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Economic approaches to support decision-making under uncertainty: an example

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Introduction

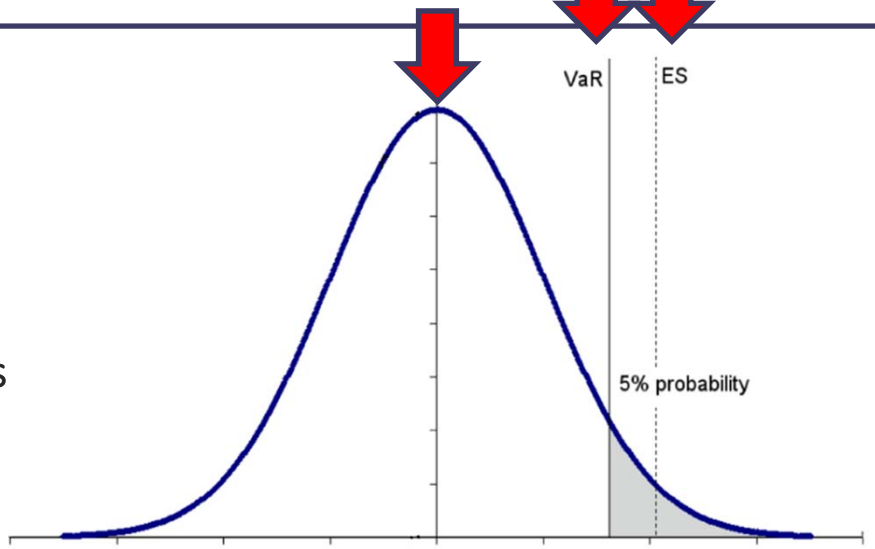
- Uncertainty has become a major in relation to decision making in climate change adaptation.
- Adaptation has been acknowledged to be dynamic, as preferences may vary over time as new or improved climate information becomes available or technologies emerge or evolve.
- Robust approaches that consider flexibility and the time dimension can be very valuable in supporting decision-making under uncertainty.
- Developing approaches that account for uncertainty are one of the main priorities in the field of the economics of adaptation to climate change.

Introduction

- Risk measures have proven to be very valuable tools to assess climate change risks and low probability but high impact events (the so-called tail events).

VaR (95%) is the value of the loss corresponding to a SLR in the 95% percentile.

ES (95%) refers to the mean expected loss when the value VaR is exceed.



- Risk-based approaches incorporate uncertainty, which is one of the key issues for defining, investing and implementing adaptation.
- There is an increasing demand for more robust economic approaches, such as real options analysis. Estimating risk measures enables this kind of analysis.

A new assessment of flood-risk in major European coastal cities

- Sea-level rise projections:

  We calibrate a Geometric Brownian Model (GBM) stochastic model for SLR based on Kopp et al (2014) RCP projections (Local relative SRL).

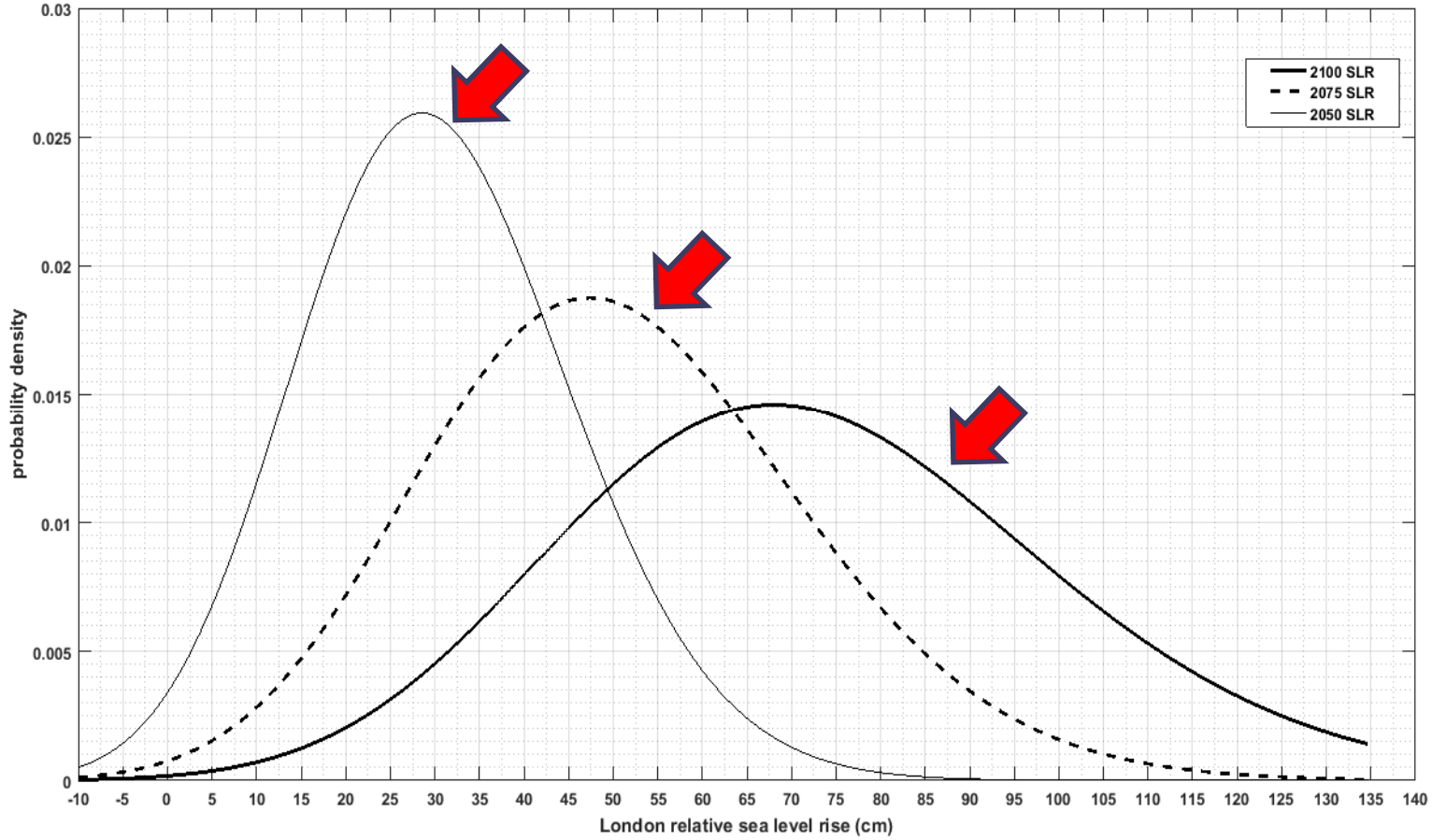
- Damage functions:

  We develop a damage function from the stochastic SLR (based on Hallegatte et al. 2013).

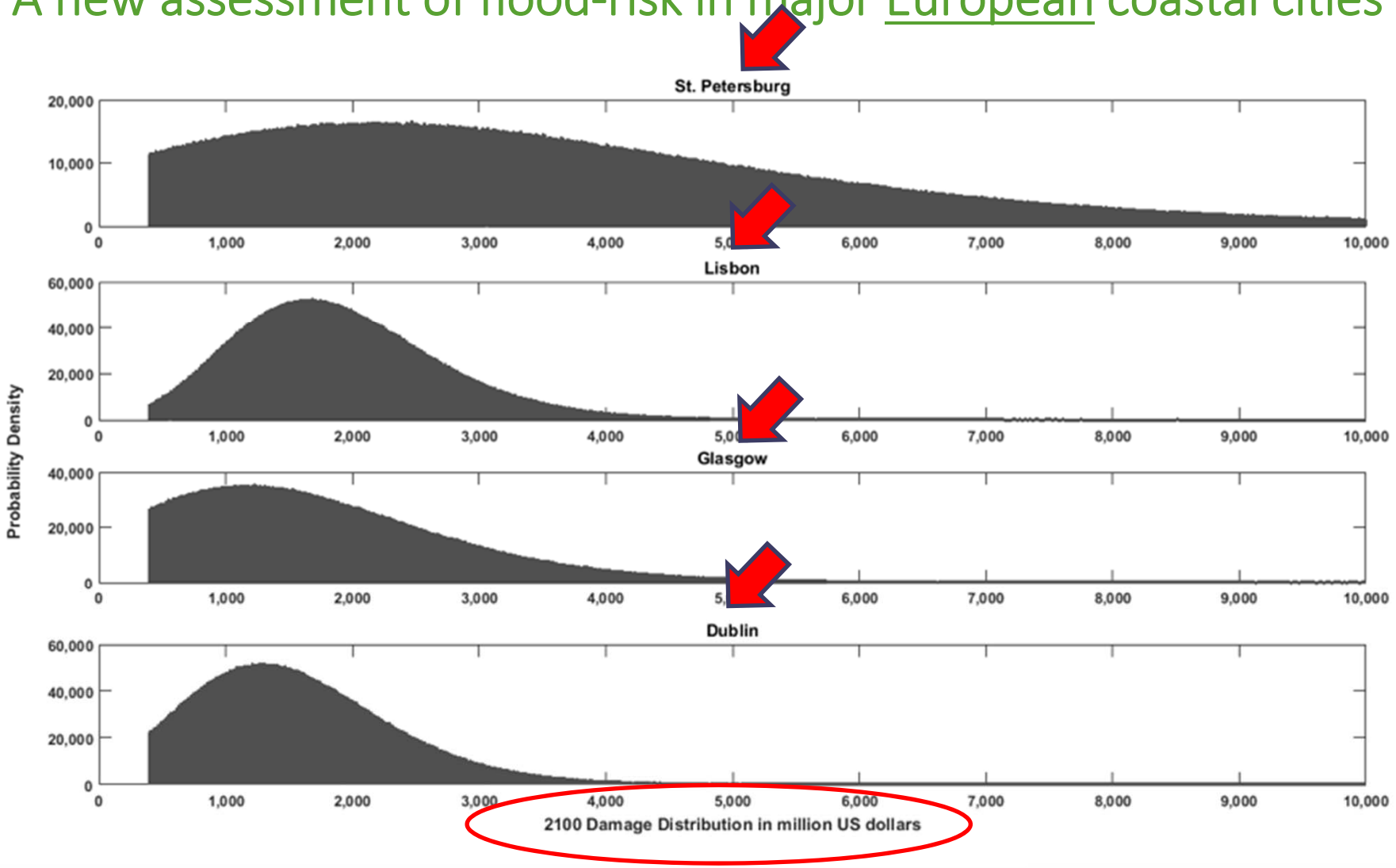
  A time based damage function, based on socio-economic scenarios.

- We can use the GBM model to calculate through MonteCarlo simulation (5 mill cases) risk measures ES and VaR.

A new assessment of flood-risk in major European coastal cities: The case of London



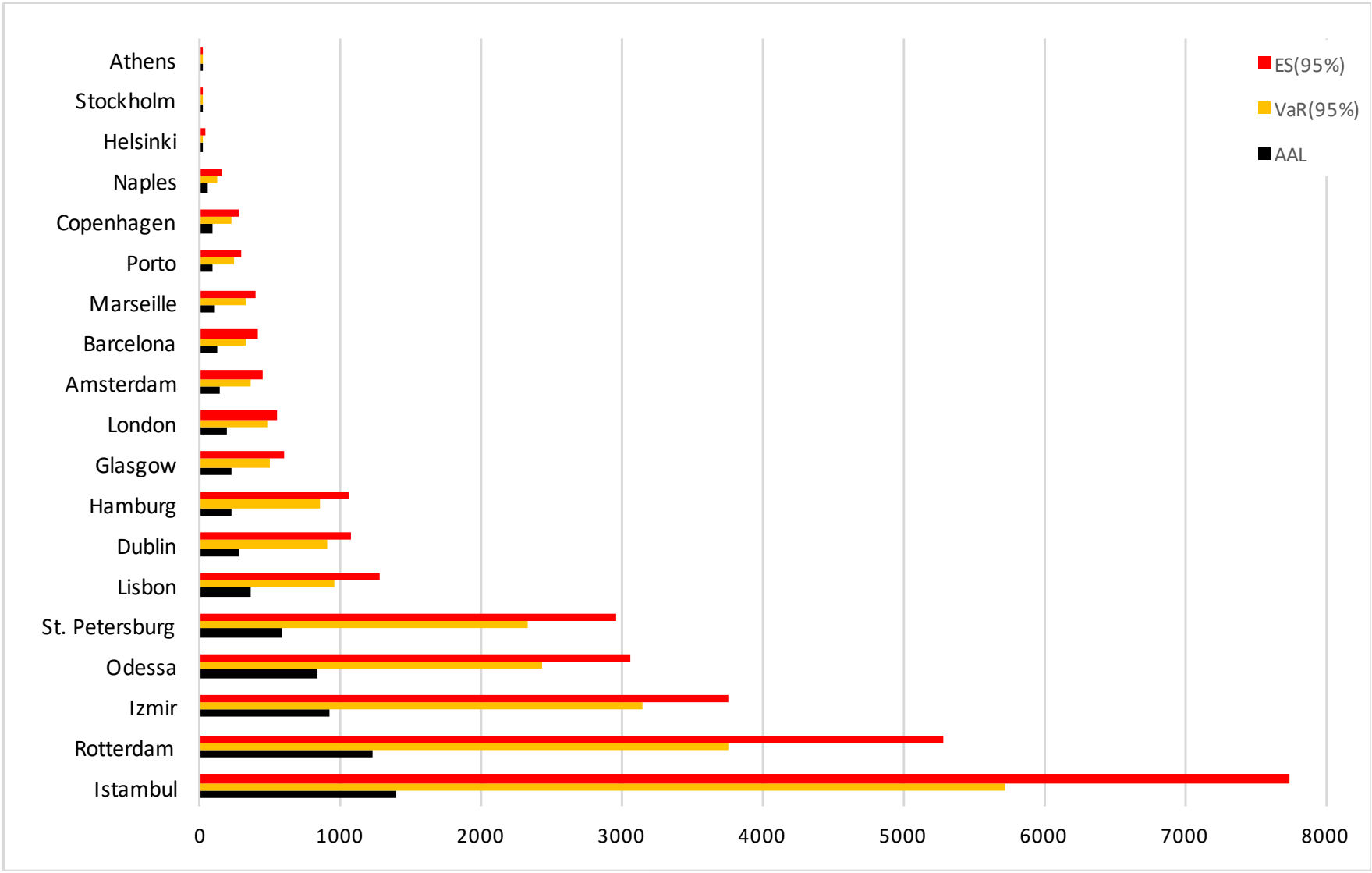
A new assessment of flood-risk in major European coastal cities



A new assessment of flood-risk in major European coastal cities

City	2030			2050			2100		
	AAL	VaR(95%)	ES(95%)	AAL	VaR(95%)	ES(95%)	AAL	VaR(95%)	ES(95%)
Amsterdam	39	125	162	137	329	388	523	922	1046
Athens	0	0	0	0	1	1	86	366	564
Barcelona	18	60	107	124	367	453	797	1488	1729
Copenhagen	22	76	110	81	240	297	368	769	913
Dublin	48	191	314	272	855	1060	1504	2944	3421
Glasgow	30	89	258	218	956	1278	1558	3685	4424
Hamburg	68	197	244	221	474	549	775	1283	1438
Helsinki	3	5	8	8	25	38	53	154	207
Istambul	201	1101	2071	1400	5716	7748	9806	25895	33649
Izmir	132	436	711	915	2429	2949	5746	10300	11912
Lisbon	65	221	322	354	901	1081	1891	3340	3834
London	56	199	261	190	497	593	703	1310	1493
Marseille	13	36	64	101	331	418	810	1524	1773
Naples	10	31	43	52	129	156	290	517	596
Odessa	116	485	1191	836	3749	5281	6577	18707	24994
Porto	19	56	83	87	227	275	460	834	963
Rotterdam	237	998	1368	1219	3151	3758	5511	9803	11170
St. Petersburg	106	525	948	577	2326	3062	3274	8135	9986
Stockholm	0	0	0	1	1	2	91	418	692

A new assessment of flood-risk in European coastal cities



A new assessment of flood-risk in major coastal cities in the World

- Defining a level of acceptable risk

- This approach allows defining a risk threshold. In this case, we used 0.1% and 1% of each city's GDP.
- As the damage function is continous, we can estimate the damage at any time → We can calculate when the previously defined aceptable risk would be exceeded.

Note: cities are ranked following ES(95%) and the colours represent RCP scenarios for sea-level rise (RCP 8.5 ■; RCP 6.5 ■, RCP 4.5 ■ and RCP 2.6 ■).

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Thank you!