



Dedicated to innovation in aerospace

Big data for improving aerospace safety

Overview of NLR research activities

**FSS Public Workshop
Brussels – 8 March 2017**

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“Big data is in the eye of the beholder”



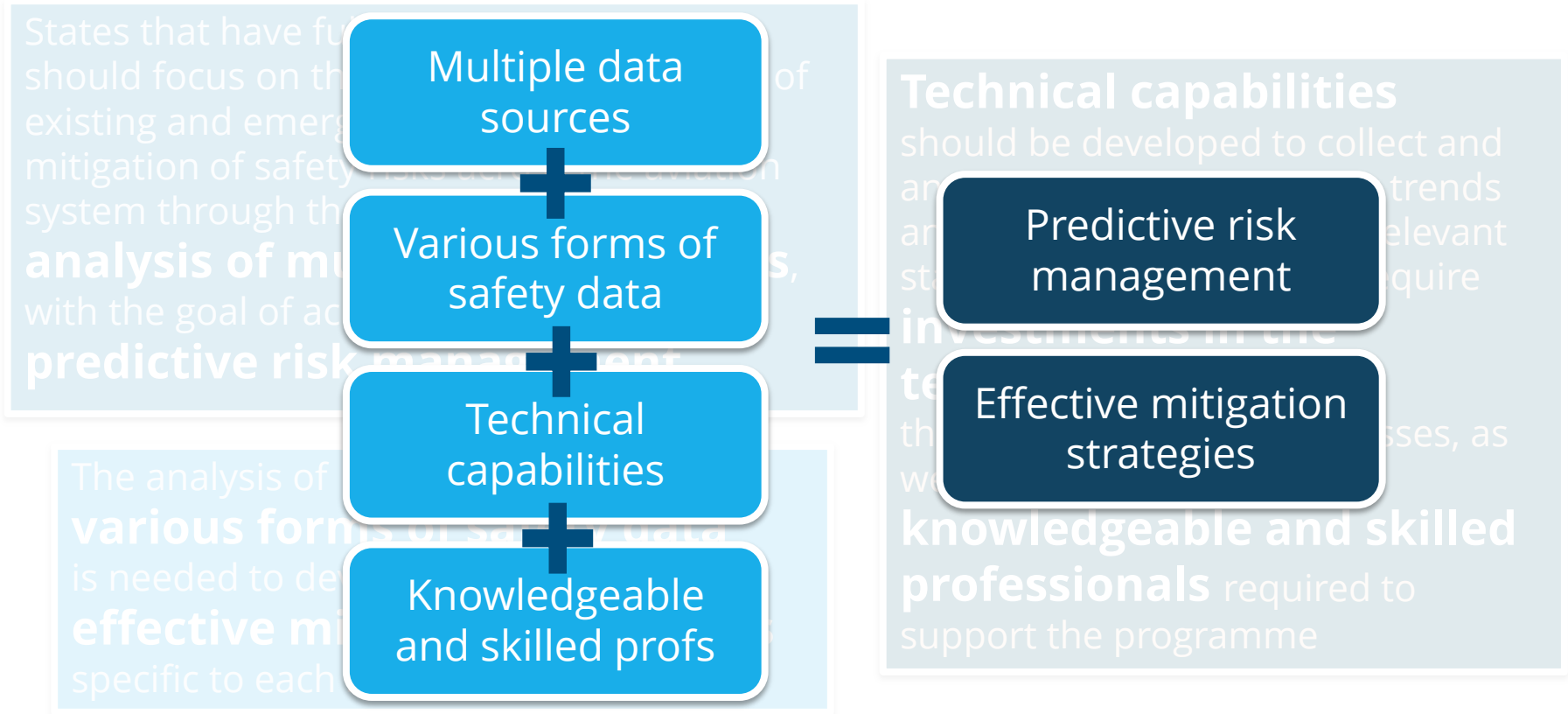
Motivation – ICAO Global Aviation Safety Plan

States that have fully implemented an SSP should focus on the systemic identification of existing and emerging hazards and the mitigation of safety risks across the aviation system through the **analysis of multiple data sources**, with the goal of achieving **predictive risk management**.

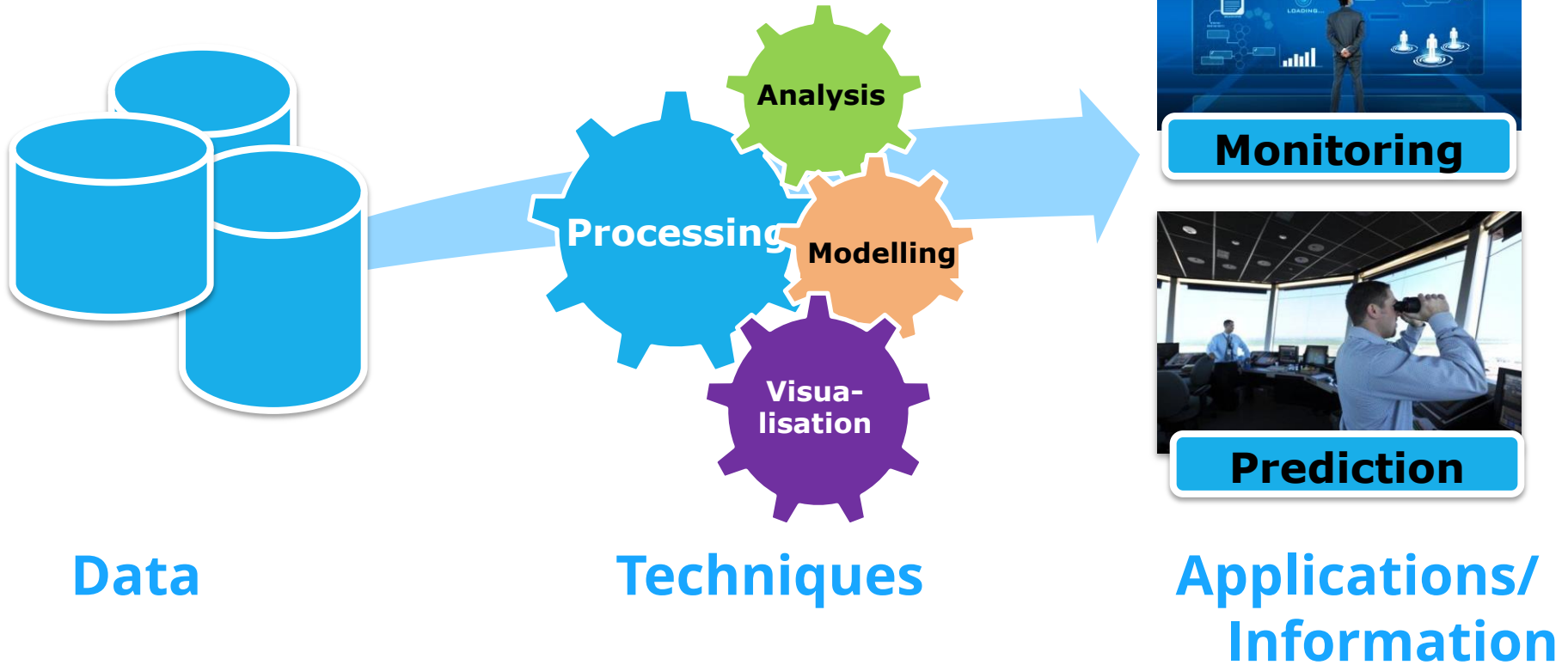
The analysis of **various forms of safety data** is needed to develop **effective mitigation strategies** specific to each State or region

Technical capabilities should be developed to collect and analyse data, identify safety trends and disseminate results to relevant stakeholders. An SSP may require **investments in the technical systems** that enable analytical processes, as well as **knowledgeable and skilled professionals** required to support the programme

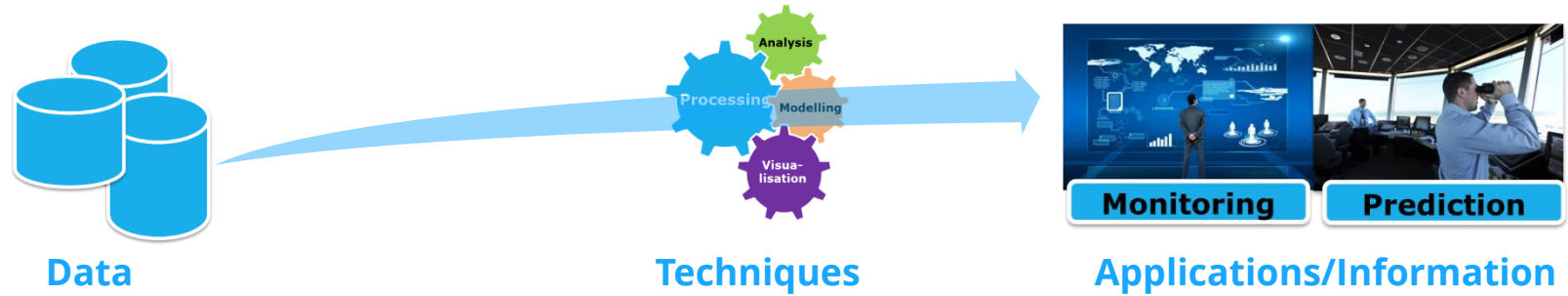
Motivation – ICAO Global Aviation Safety Plan



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2. Data + machine learning = Prediction of indicators
3. Analysis / visualisation of data from occurrence reports
4. Data + risk modelling = risk picture
5. Text and data mining of occurrence reports



Data driven performance monitoring: Flight path data

Fanomos v3.0 build 20160211 logged in as EUROPEOPENSKYn :: Opened EUROPEOPENSKY (NLR latlon EUROPE OpenSky dbase (fanomos-nlr))

File Preferences Help Tools

Map Windows: Control Area Map Layer Control Spatial Analysis Altitude Bands: Default Compass Profile Window

Printing: Ready

QuickInfo: Time CS Alt ft

Zoom: Min X -5 Max X 25 Min Y 46 Max Y 55

Control Area: Map Information Grid Flights Track Density Runways OffenderBox

Map Layers Control: Border Germany Significant Points

Altitude bands: AA Transparent Gray

Map Selection: maps | GERMANY

Altitude bands: < 0 ft, 0 - 1500 f, 1500 - 3000 f, 3000 - 4500 f, 4500 - 6000 f, 6000 - 7500 f, > 7500 ft

Copyright: Vermessungsverwaltungen der Länder und BKG 2002. ATKIS, Basis-DLM

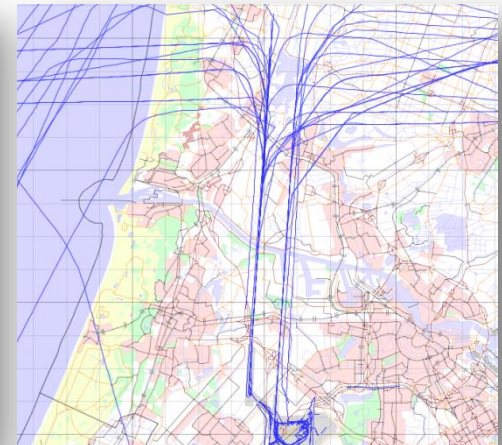
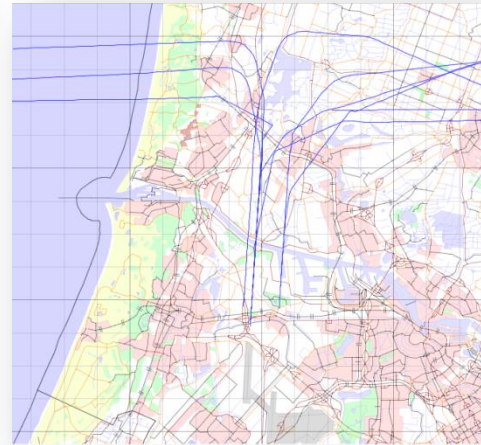
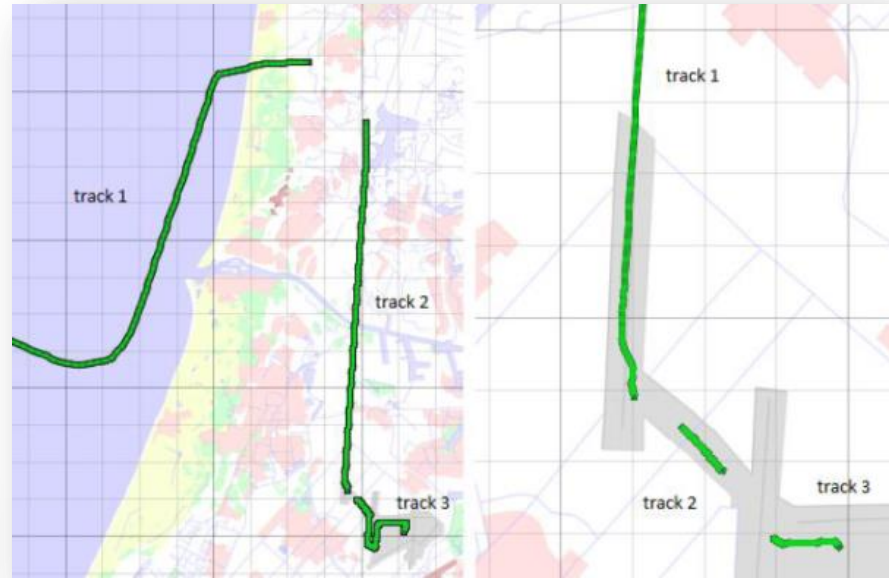
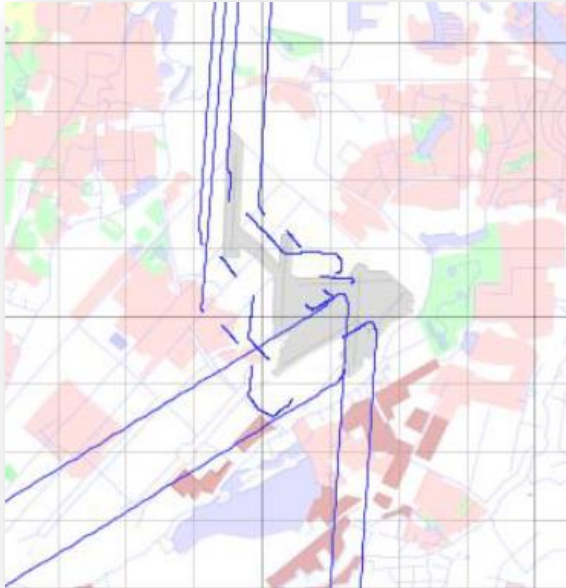
Flights | Logs

Date	ATD	ATA	SSR	Callsign	Gradient	Reg	Type	Cat	Weight	Size	Comp	Rwy	Route	Orig	Dest	QNH	OFF	Ntr
2017-01-16	09:08	09:48	6267	BCY172		EI-RJW	RJ85	Jet	Medium	Big	BCY			EGLC	EHAM	1013.0		1
2017-01-16	09:55	09:52	7330	KLM13N		PH-KZK	F70	Jet	Medium	Big	KLC			EGFF	EHAM	1013.0		1
2017-01-16	09:42	10:11	3532	KLM74R		PH-EZC	E190	Jet	Medium	Big	KLC			ESSA	EHAM	1013.0		2
2017-01-16	09:08	10:00	1034	KLM12P		PH-BXA	B738	Jet	Medium	Big	KLM			LFPG	EHAM	1013.0		1
2017-01-16	09:29	10:00	1034	IBS3722		EC-MEG	A320	Jet	Medium	Big	IBS			LEMD	EHAM	1013.0		1
2017-01-16	09:40		6474	DLH6JW		D-AEMB	E190	Jet	Medium	Big	DLH			EDDM	EHAM	1013.0		1
2017-01-16		09:26	1342	KLM82V		PH-BGA	B738	Jet	Medium	Big	KLM			EDDH	EHAM	1013.0		1
2017-01-16		09:05	6257	TFL376		PH-TFK	B788	Jet	Heavy	Big	TFL			TNCB	EHAM	1013.0		1

Flight: PH-BXA CS=KLM12P selected

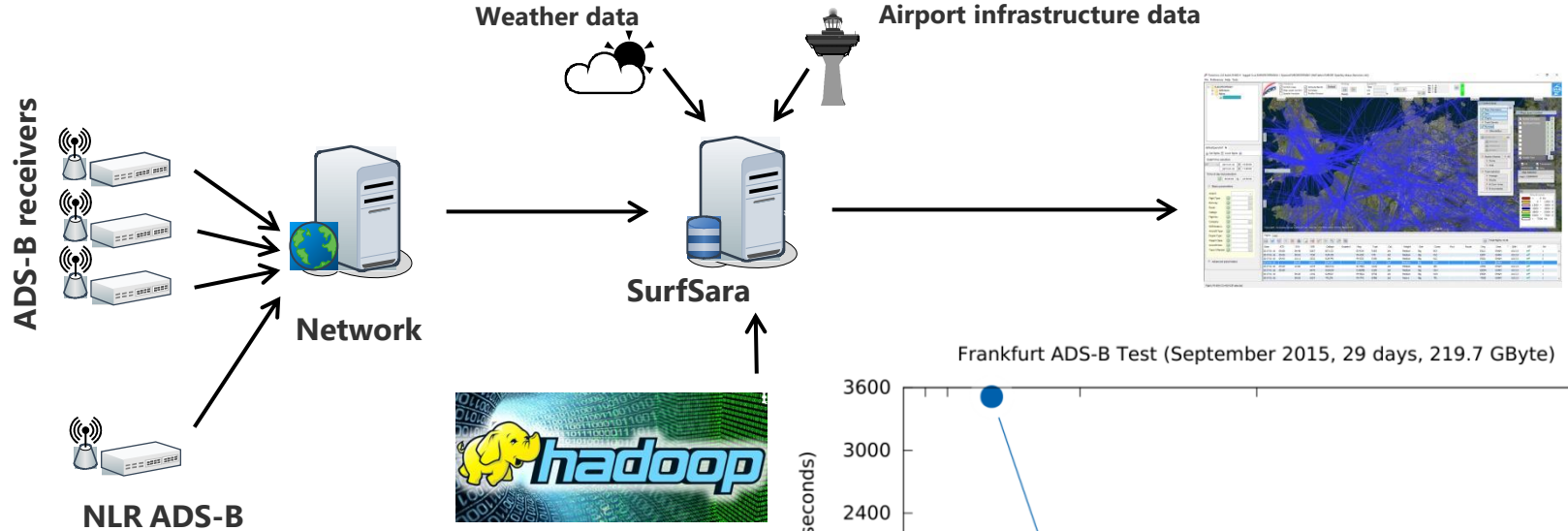
Quality of data

- Is it complete?
- Is it accurate?



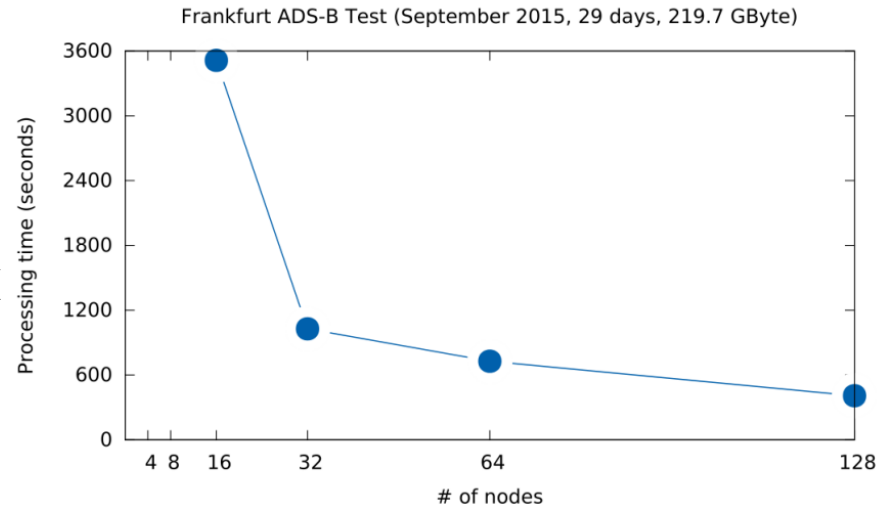
Data driven performance monitoring

Collecting and processing 10,000 flights per hour



Tests on SURFsara Hadoop cluster / SPARK

- Scaling in volume: longer time periods
- Scaling in variety: more airports
- Including shared data





Data driven performance monitoring

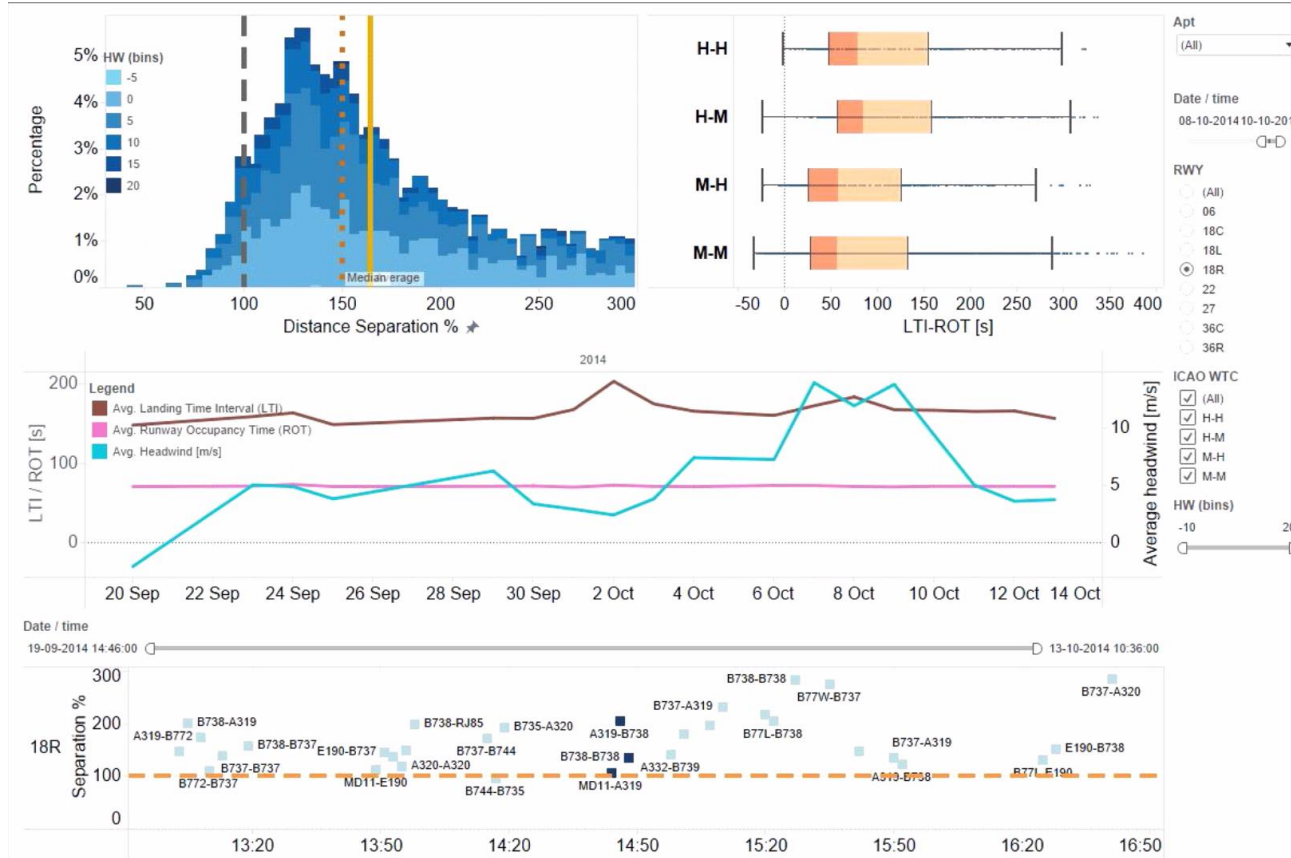
Fusion data sources, focus on exposure data





Data driven performance monitoring

Convert data into performance information



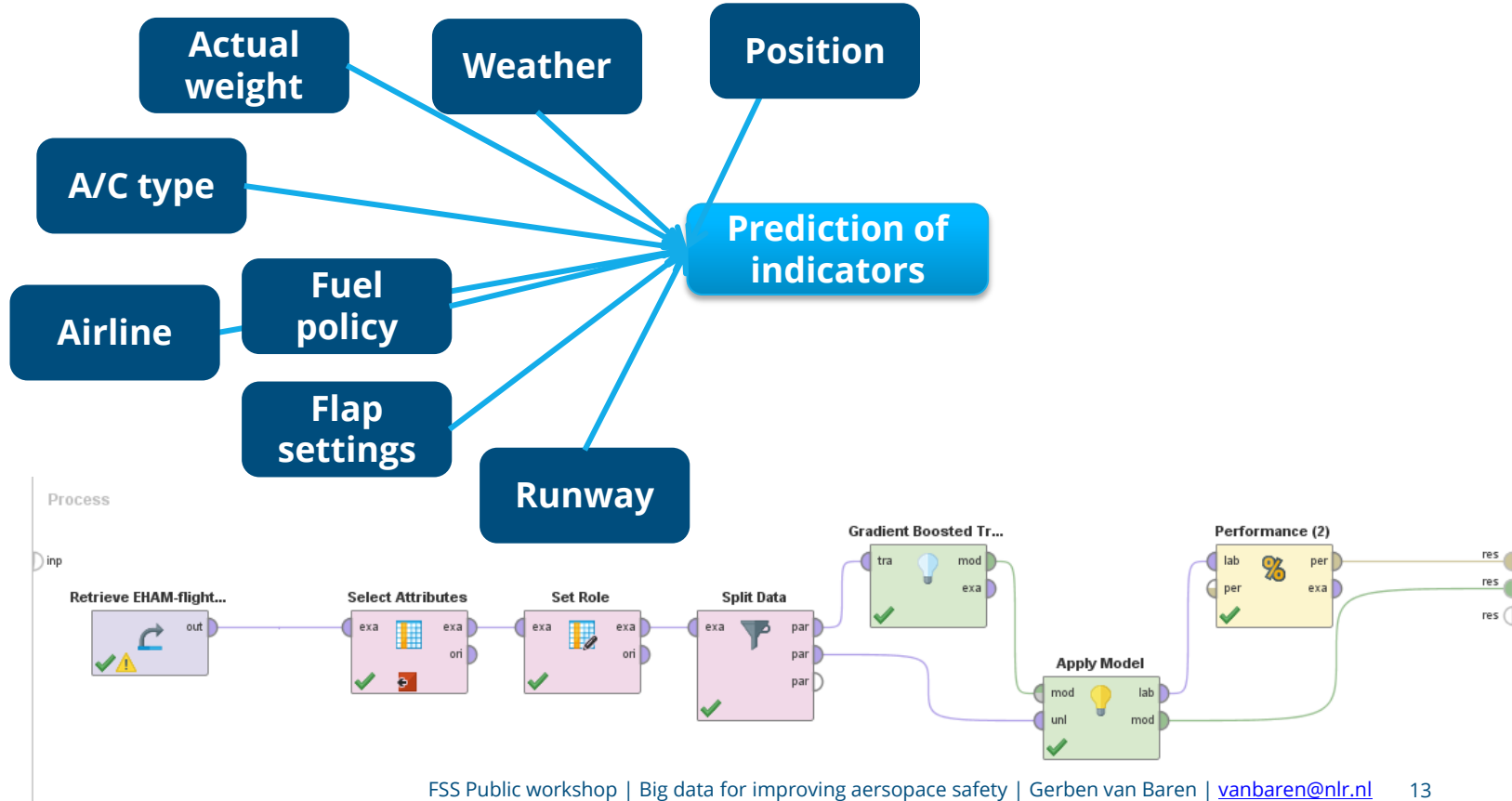
Data driven performance monitoring

Convert data into performance information

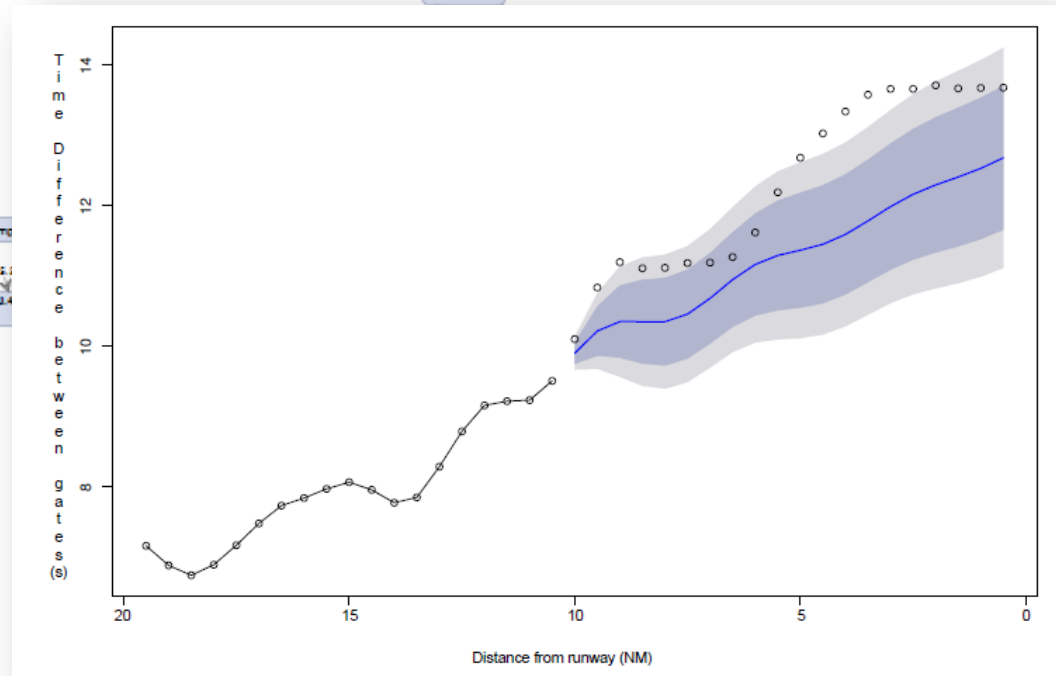
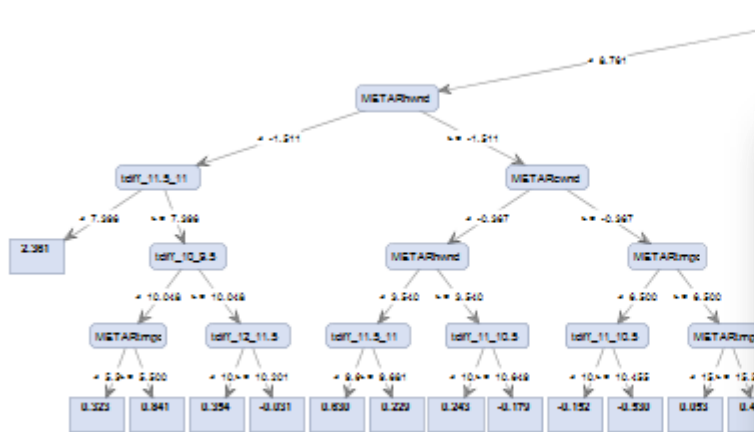
Traffic density
on runways/
taxiways



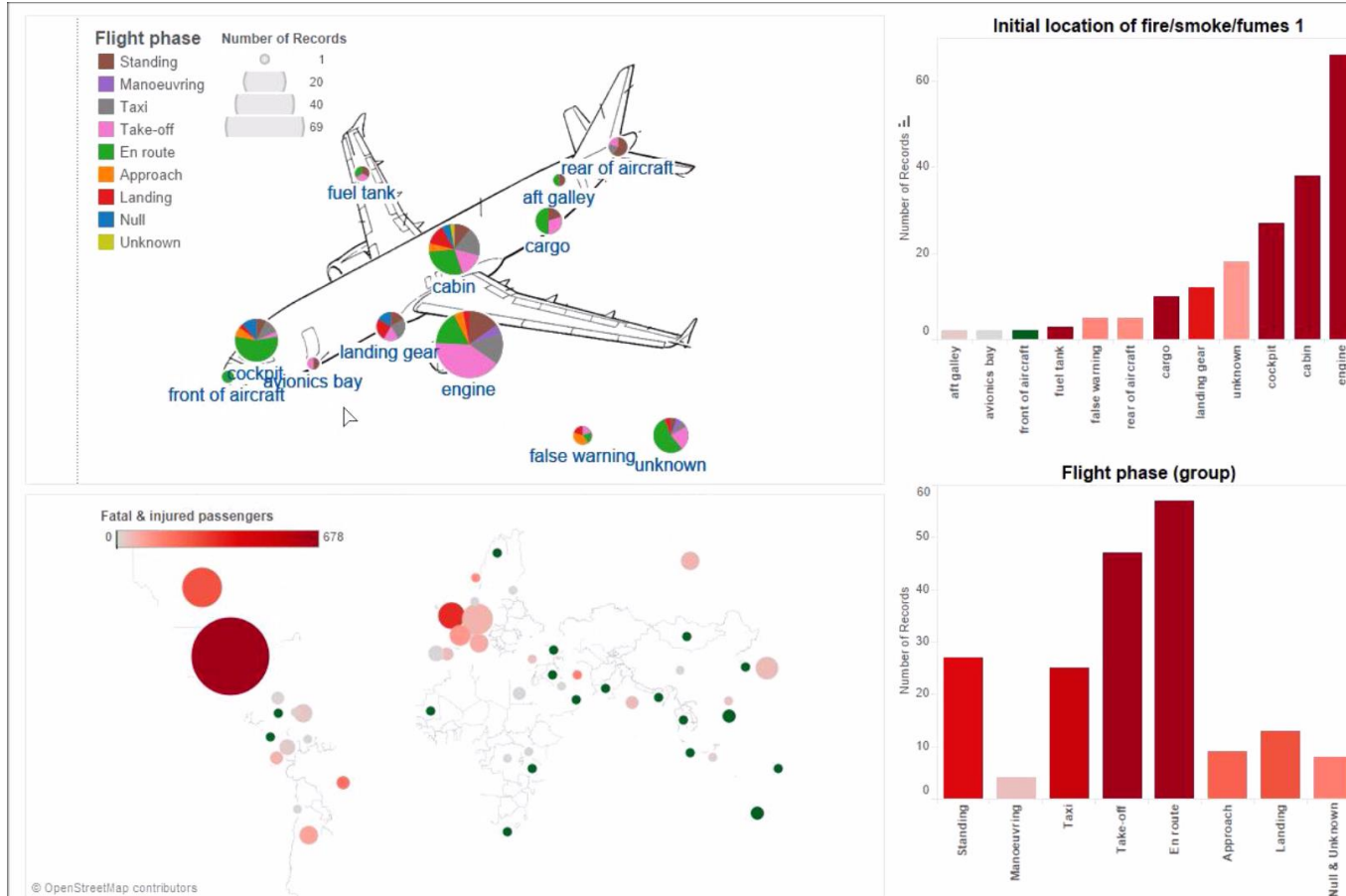
Prediction of indicators using historical and actual data, state-of-the-art software and tool-sets



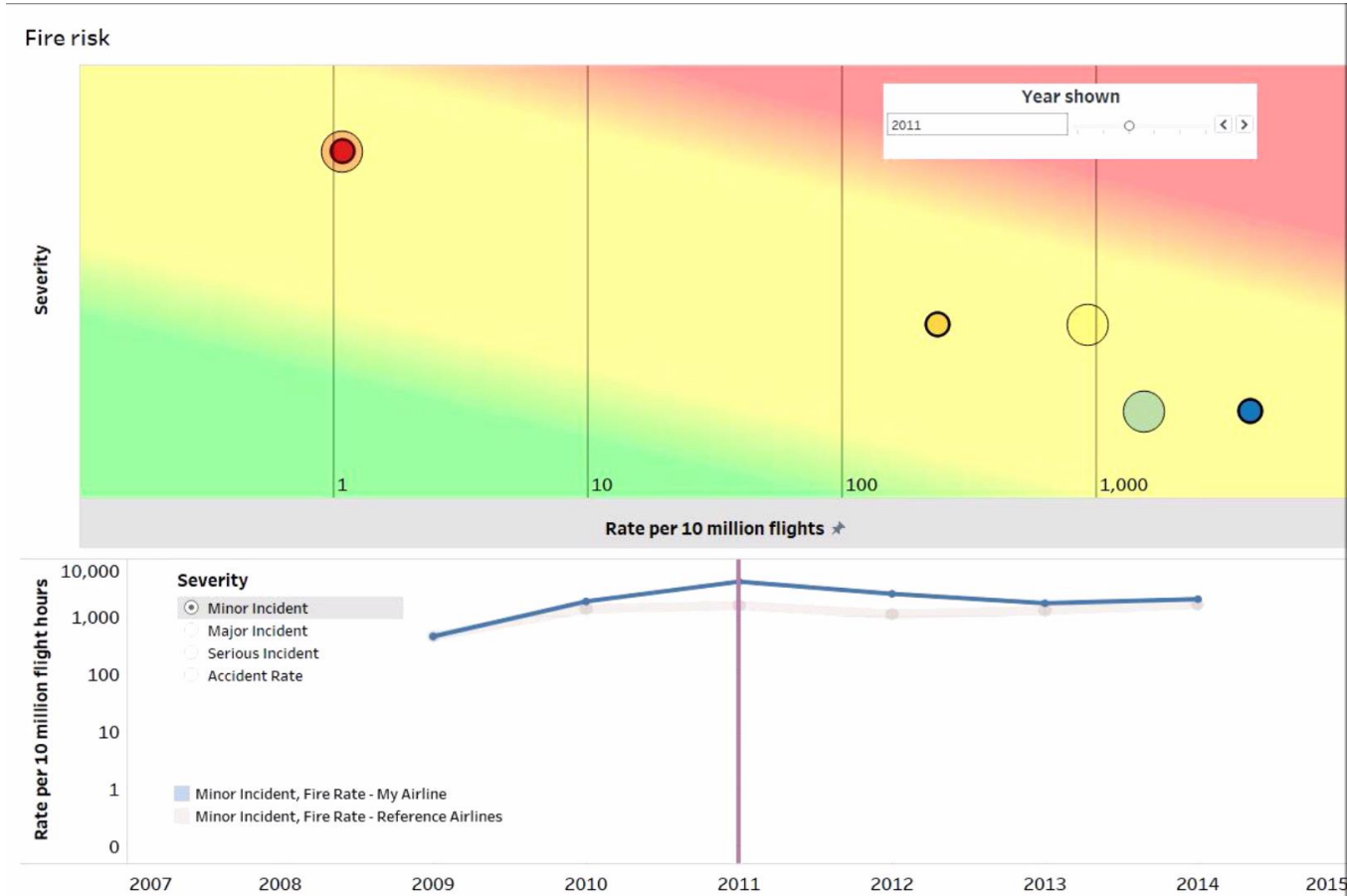
Prediction of indicators using historical and actual data, state-of-the-art software and tool-sets



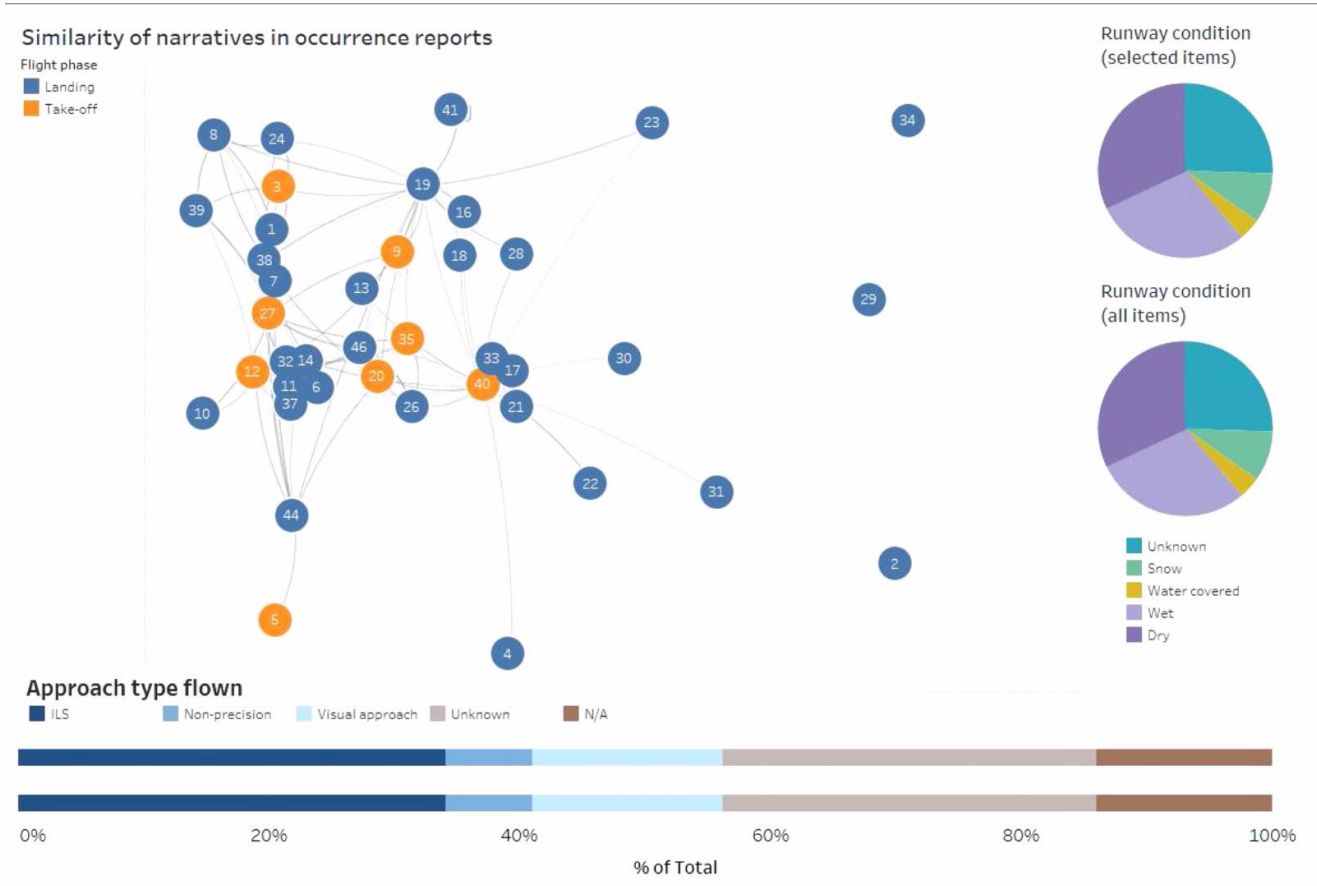
Analysis / visualisation of data from occurrence reports



Data and risk modelling, Risk picture, blind comparison



Text and data mining of occurrence reports

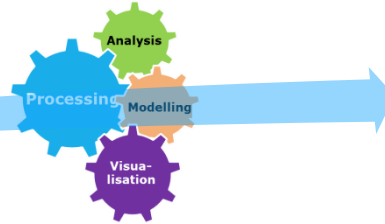
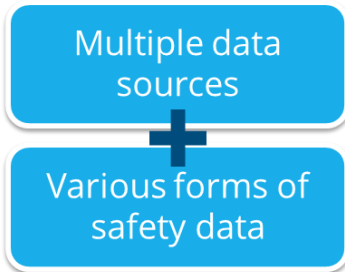


In summary



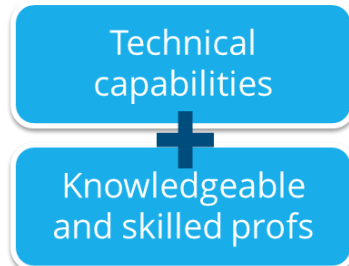
Data

- Flight path
- FDM
- Occurrence
- Weather



Techniques

- IT infrastructure
- Data mining
- Machine learning
- Text processing
- Visualisation



Monitoring

Prediction

Applications/Information

- Monitoring of performance
- Prediction of indicators
- Learning from occurrence reports

