

HORIZON.IQ

FAQ

Compiled by Lightspark.AI

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Lightspark HorizonIQ & API Alignment with OSFI B-15

Climate Risk Management Guideline

Executive Summary

Lightspark HorizonIQ and the Lightspark API provide property-level physical and transition risk data that operationalize OSFI's Climate Risk Management Guideline (B-15). This document explains how Lightspark supports governance, ERM integration, scenario analysis, capital adequacy, disclosure, and PCAF-aligned emissions reporting.

Chapter 1 – Governance & Risk Management

Principle 1 – Governance & Accountability

HorizonIQ provides quantified Fire, Flood, and Wind scores, return periods, and annual exceedance probabilities. These support board oversight, risk appetite statements, and executive dashboards.

Principle 2 – Business Model & Climate Transition Plan

The API provides Energy Score, Carbon Score, Energy Intensity, and Carbon Intensity metrics. These enable transition risk quantification, mortgage decarbonization planning, and climate-aligned product strategy.

Principle 3 – Risk Identification & Measurement

Lightspark supports geophysical exposure identification (latitude/longitude, H3 hex indexing), portfolio aggregation, physics-based hazard modeling (FWI, GEV, Holland wind model), and compound risk modeling.

Principle 4 – Climate Scenario Analysis

HorizonIQ supports SSP-aligned projections, multi-horizon scenario tagging, and stress testing inputs for ICAAP and ORSA processes.

Principle 5 – Capital & Liquidity Adequacy

Exposure-at-risk can be calculated using property value, hazard intensity, and adjusted land-use risk. This enables AEP-to-expected-loss conversion and capital stress modeling.



Chapter 2 – Disclosure Requirements

Principle 1 – Relevant Information

Lightspark enables disclosure of percentage of assets vulnerable to physical and transition risks, scenario-based projections, and capital deployed toward mitigation.

Principle 2 – Specific & Comprehensive

Physics-based methodologies (FWI, GEV, Copula modeling) are documented and auditable, supporting quantitative and methodological disclosure expectations.

Principle 3 – Clear & Balanced

Normalized 0–100 risk scores, return period tables, and scenario outputs support clear executive and investor reporting.

Principle 4 – Reliable & Verifiable

H3 spatial traceability, raw hazard metrics, and adjusted risk values provide audit trails and model validation support.

Principle 5 – Appropriate for Size & Complexity

Supports aggregation at property, postal code, city, portfolio, and national levels for D-SIBs, IAIGs, and SMSBs.

Principle 6 – Consistency Over Time

Persistent spatial indexing and stable methodology allow inter-period comparability and explanation of exposure changes.

GHG & PCAF Alignment (Annex 2-1 / 2-2)

Energy intensity, carbon intensity, heating fuel type, and retrofit carbon reduction fields support Scope 3 Category 15 financed emissions calculations under PCAF.

Annex 1-2 Transmission Channel Coverage

Lightspark maps OSFI transmission channels including credit risk (collateral damage), market risk (geographic concentration), insurance loss modeling (flood RP), and operational risk (acute hazard probability).

Conclusion

HorizonIQ operationalizes OSFI B-15 from high-level principle to quantitative, portfolio-level implementation. It provides regulator-grade, auditable, scenario-ready climate risk infrastructure for Canadian financial institutions.

What is HorizonIQ?



HorizonIQ is a high-resolution climate risk modeling engine that estimates the annual probability, severity, and return periods (10-, 30-, 50-, 100-year) for:

- Wildfire
- River Flood
- Coastal Flood
- Surface (Pluvial) Flood
- Severe Wind / Tropical Cyclone

It is designed for:

- Insurance underwriting
- Portfolio risk management
- Reinsurance modeling
- Regulatory reporting (TCFD, SEC Climate Rule)
- Climate scenario analysis (SSP pathways)



Lightspark covers 62 major cities across Canada and 5MM homes. By Q3 we will have complete coverage across Canada

Province	# Cities	Total SFD Homes
ON	33	1,664,440
AB	6	558,094
QC	6	293,750
BC	12	244,630
MB	2	184,015
SK	2	107,830
NS	1	84,865
NB	2	28,285



Client Cities	Province	# SFD Homes/ City
Airdrie	AB	18,515
Calgary	AB	263,835
Chestermere	AB	5,400
Edmonton	AB	196,495
Red Deer	AB	44,304
Strathcona	AB	29,545
Abbotsford	BC	19,775
Burnaby	BC	19,080
Coquitlam	BC	12,500
Kelowna	BC	19,845
Langley	BC	25,080
Maple Ridge	BC	17,415
New Westminster	BC	5,000
North Vancouver	BC	2,580
Penticton	BC	8,230
Surrey	BC	60,960
Vancouver	BC	44,750
Vernon	BC	9,415
Brandon	MB	11,045
Winnipeg	MB	172,970
Moncton	NB	14,615
Saint John	NB	13,670
Halifax	NS	84,865
Ajax	ON	25,560
Aurora	ON	12,980
Barrie	ON	34,335



Brampton	ON	96,010
Brantford	ON	24,945
Burlington	ON	37,300
Caledon	ON	19,120
Cambridge	ON	29,110
Cornwall	ON	10,480
Guelph	ON	27,710
Hamilton	ON	113,110
King	ON	7,820
Kingston	ON	28,155
Kitchener	ON	45,870
London	ON	72,745
Markham	ON	62,255
Milton	ON	22,720
Mississauga	ON	90,660
Newmarket	ON	18,115
Niagara	ON	24,625
Oakville	ON	43,125
Oshawa	ON	37,030
Ottawa (Metro)	ON	204,485
Peterborough	ON	10,860
Pickering	ON	2,490
Richmond Hill	ON	39,285
St Catherines	ON	32,725
Sudbury	ON	45,025
Toronto	ON	270,470
Vaughan	ON	65,010
Waterloo	ON	21,635
Whitby	ON	32,295
Windsor	ON	56,380
Gatineau	QC	40,280
Laval	QC	76,000
Montréal	QC	70,495

Québec City	QC	79,730
Repentigny	QC	15,770
Rimouski	QC	11,475
Regina	SK	58,755
Saskatoon	SK	49,075

GENERAL QUESTIONS

1. What does HorizonIQ actually produce?

It produces:

- Annual probability of hazard
- Annual Exceedance Probability (AEP)
- Return period intensities (RP10, RP50, RP100)
- Confidence intervals
- Scenario-based projections (2030–2100)

2. Is the model probabilistic or deterministic?

It uses both, depending on hazard type:

Hazard	Method
Wildfire	Probabilistic (Graph Neural Network + Fire Weather Index physics)
River Flood	Probabilistic (Hydrology + GNN + Extreme Value Theory)
Coastal Flood	Deterministic water level + probabilistic return periods
Wind (Tropical Cyclone)	Deterministic parametric wind field + GEV extreme value statistics

3. What spatial resolution does it operate at?

H3 hexagonal grid system (approximate edge lengths):

- 22 km
- 8.5 km
- 3.2 km

- 1.2 km (primary production resolution)

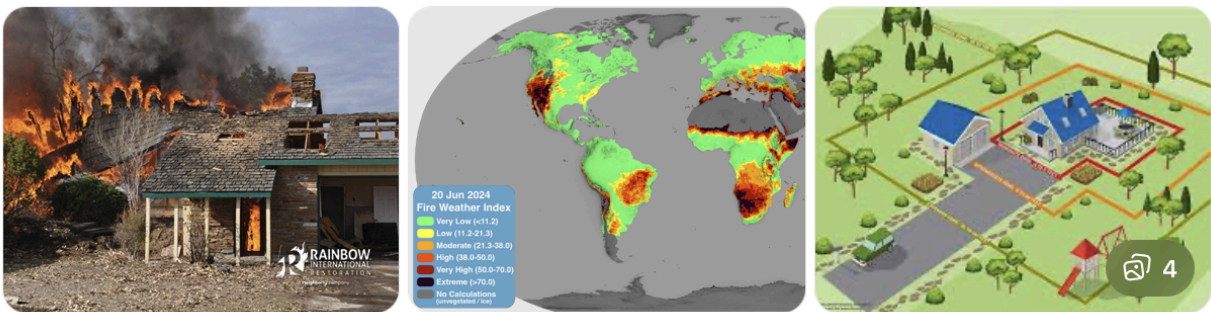
4. What climate scenarios are supported?

- SSP1-2.6
- SSP2-4.5
- SSP3-7.0
- SSP5-8.5

With projections through 2100.

WILDFIRE QUESTIONS

Wildfire Risk



5. What is the probability of ignition?

It is the modeled annual probability that a given H3 cell experiences a fire event, based on:

- Fire Weather Index (FWI)
- Temperature, humidity, wind, precipitation
- Spatial spread effects (Graph Neural Network)
- Historical satellite fire detections

6. Does it model fire spread?



Yes. Spatial relationships between neighboring cells are modeled using Graph Neural Networks, allowing fire risk to reflect:

- Wind direction
- Fuel connectivity
- Neighboring fire conditions

7. What is the Fire Weather Index (FWI)?

FWI is a physics-based Canadian system that calculates fire danger using:

- FPMC (fine fuel moisture)
- DMC (duff moisture)
- DC (drought code)
- ISI (spread index)
- BUI (fuel buildup)
- FWI (overall fire intensity)

8. Does HorizonIQ adjust for urban areas?

Yes. It includes a Fire Attenuation Model that adjusts raw fire weather risk for:

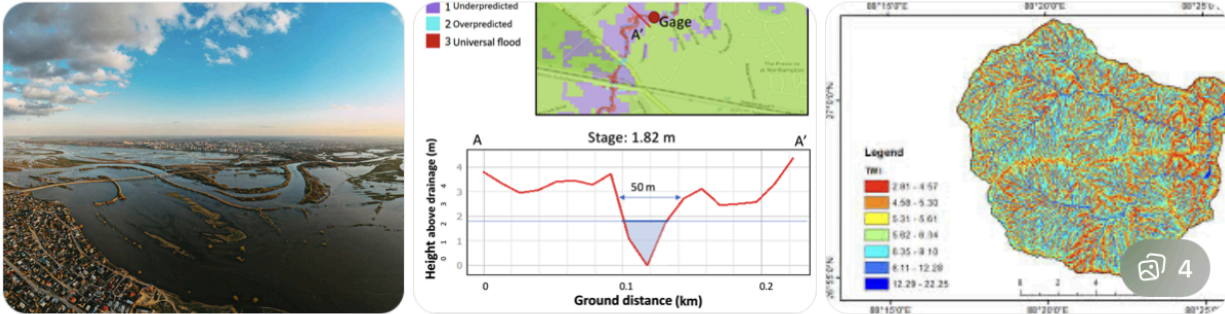
- Urban land cover
- Vegetation proximity (FireSmart zones)
- Building density

This produces both:

- Raw landscape fire risk
- Property-level attenuated fire risk

FLOOD QUESTIONS

River & Surface Flood



9. How is river flood risk calculated?

It combines:

- GloFAS river discharge data
- HydroSHEDS terrain elevation
- HAND (Height Above Nearest Drainage)
- Topographic Wetness Index (TWI)
- Extreme value statistics (GEV)

10. What is HAND?

Height Above Nearest Drainage measures how high land sits above the nearest stream channel.

Low HAND (<10m) indicates floodplain exposure.

11. What is pluvial (surface water) flood risk?

Pluvial flooding occurs when rainfall exceeds drainage capacity. It uses:

- IDF (Intensity-Duration-Frequency) curves
- Impervious surface coefficients
- Storage deficit
- Topographic Control Index (TCI)



12. Does the model include compound flooding?

Yes. It models joint probability of:

- Coastal + river flooding
- Coastal + pluvial flooding
- River + pluvial flooding

Using empirically calibrated co-occurrence ratios.

Coastal Flood Questions

13. How is coastal flood risk calculated?

Total Water Level =

Storm Surge + Sea Level Rise + Subsidence + Tide Offset

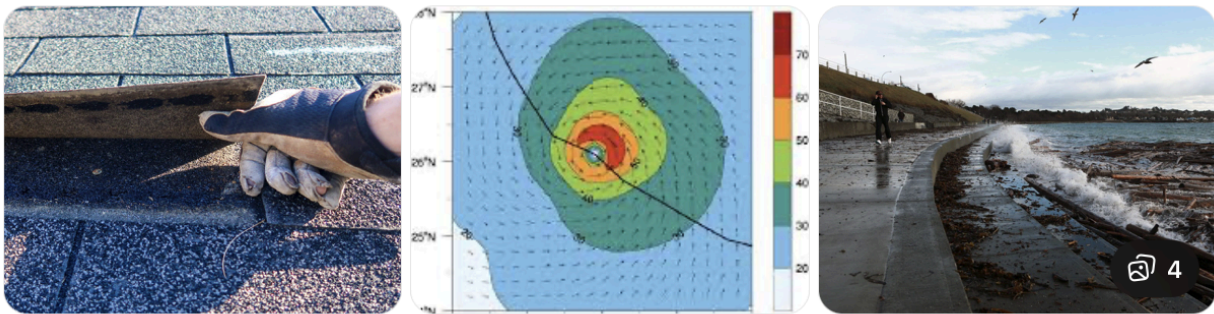
Risk is based on freeboard (elevation minus water level).

14. Does it include sea level rise?

Yes. IPCC AR6 projections are integrated under all SSP scenarios.

WIND / HURRICANE QUESTIONS

Tropical Cyclone Risk



15. How is wind risk modeled?

Wind modeling is deterministic, not ML-based:

1. Historical hurricane tracks (IBTrACS)
2. Holland parametric wind field model
3. Extreme value distribution (GEV)
4. Return period wind speeds

16. What return periods are provided?

- RP10
- RP30
- RP50
- RP100

Higher return periods available via extrapolation.



17. What is Annual Exceedance Probability (AEP)?

AEP = probability that a threshold is exceeded at least once per year.

It uses a Poisson model to properly bound probabilities between 0 and 1.



VALIDATION & ACCURACY

18. How is the model validated?

Using:

- Brier Score
- Brier Skill Score
- AUC
- Calibration Error
- Reliability Diagrams

Acceptance thresholds are defined per hazard.

19. Does the model overfit to historical data?

No. It uses:

- Temporal hold-out testing
- Walk-forward cross-validation
- No future data leakage

20. How much historical data is used?

Typically:

- ERA5 climate (1940-present)
- Fire detections (2000-present)
- Flood discharge (1980-present)
- Hurricane tracks (1851-present)



WILDFIRE – ANSWERS

What is the probability of ignition?

The probability of ignition is the modeled annual probability that a given H3 cell experiences a fire event, based on:

- Daily Fire Weather Index (FWI) physics
- Temperature, humidity, wind, precipitation
- Historical satellite fire detections (MODIS/VIIRS)
- Spatial spread modeled via Graph Neural Networks
- Temporal validation (walk-forward cross-validation)

It is output as a calibrated annual probability with confidence intervals.

What is the annual rate of wildfire occurrence?

It is the mean annual frequency of fire-positive cell-days aggregated over historical observations, transformed into:

- Annual probability
- Annual Exceedance Probability (AEP)
- Return period equivalents (e.g., 1-in-50-year fire conditions)

How is FWI computed daily?

FWI is computed sequentially using:

- Temperature
- Relative humidity
- Wind speed
- Precipitation

The model calculates FFMCI, DMC, DC → ISI & BUI → FWI daily.
Each day depends on the previous day's moisture state.

How does vegetation proximity affect ember exposure?

A vegetation proximity attenuation factor reduces risk based on:

Distance to Vegetation	Factor
0–30m	1.00
30–100m	0.70
100–250m	0.40
250–500m	0.20
>500m	0.10

This models FireSmart Home Ignition Zone principles.

How is structure-to-structure fire risk handled?

A 5% minimum attenuation floor accounts for:

- Urban conflagration
- Long-range ember transport
- Infrastructure ignition

Even dense urban areas maintain non-zero risk.

RIVER & SURFACE FLOOD – ANSWERS

What threshold defines a flood event?

- A flood label is triggered when:
- River discharge > 1000 m³/s
- This threshold reflects rare event behavior (~0.3% positive rate).

How is discharge converted to flood probability?

Process:

1. Extract annual maximum discharge per cell.
2. Fit a Generalized Extreme Value (GEV) distribution using L-moments.
3. Compute return levels (RP10, RP50, RP100).
4. Convert to Annual Exceedance Probability (Poisson model).

How are GEV parameters estimated?

Using L-moments, which are linear combinations of ordered annual maxima.

They estimate:

- μ (location)
- σ (scale)
- ξ (shape)

No iterative optimization required.

What is the shape parameter ξ ?

ξ determines tail behavior:

ξ	Interpretation
>0	Heavy tail (unbounded extremes)
$=0$	Exponential tail
<0	Bounded tail

Wind typically has $\xi < 0$; precipitation often $\xi > 0$.

How are return periods extrapolated?



If limited data exists:

Log-linear extrapolation is used:

$$x(T) = a + b \cdot \log(T)$$

For very sparse data, observed maximum is used conservatively.

How is compound flood joint probability calculated?

Joint AEP:

$$P_{\text{total}} = P_{\text{fluvial}} + P_{\text{coastal}} + P_{\text{pluvial}}$$

- $\text{co-occurrence} \times \text{copula}(P_i, P_j)$

Co-occurrence ratios are empirically calibrated from NOAA storm event data (25 years).

COASTAL FLOOD – ANSWERS

How is freeboard calculated?

$$\text{Freeboard} = \text{Ground Elevation} - \text{Total Water Level}$$

Total Water Level =

$$\text{Storm Surge} + \text{Sea Level Rise} + \text{Subsidence} + \text{Tide Offset}$$

Lower freeboard → higher risk score.

What sea level rise percentile is used?

IPCC AR6 median SLR projections are used by default, with percentile bounds available for uncertainty analysis.

Are storm surge datasets region-specific?

Yes.

- US: NOAA SLOSH MOMs

- Canada: DFO IWLS + CAN-EWLAT

How is subsidence incorporated?

Vertical land motion is added to projected sea level rise over the time horizon.

WIND / HURRICANE – ANSWERS

Why is wind modeled deterministically?

Because:

- ERA5 already contains the storm signal.
- ML yields $AUC \approx 0.5$ (no added discrimination).
- Industry standard (AIR, RMS) uses parametric wind fields.

Thus HorizonIQ uses:

Holland wind model + GEV return period analysis.

What is the Holland B parameter?

B controls the radial wind decay rate.

Typical range: 1.3–1.8

Higher B → sharper peak wind near center.

How is haversine distance used?

Wind speed at each H3 cell is computed based on actual spherical distance from storm center using haversine formula.

This ensures realistic decay of wind speed with distance.

Why is ML not used for wind hazard?

Because:

- The phenomenon is embedded in the reanalysis data.
- ML would be predicting the presence of a known event.
- Deterministic parametric modeling is physically correct.



ML is more appropriate for damage modeling, not hazard detection.

VALIDATION & STATISTICS – ANSWERS

What is Brier Skill Score relative to climatology?

$$\text{BSS} = 1 - (\text{BS_model} / \text{BS_reference})$$

Positive BSS (>0.10 for fire) indicates skill above climatology.

What is Expected Calibration Error (ECE)?

ECE measures deviation between predicted probability and observed frequency across bins.

Target: < 0.05

What is CRPS?

Continuous Ranked Probability Score evaluates full probabilistic forecasts (mean + variance).

Lower CRPS → better uncertainty modeling.

How is walk-forward validation performed?

Expanding training window:

Train 2000–2005 → Test 2006

Train 2000–2006 → Test 2007

...

Ensures no future leakage.



INSURER-FOCUSED ANSWERS

What is the 100-year flood depth at this location?

Derived from GEV-fitted annual maxima discharge, converted to return level discharge; depth can be inferred via terrain modeling.

What is the 2050 wildfire probability under SSP3-7.0?

Computed by:

1. Running bias-corrected CMIP6 climate data
2. Recomputing FWI
3. Applying trained GNN weights
4. Aggregating to annual probability

What is the 100-year wind speed?

Derived from:

- Historical IBTrACS wind tracks
- Holland wind field
- GEV distribution fitting

Capped at 100 m/s physical limit.

What is Annual Exceedance Probability?

$$AEP = 1 - \exp(-\lambda)$$

Where λ = mean annual frequency of exceedance events.

What is the compound flood risk multiplier?

Region-specific co-occurrence ratios (e.g., Gulf Coastal-Pluvial ≈ 1.79).

How does risk change between SSP2-4.5 and SSP5-8.5?



Higher SSP forcing → hotter/drier climate → higher FWI → higher modeled fire probability.

Similarly affects flood intensity and sea level rise.

What confidence interval surrounds the probability?

Model outputs include 95% CI based on ensemble spread and statistical uncertainty.

Is this risk calibrated against historical observations?

Yes.

Validation includes:

- AUC
- Brier Score
- Brier Skill Score
- Reliability diagrams
- Walk-forward cross-validation

SUMMARY

HorizonIQ provides:

- Physically grounded hazard modeling
- Probabilistic outputs
- Extreme value return periods
- Climate scenario projections
- Proper scoring rule validation
- Regulatory-ready metrics

All grounded in documented methodology

[HORIZONIQ MANUAL 2026](#)

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