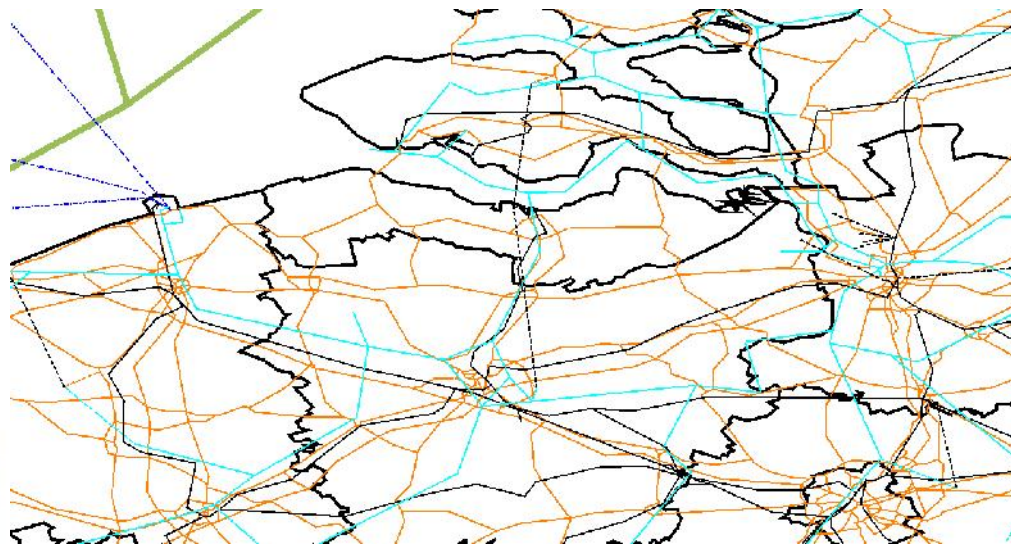
- Integration of the WCM in OmniTRANS
 - Manipulating text files => Graphical user interface
 - Greatly improved graphical presentation of input and results
 - Improved data management
 - Guaranteed consistency of the input
- A detailed route choice and mode choice model for land transport
 - Applied and calibrated for Europe
 - Based on the transtools network and NUTS 2 zones
- Modelling effects on trade (integration with trade/SCGE model)
 - This is currently being developed in ETIS Plus

WCM-OmniTRANS integration

The screenshot displays the WCM-OmniTRANS integration interface. On the left, a Microsoft Excel spreadsheet is open, showing a list of countries with columns for Country, ISO ALPHA-3 code, Latitude, Longitude, Country id, Under continent, and Continent. Below the spreadsheet, a table of ports is visible, with columns for Port Id, Label, Port, Country, Nbre of call, and Latitude. On the right, a map of East Asia is shown, displaying a network of orange lines representing shipping routes. A 'Minimize Editor' dialog box is open over the map, showing properties for a selected link (11821) such as direction, length, capacity, and speed.

Port Id	Label	Port	Country	Nbre of call	Latitude
3001	HONGH	HONG KONG	HKG	234	22.283
3002	SING5	SINGAPORE	SGP	229	1.365
3003	SIJIANC	SIJIANCIAI	CIJN	201	31.230
3004	NINGC	NINGBO	CHN	137	29.865
3005	ROTTN	ROTTERDAM	NLD	137	51.921
3006	ANTWD	ANTWERP	BEL	135	51.215
3007	KAOHT	KAOHSIUNG	TWN	131	22.633
3008	PUSAK	PUSAN	KOR	123	
3009	NYORJ	NEW YORK	USA	111	40.73775
3010	YANTC	YANTIAN	CHN	109	22.565
3011	LEHAF	LE HAVRE	FRA	108	4
3012	BRJMD	BRJMFRIHAVN	DFU	107	53
3013	HAMB	HAMBURG	DEU	100	53.583
3014	IANJM	IANJUNG PELEPAS	MYS	98	1.365

WCM-OmniTRANS integration





Recent applications (TML-TNO)

- Economic feasibility of transporting goods across Trans-Siberian Railway
 - Determination of optimal tariff, in relation to the maritime tariff
 - Prognosis of container volumes per NSTR-type
- Investigation of the effect of improved accessibility (over land) of the port of Rotterdam
 - See Arjen's presentation
- Effect of improved efficiency of Dutch customs on container flows
 - Time reduction of port handling by ½ day (now: 2 days)
 - Cost reduction of port handling by \$25 (now: gen cost = ± \$2,000)



Conclusions

- New strategic level model for studying global routing of container flows
- Model uses publicly available data and reproduces observed flows
- Various extensions possible: research programme
- Applications
 - Effects of transport policy
 - Business models for global transport chains
 - Environmental analysis

A photograph of a freight train on tracks next to a large industrial building under a blue sky with clouds. The train consists of several colorful boxcars, including yellow and red ones. The tracks are made of gravel and steel rails. The building has a corrugated metal roof and a wooden door. The sky is bright blue with scattered white clouds.

Q&A

**Thank you for your
attention!**