

Station Nord, Groenland (81°N)

A. Dommergue

CHANGEMENT CLIMATIQUE ET DEVENIR DES POLLUANTS PERSISTANTS EN ARCTIQUE

L'Homme, acteur et victime

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Université d'Ottawa

Collège de France, Paris, 4 juin 2013

Ny-Ålesund, Svalbard (79°N), Avril 2003







Doug Wilson/Corbis



ENJEUX ÉNERGÉTIQUES, MINIERS ET GÉOPOLITIQUES

Energy Resources
EU reviews its strategy in the arctic

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Published: April 18, 2013 at 7:35 AM

BRUSSELS, April 18 (UPI) -- The European Union wants to take advantage of energy and shipping opportunities in the arctic but in a way that is environmentally sound, a commissioner said.


JUN 12 PAST EVENT

The Challenges and Opportunities of Arctic Energy and Resources Development

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Posted on Friday, May 10, 2013 SHARE | | | | | | | | | |

Obama administration outlines new policy for protecting, drilling in the Arctic



The melting Arctic Ocean ice | Mike Dunn/MGT/NC State Museum of Natural Sciences/NOAA

By Erika Bolstad | McClatchy Washington Bureau

WASHINGTON — The Obama administration on Friday released a national strategy for the Arctic in advance of Secretary of State John

0 3 1 5 | | | | | | | | | |

ENJEUX COMMERCIAUX (ÉNERGÉTIQUES)



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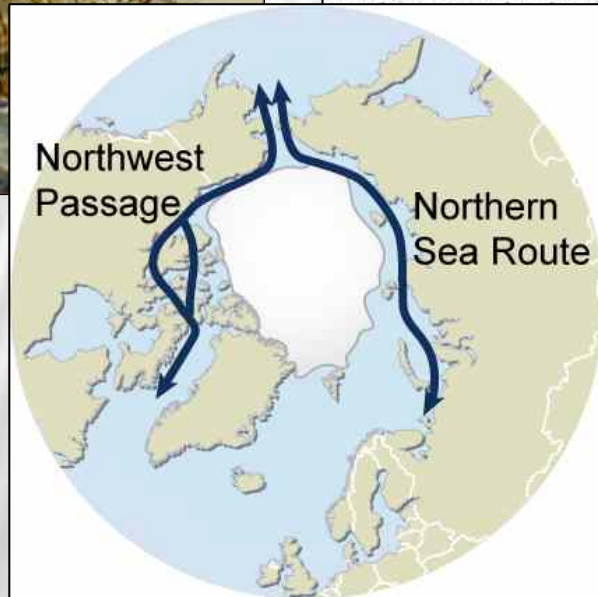
Global Warming Reopens the Northeast Passage

By Adam Smith | Thursday, Sept. 17, 2009

Like 30 Tweet 0 +1 0 Share Send to Kindle

As you're reading this, two German ships are heading for the Dutch port of Rotterdam, having set sail from South Korea in late July. Nothing remarkable about that. Except that by Sept. 16, both vessels – the *Beluga Fraternity* and *Beluga Foresight* – had

...cent-shaped island many marks the end of conventional shipping and Europe in what is a special navigation via the Beluga, the shipping



EVOLUTION DES SOURCES DE CONTAMINANTS

Historiquement les polluants étaient transportés jusqu'en Arctique, ils sont désormais produits en Arctique





« The dirty dozen »

Aldrine, Chlordane, DDT, Dieldrine,
Endrine, Heptachlore, HCB, Mirex,
Toxaphène,
PCB , PCDD (dioxines), PCDF

Convention de Stockholm - 2001

alpha-HCH, beta-HCH

Chlordécone, hexabromobiphényle (HBrB), hexaBDE et heptaBDE, Lindane, Pentachlorobenzène (PeCB)

Perfluorooctane sulfonic acid (PFOS), PFOS-F, endosulfan, tetraBDE et pentaBDE

biphenyls and naphthalenes

(tetra) PCN-28
(tetra) PCN-29
(tetra) PCN-34
(tetra) PCN-38
(penta) PCN-52
(penta) PCN-54
(penta) PCN-61
(hexa) PCN-66
(hexa) PCN-69
(hexa) PCN-71
(tetra-o) PCB-52
(tetra-o) PCB-66
(tetra-o) PCB-74
(penta-o) PCB-99
(penta-no) PCB-118
(penta-no) PCB-126
(hexa-o) PCB-138
(hexa-o) PCB-153
(hexa-no) PCB-169
(hepta-o) PCB-170
(hepta-o) PCB-180
bridged diphenyls
p,p'-DDD
p,p'-DDE
p,p'-DDT
BDE-28
BDE-47
BDE-99
BDE-100
BDE-153
BDE-154

monocyclics

PeCB
HCB
 α -HCH
 β -HCH
 γ -HCH
HBCD
PtCS (pentachlorostyrene)
HxCS (hexachlorostyrene-beta-trans)
HpCS (heptachlorostyrene-beta,beta)
OCS (octachlorostyrene)
alkyls
perfluorooctane sulfonate (PFOS)
perfluorooctane sulfonamide (PFOSA)
perfluorooctanoic acid (PFCA-8)
perfluorononanoic acid (PFCA-9)
perfluorodecanoic acid (PFCA-10)
perfluoroundecanoic acid (PFCA-11)
chlorinated paraffin (C10,C17)^b
chlorinated paraffin (C10,C18)^b
chlorinated paraffin (C10,C19)^b

chlorinated paraffin (C11,C17)^b
chlorinated paraffin C11,C18)^b

chlorinated paraffin (C11,C19)^b
chlorinated paraffin (C12,C16)^b
chlorinated paraffin (C12,C17)^b
chlorinated paraffin (C12,C19)^b

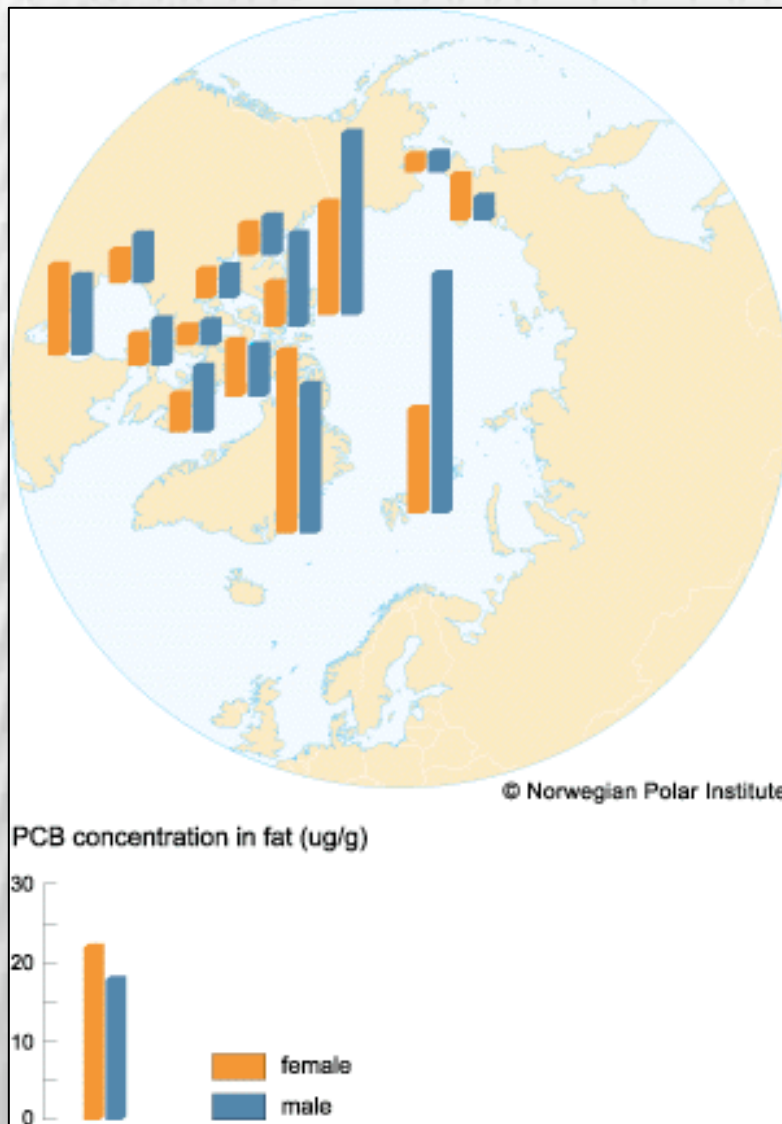
norbornenes-norbornanes

oxychlordane
Heptachlor-exo-epoxide
trans-nonachlor
MC 6
Aldrin
dieldrin
Endrin
 α -endosulfan
b-endosulfan
endosulfan-sulfate
Toxaphene 26
Toxaphene 50
Toxaphene 62
Mirex

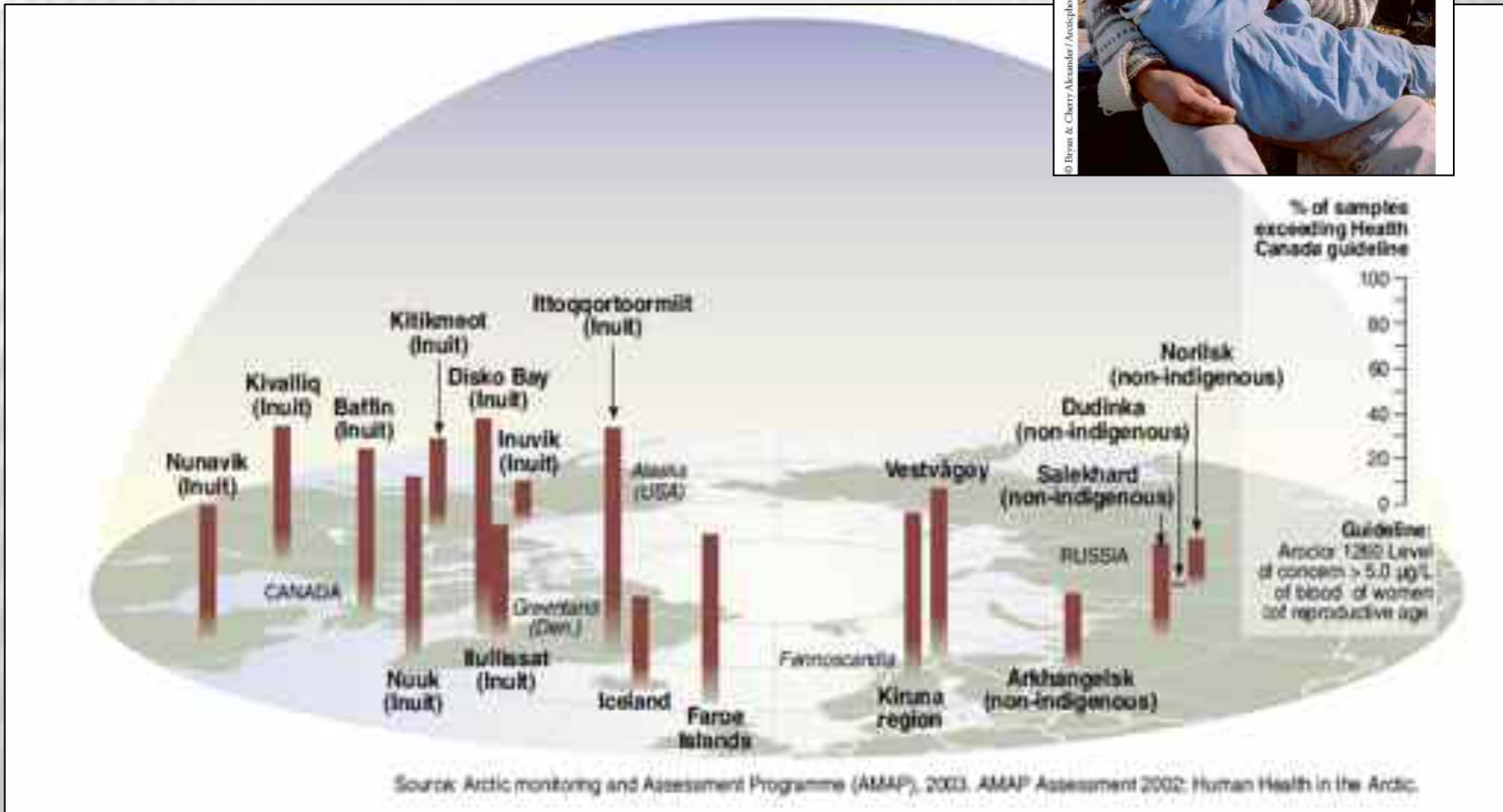
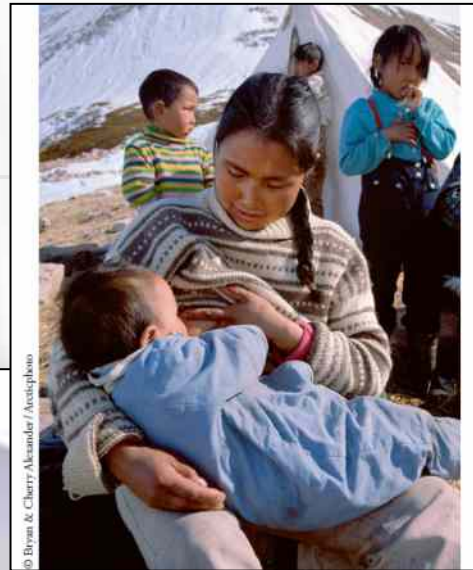
polycyclics

D
CDD
1,2,3,4,7,8-hexaCDD
1,2,3,6,7,8-hexaCDD
1,2,3,7,8,9-hexaCDD
1,2,3,4,6,7,8-heptaCDD
OCDD
2,3,7,8-tetraCDF
1,2,3,7,8-pentaCDF
2,3,4,7,8-pentaCDF
1,2,3,4,7,8-hexaCDF
1,2,3,6,7,8-hexaCDF
2,3,4,6,7,8-hexaCDF

DES « POPs » DANS LA FAUNE ARCTIQUE



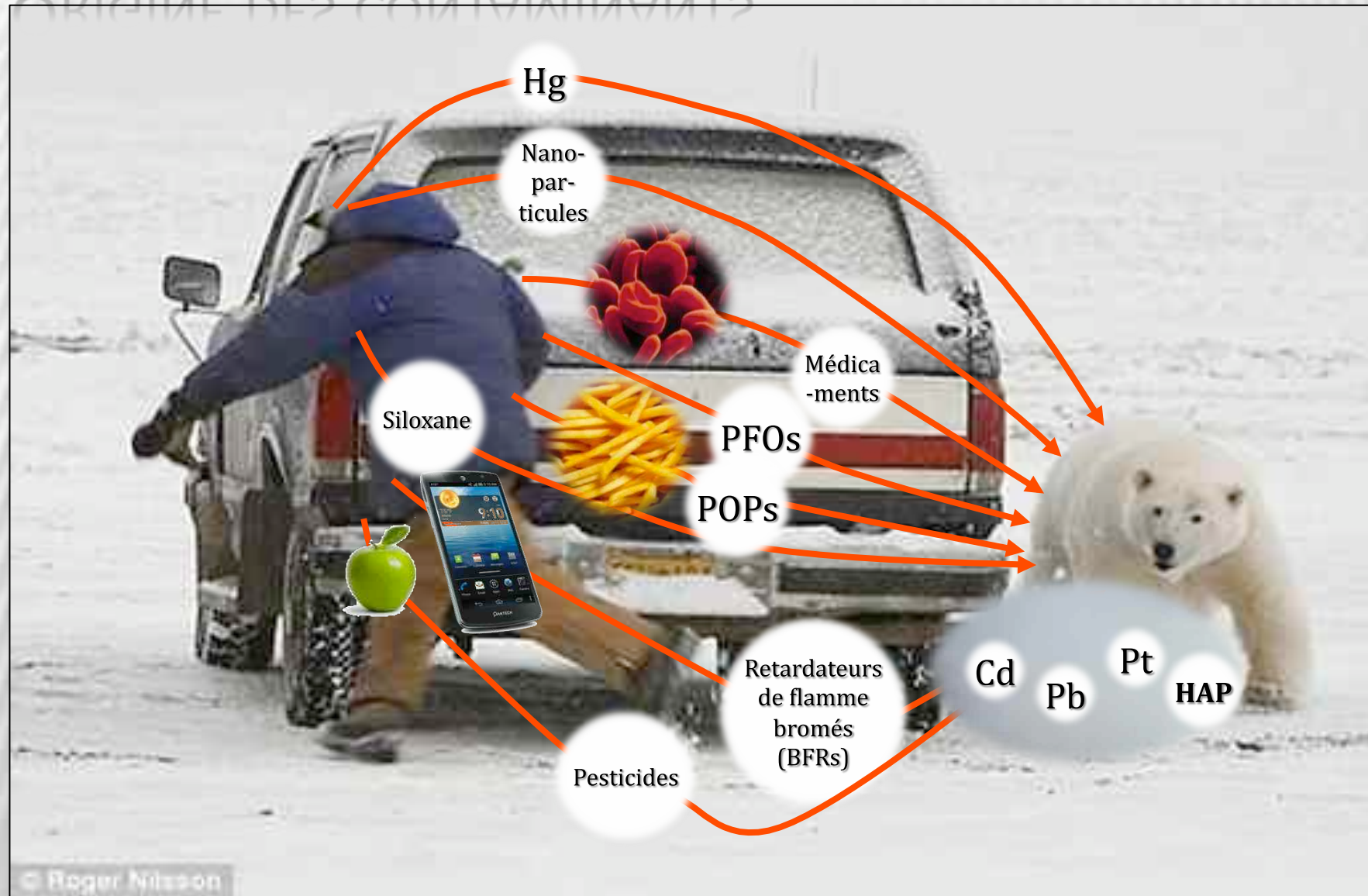
ET CHEZ L'HOMME



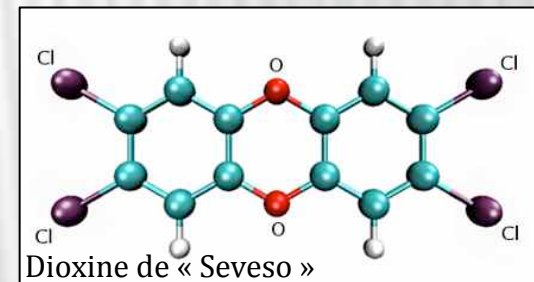
ORIGINE DES CONTAMINANTS



ORIGINE DES CONTAMINANTS



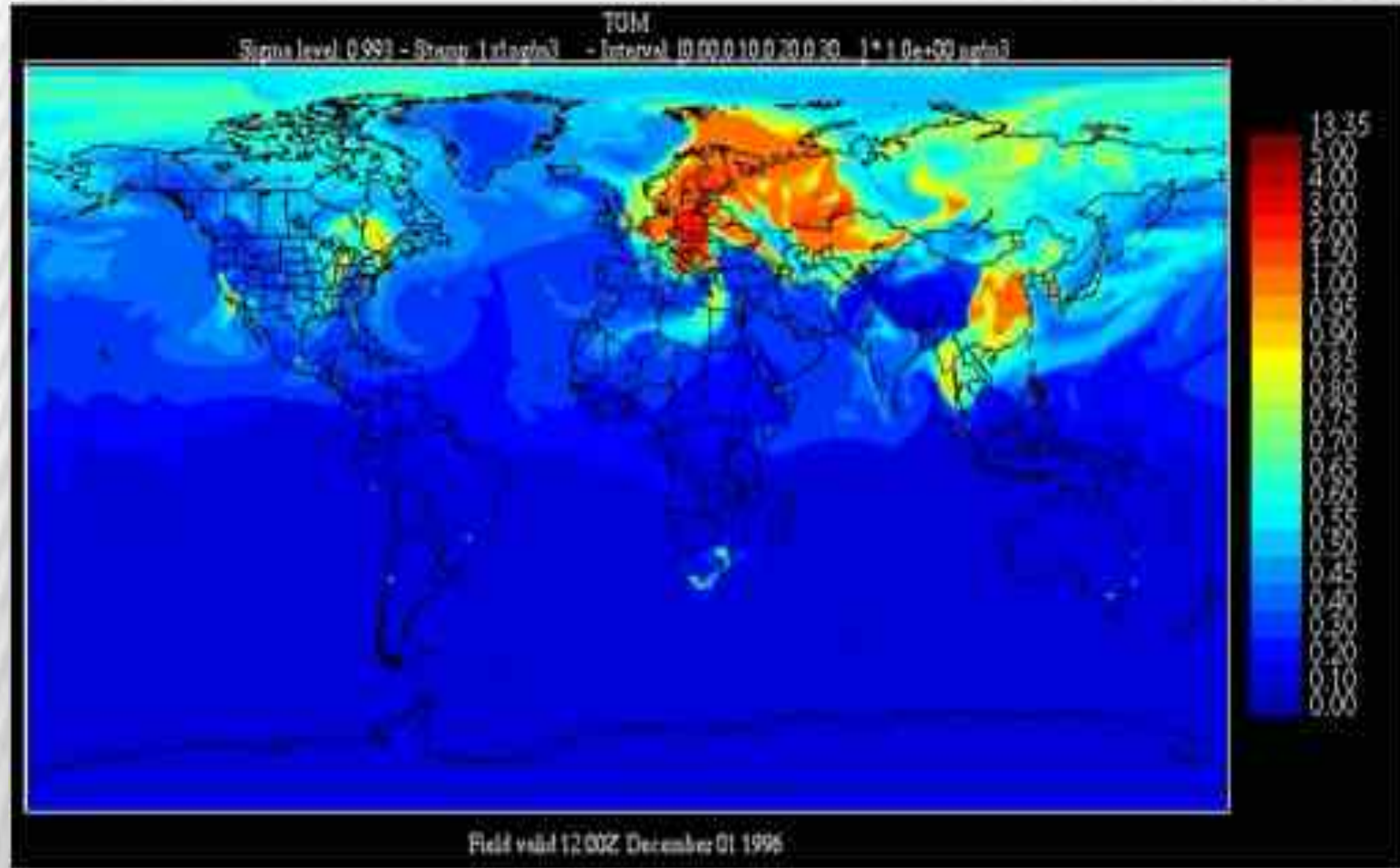
NOS MODES DE VIE: DUALITÉ DES PROGRÈS



AMAP, 2011



TRANSPORT ATMOSPHÉRIQUE,



*Modèle GRAHM, remerciements à Ashu Daastor,
Environnement Canada*

OCÉANIQUE ET FLUVIAL,



Macdonald et al., 2005

OU EN SAUMON ! (BIOVECTEURS)



Saumon rouge dans l'affluent du lac Karluk , Kodiak, Alaska (Photo L. Kimpe)

Krümmel et al., 2003
Blais et al., 2005, 2007

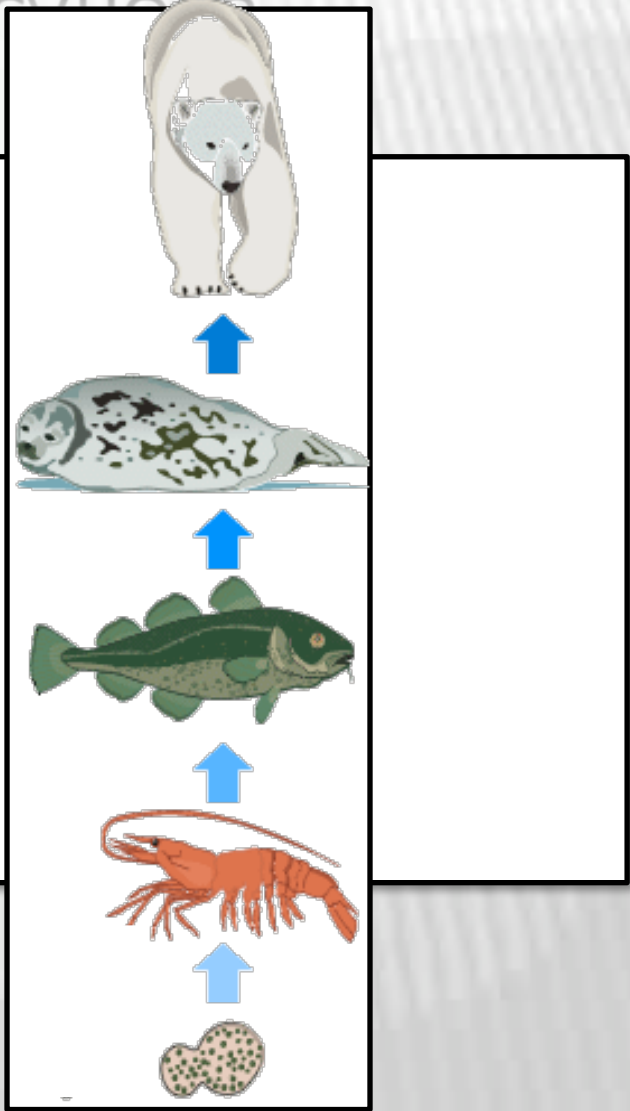
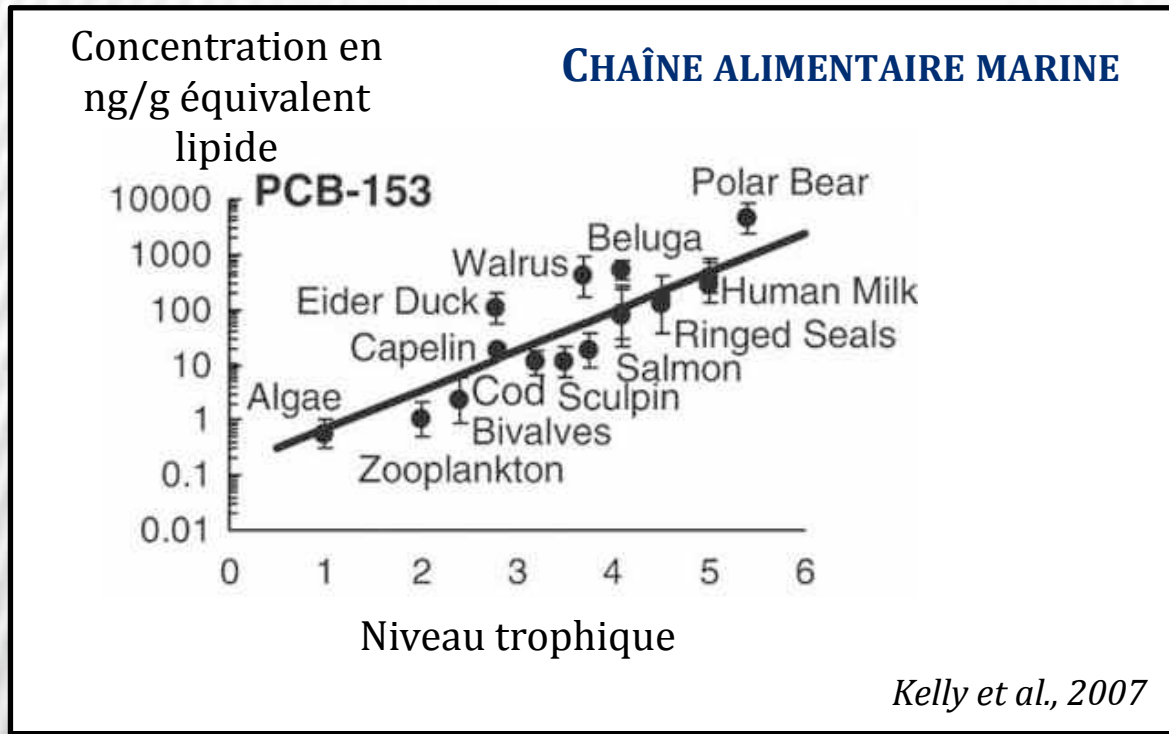
ET ALORS ?



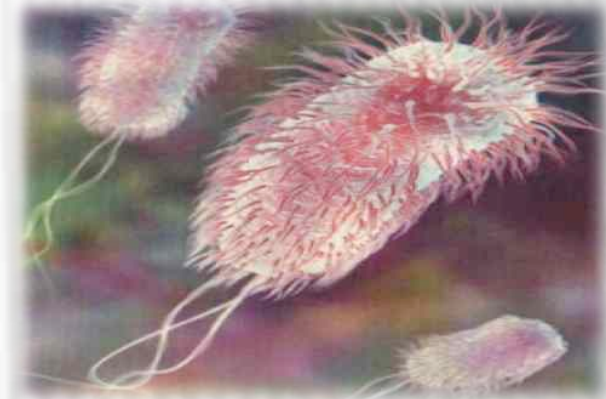
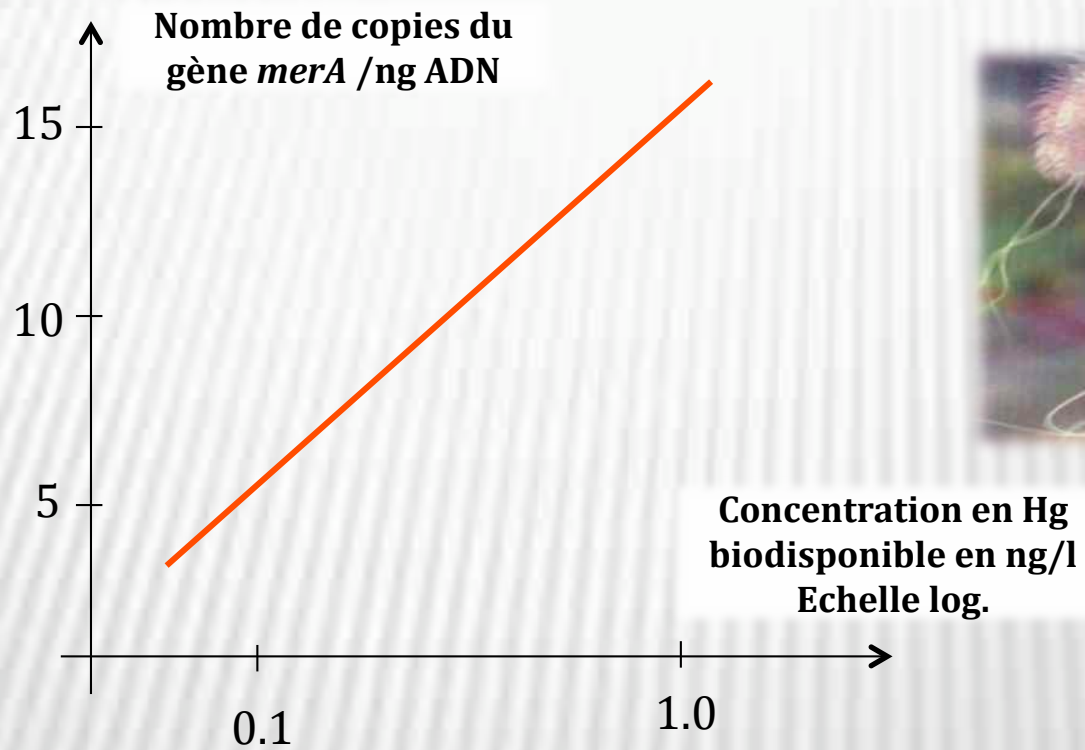
La neige est-elle toxique?

Peut-on boire l'eau des lacs ?

BIOCONCENTRATION & BIOAMPLIFICATIONS



ET À LA BASE DE LA CHAÎNE ALIMENTAIRE?



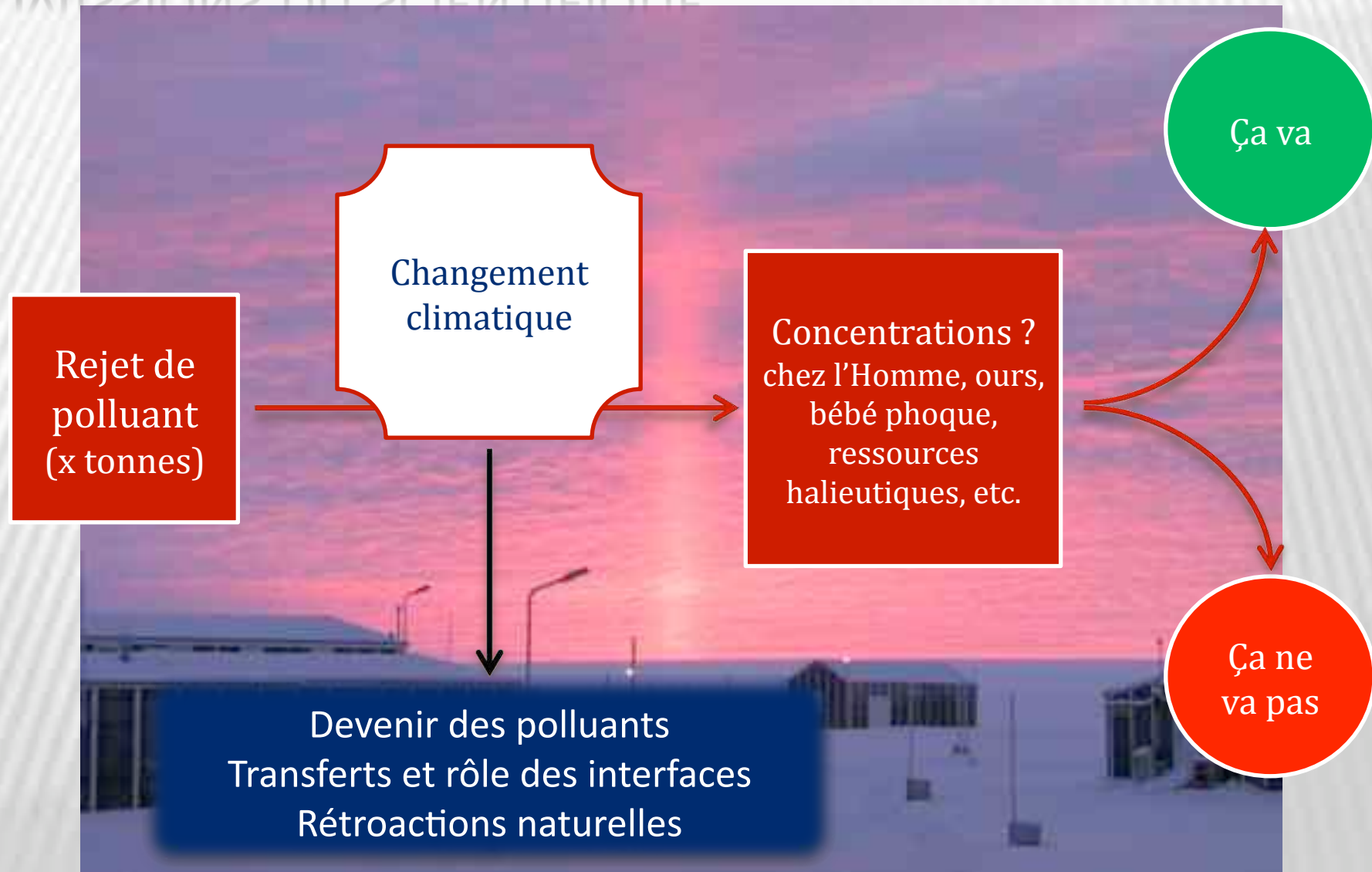
ÉVALUER LES RISQUES



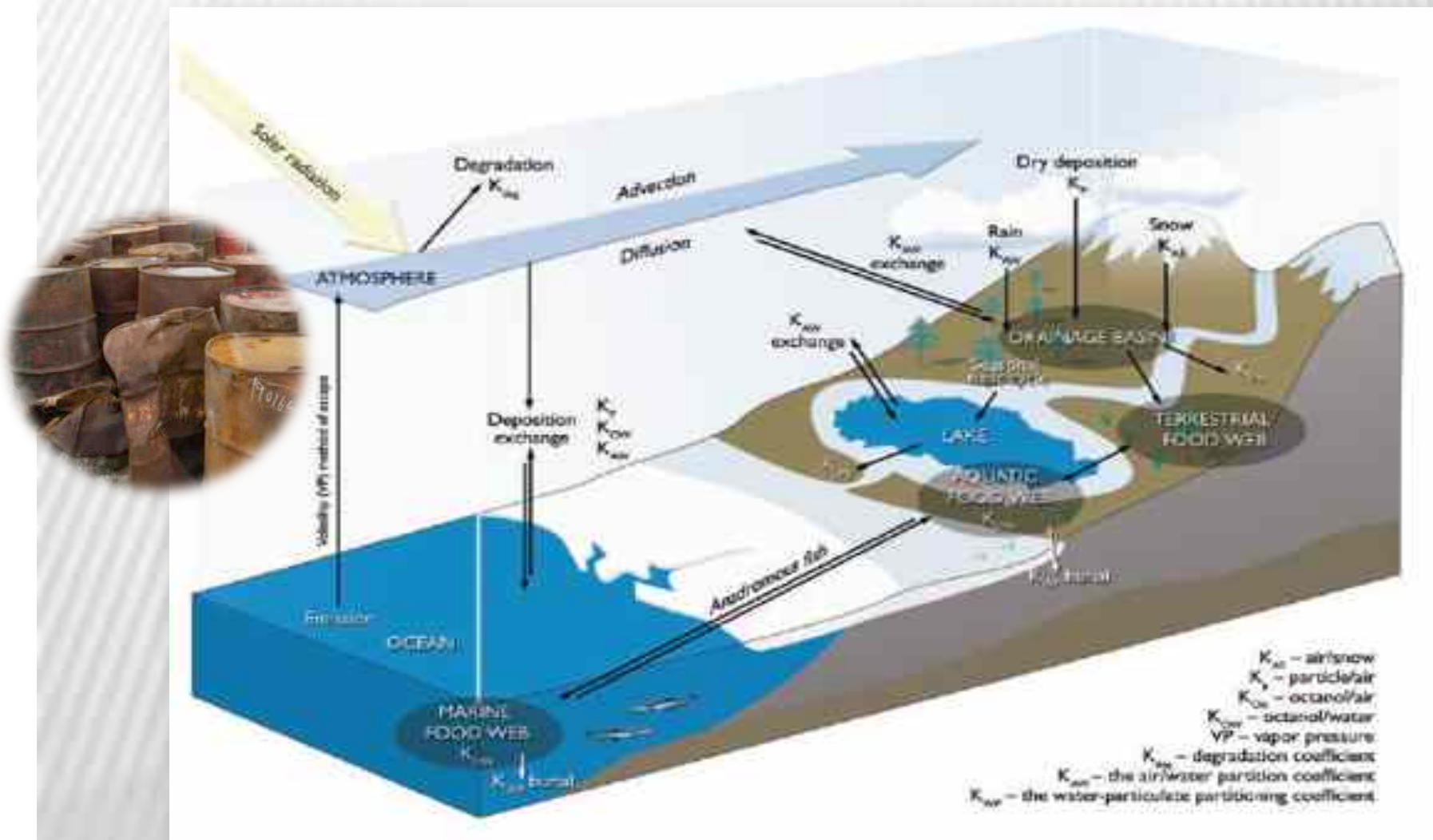
MISSIONS DU SCIENTIFIQUE



MISSIONS DU SCIENTIFIQUE

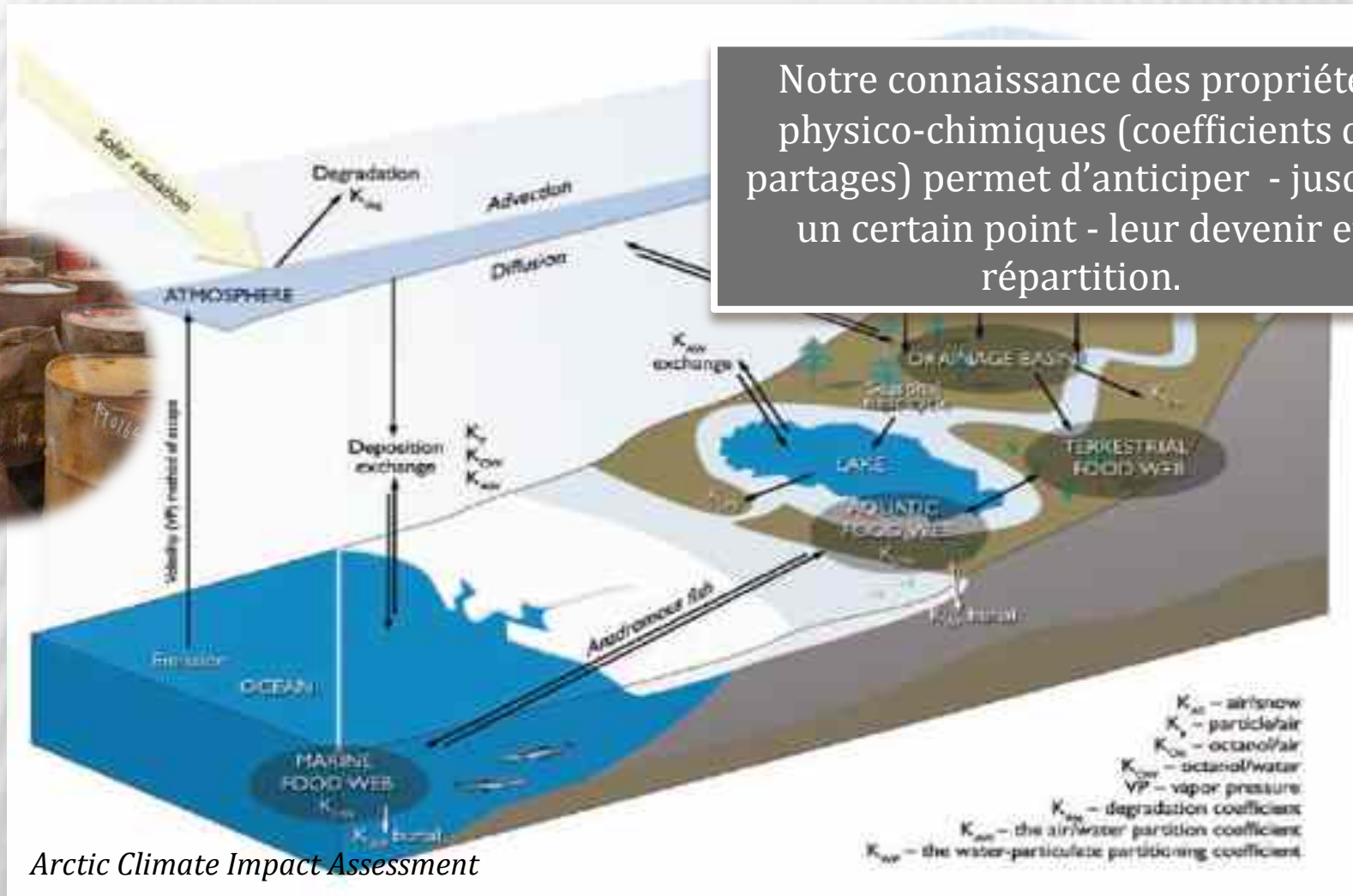


POPS EN BOÎTE



POPS IN A BOX: PRÉVISIONS

Notre connaissance des propriétés physico-chimiques (coefficients de partages) permet d'anticiper - jusqu'à un certain point - leur devenir et répartition.



Arctic Climate Impact Assessment

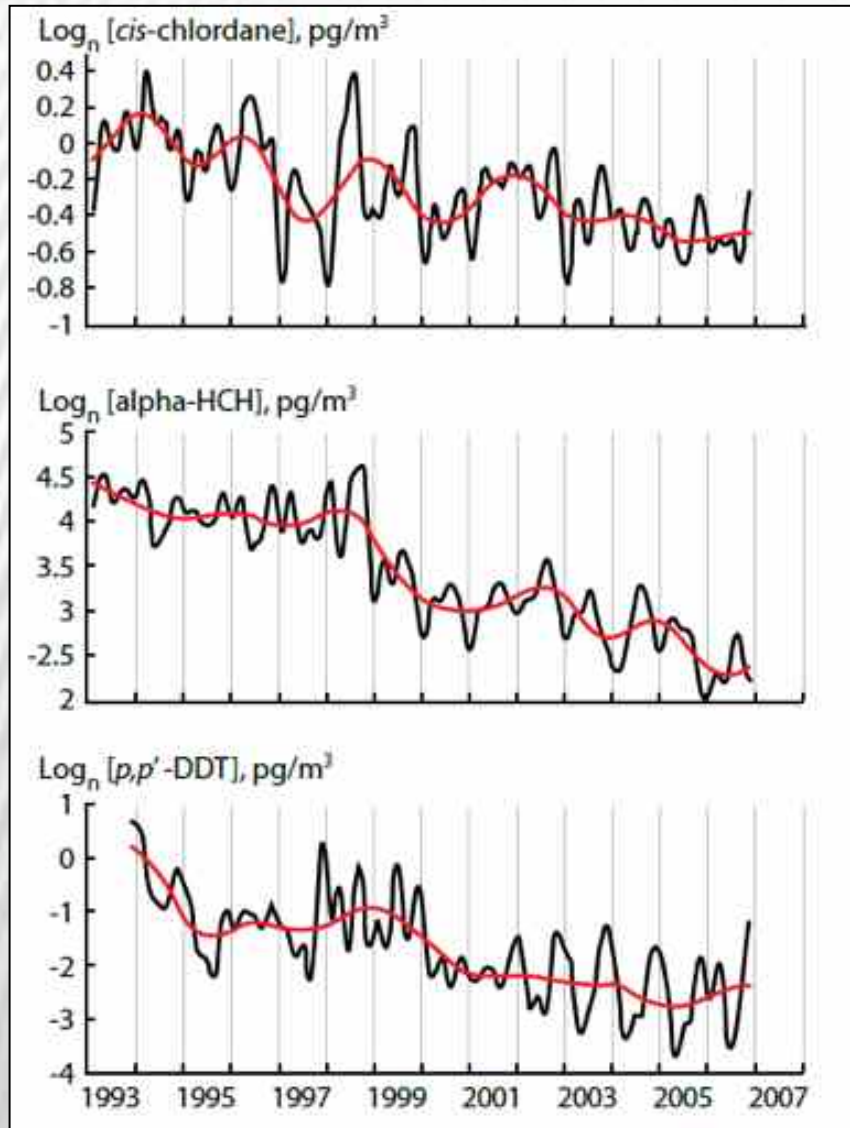
RÔLE DES INTERFACES ET COMPLICATIONS



Nicolas Le Vivant

POPs ?

RÔLE DES INTERFACES ET COMPLICATIONS

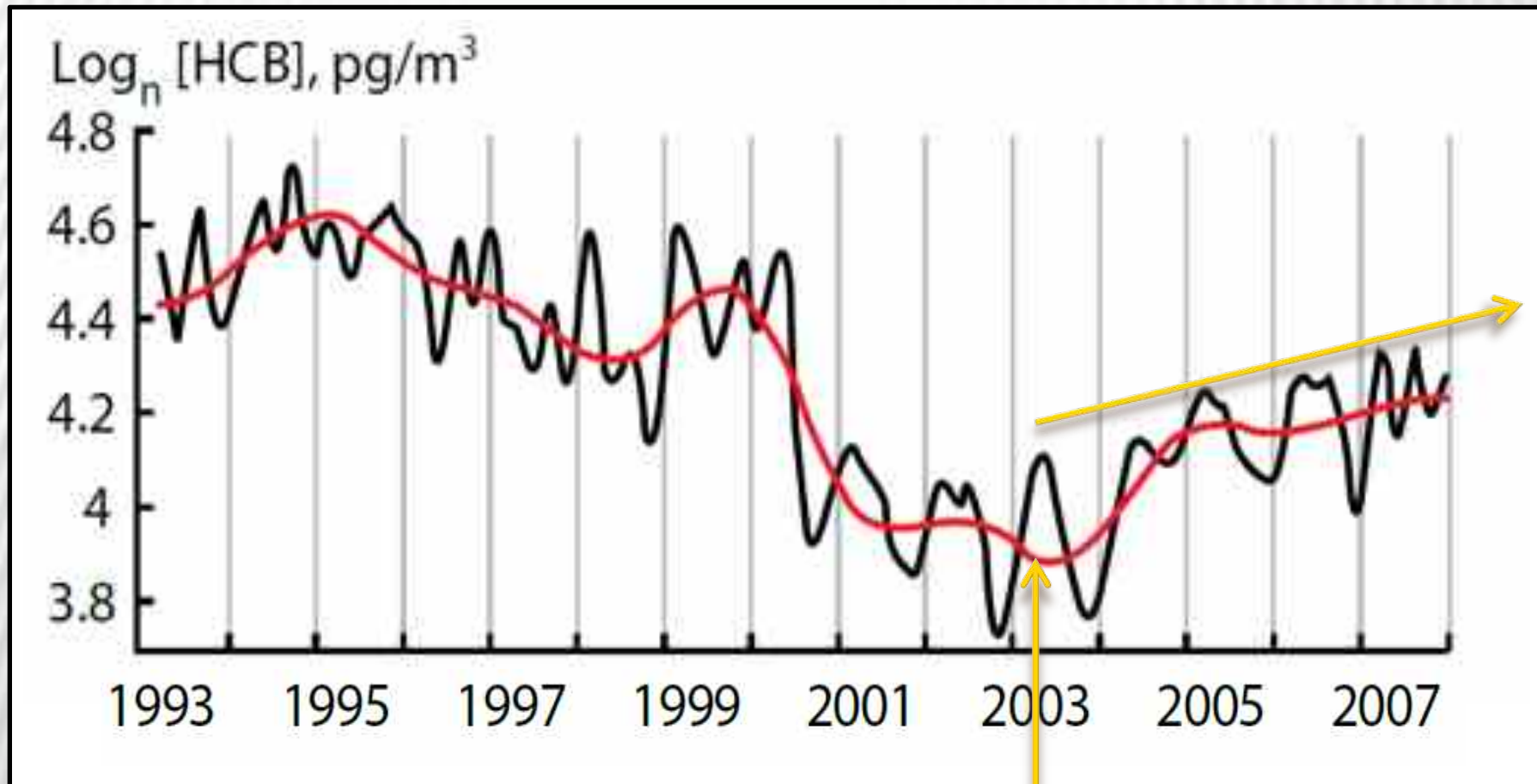


*Observatoire atmosphérique,
Zeppelin, Svalbard*

A.D

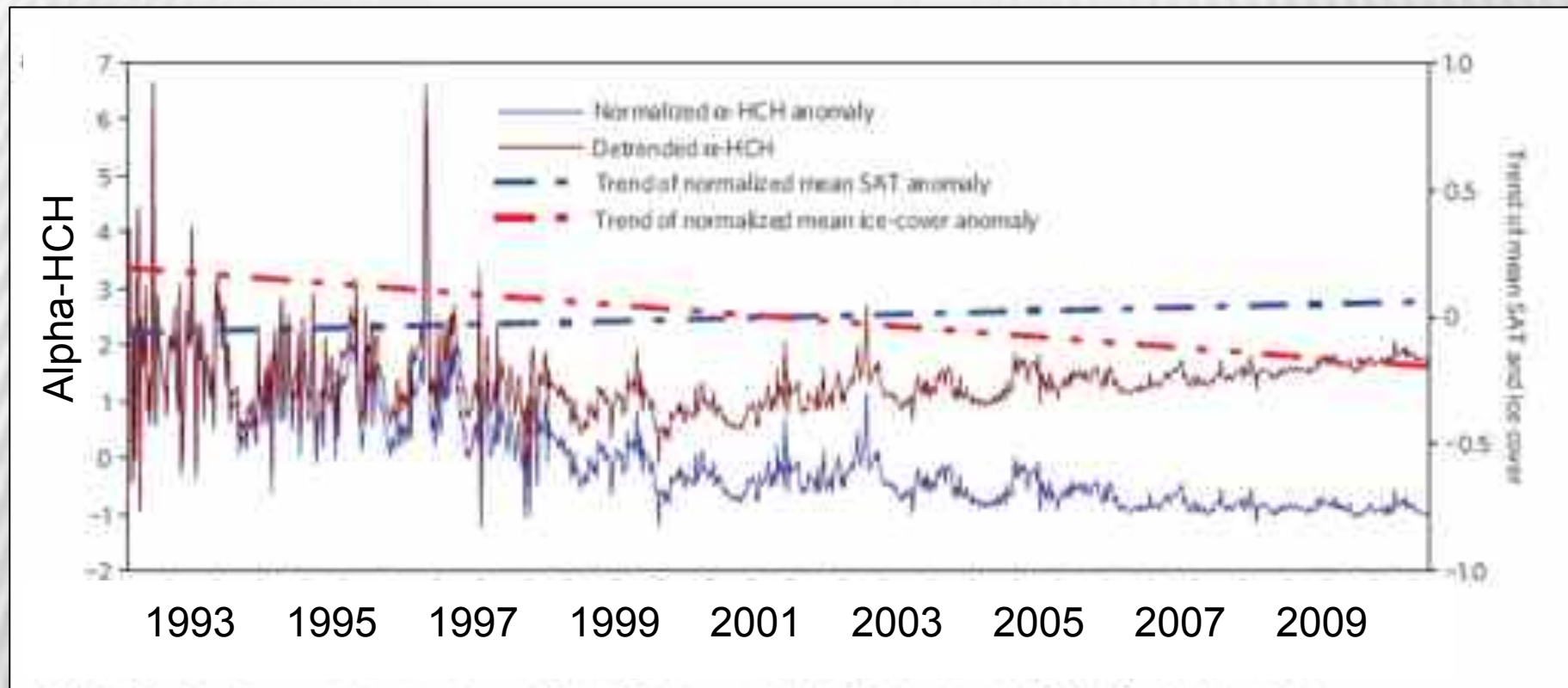
Hung et al. 2010

RÔLE DES INTERFACES ET COMPLICATIONS



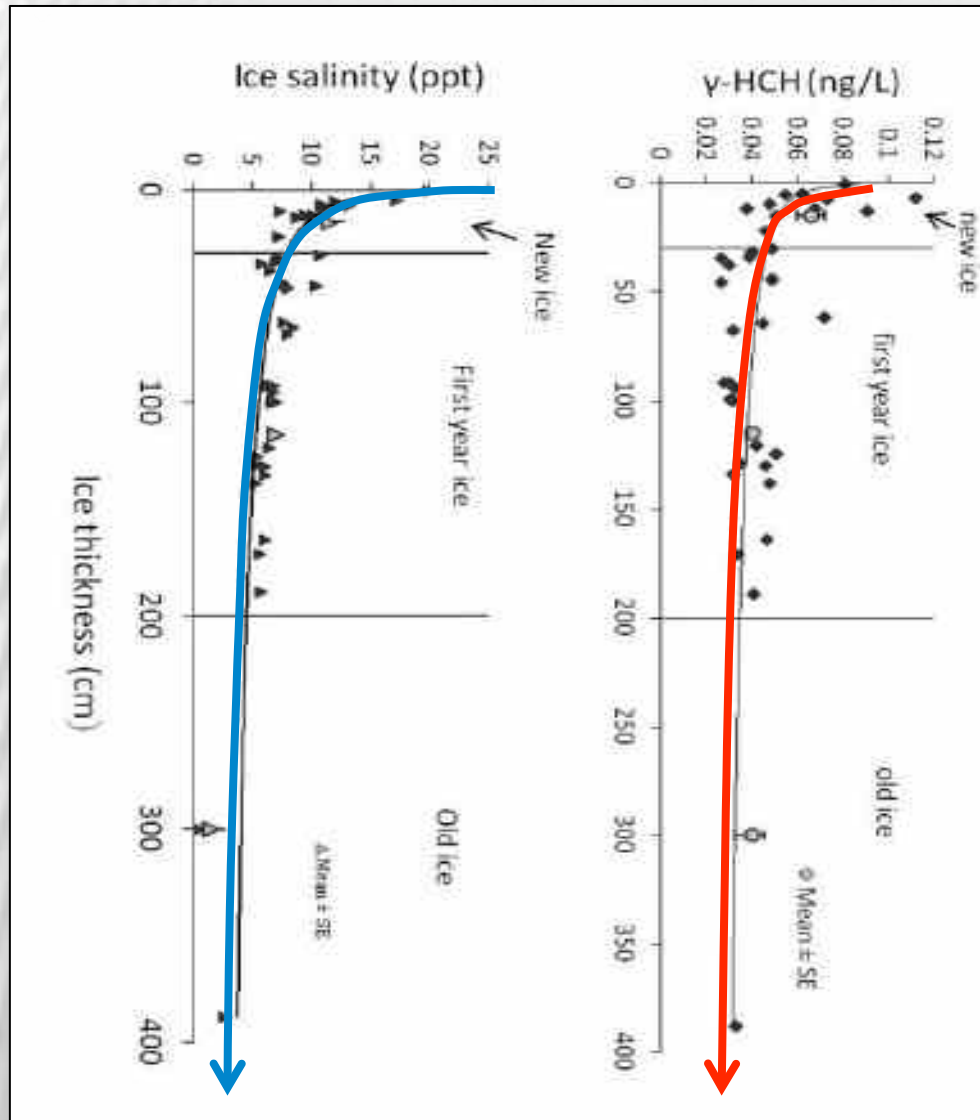
Hung et al. 2010

RÔLE DES INTERFACES ET COMPLICATIONS



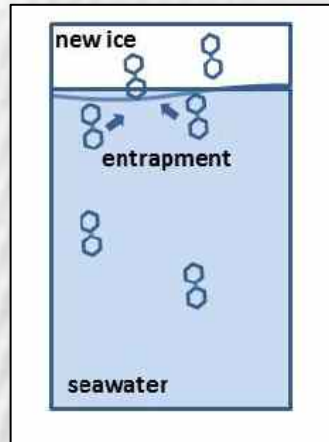
Ma et al., 2011

RÔLE DES INTERFACES ET COMPLICATIONS

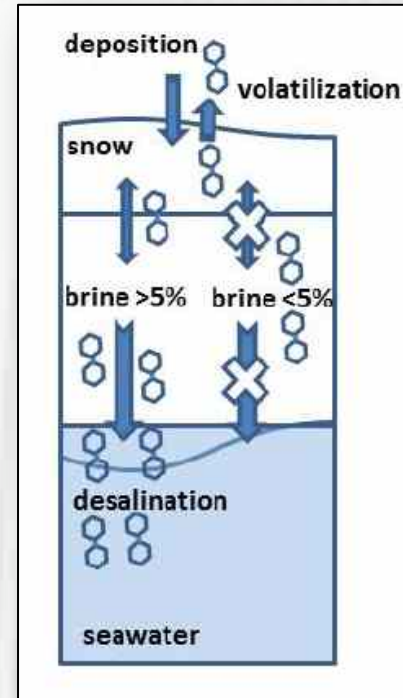


*Grannas et al. 2013,
données de Pucko et al. 2010*

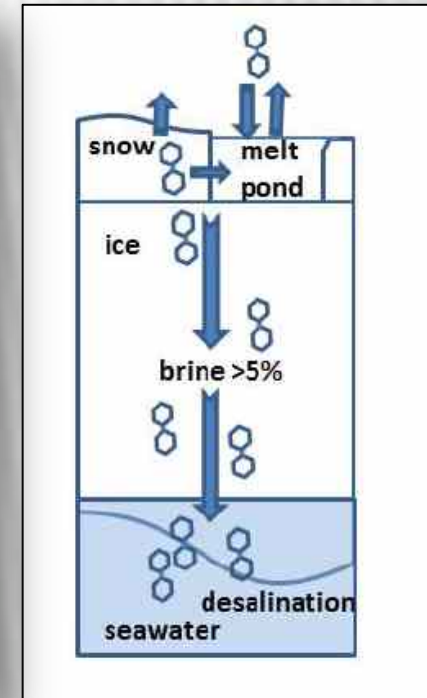
RÔLE DES INTERFACES ET COMPLICATIONS



Automne



Hiver



Printemps



QUELS ENSEIGNEMENTS ?

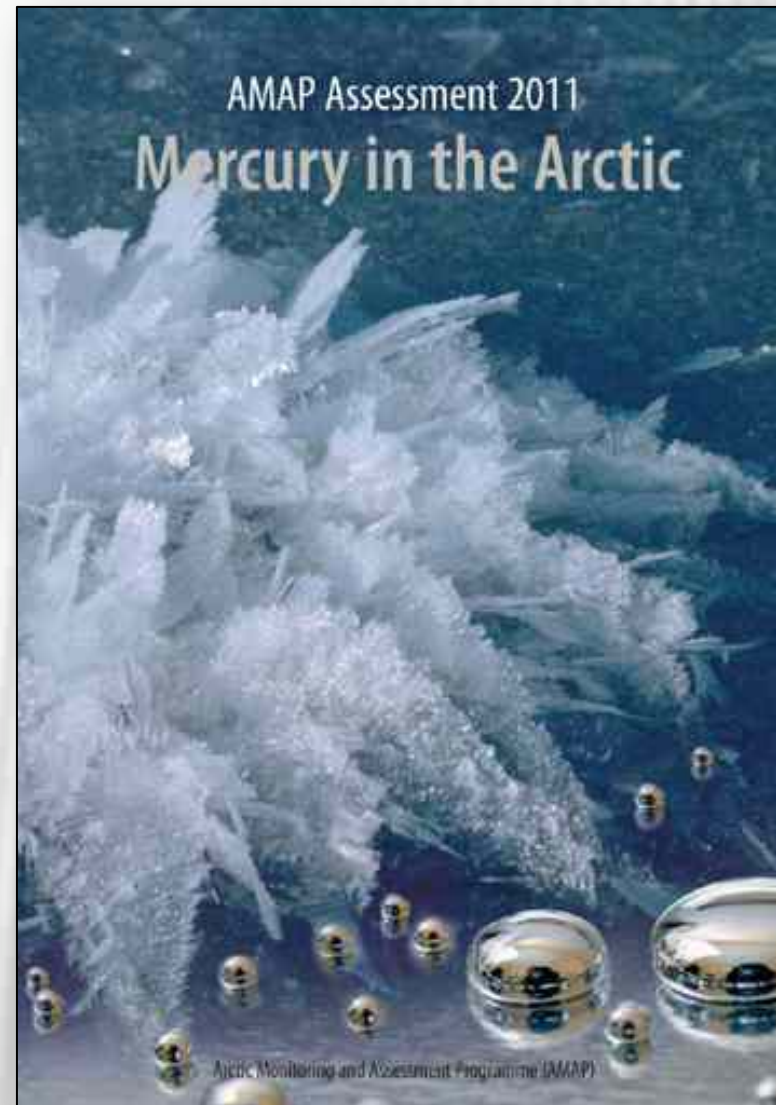
Supprimer les sources : « oui , mais

- Régime de sources secondaires désormais
- Métabolites et produits de dégradations »



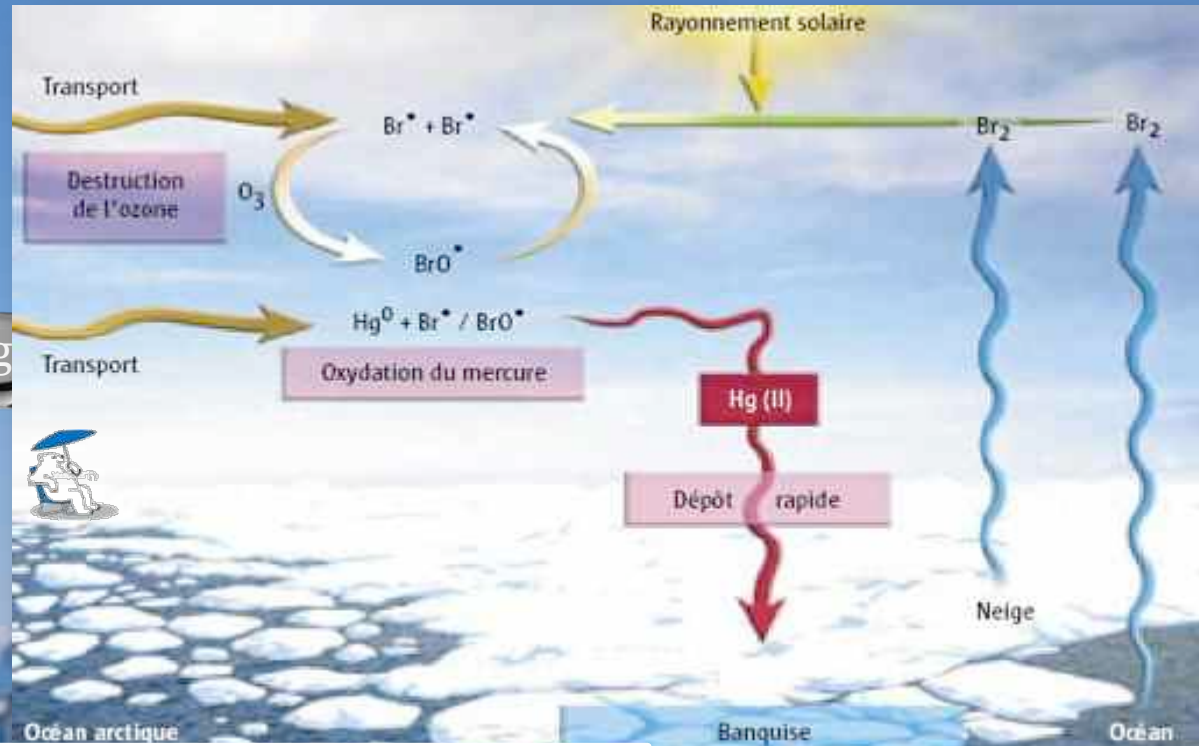
DEVENIR D'UN CONTAMINANT PRÉ-ANTHROPIQUE

Convention de Minamata,
19 janvier 2013

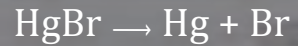
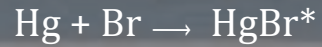








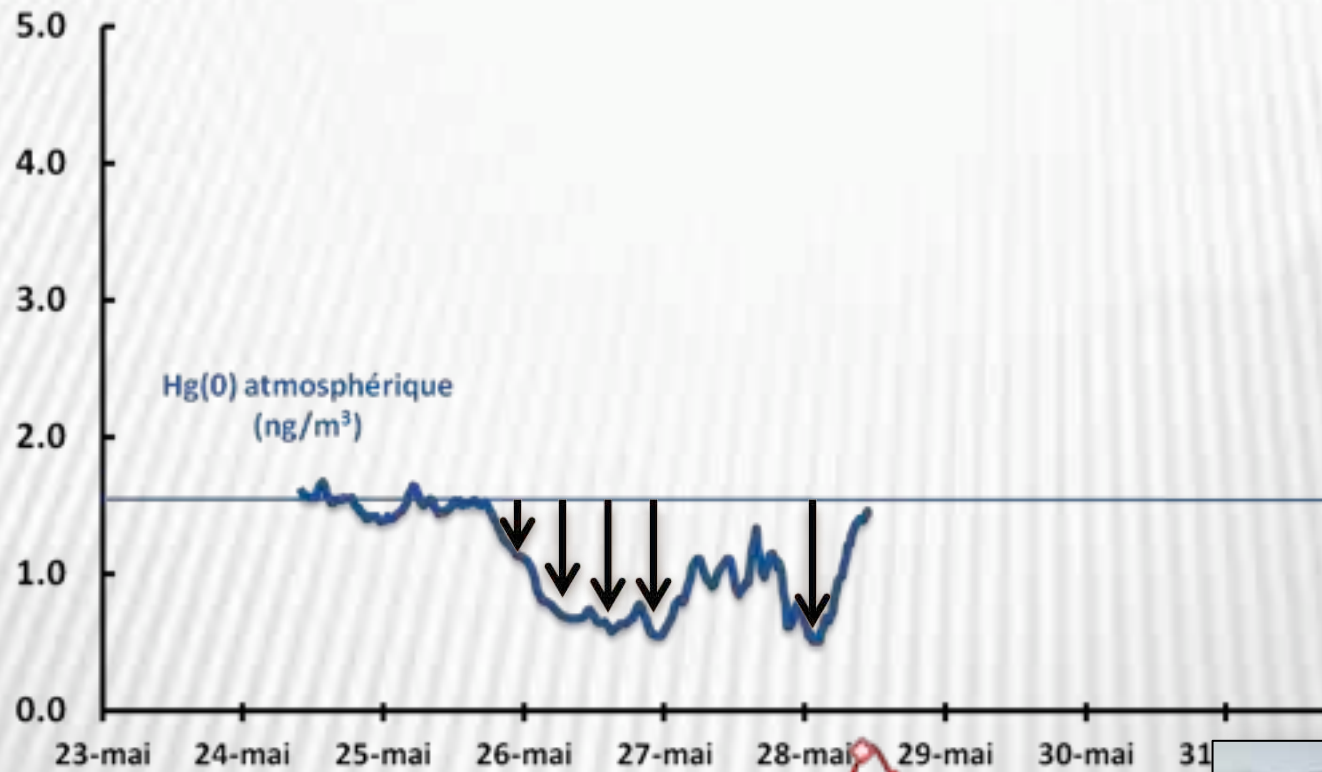
Seule cinétique phase gaz suffisamment rapide (et connue):



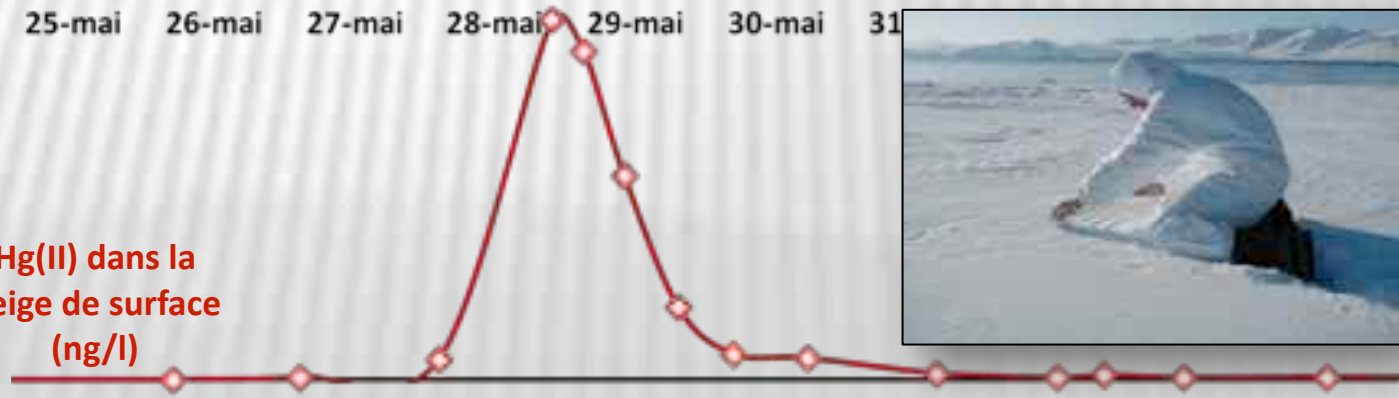
Dépendance avec T

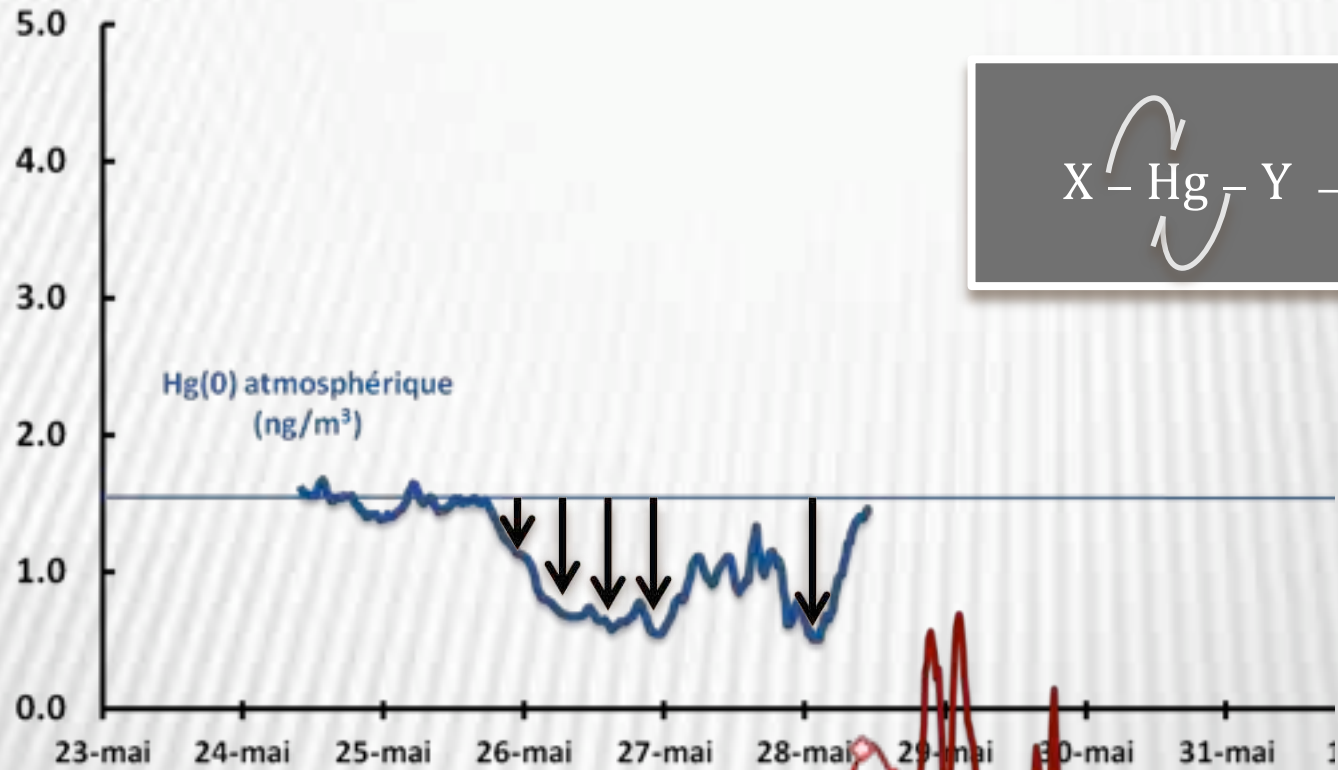
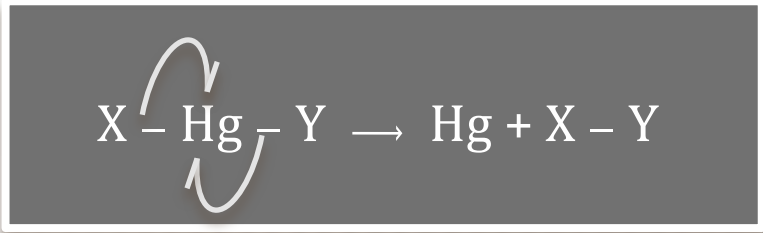
Atmospheric Mercury
Depletion Events AMDEs
Schroeder et al, 1995

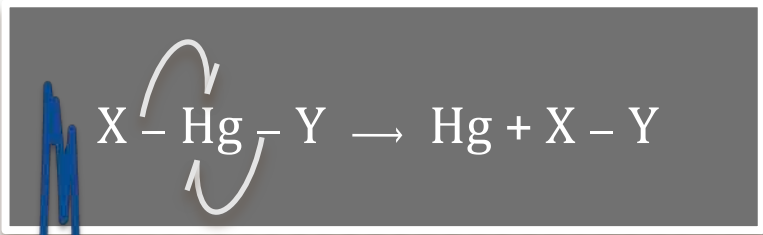
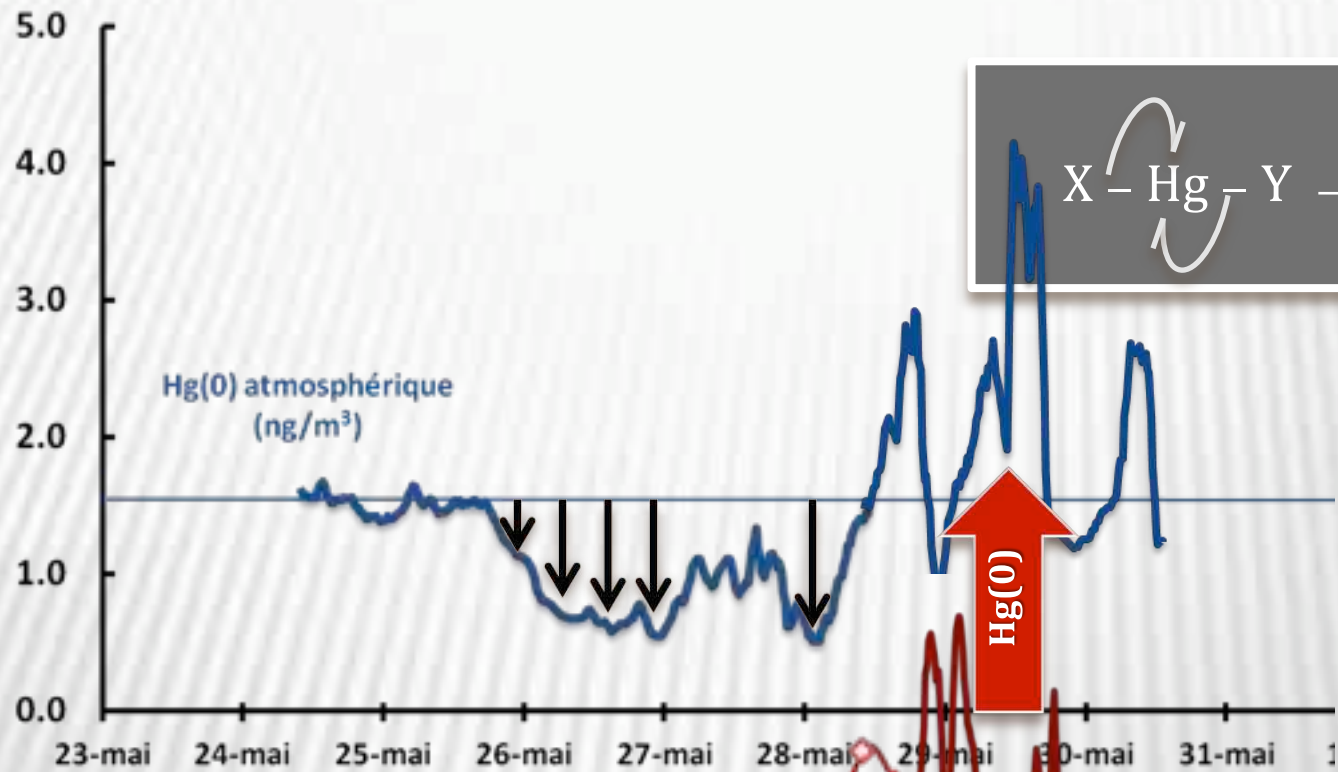




Hg(II) dans la
neige de surface
(ng/l)





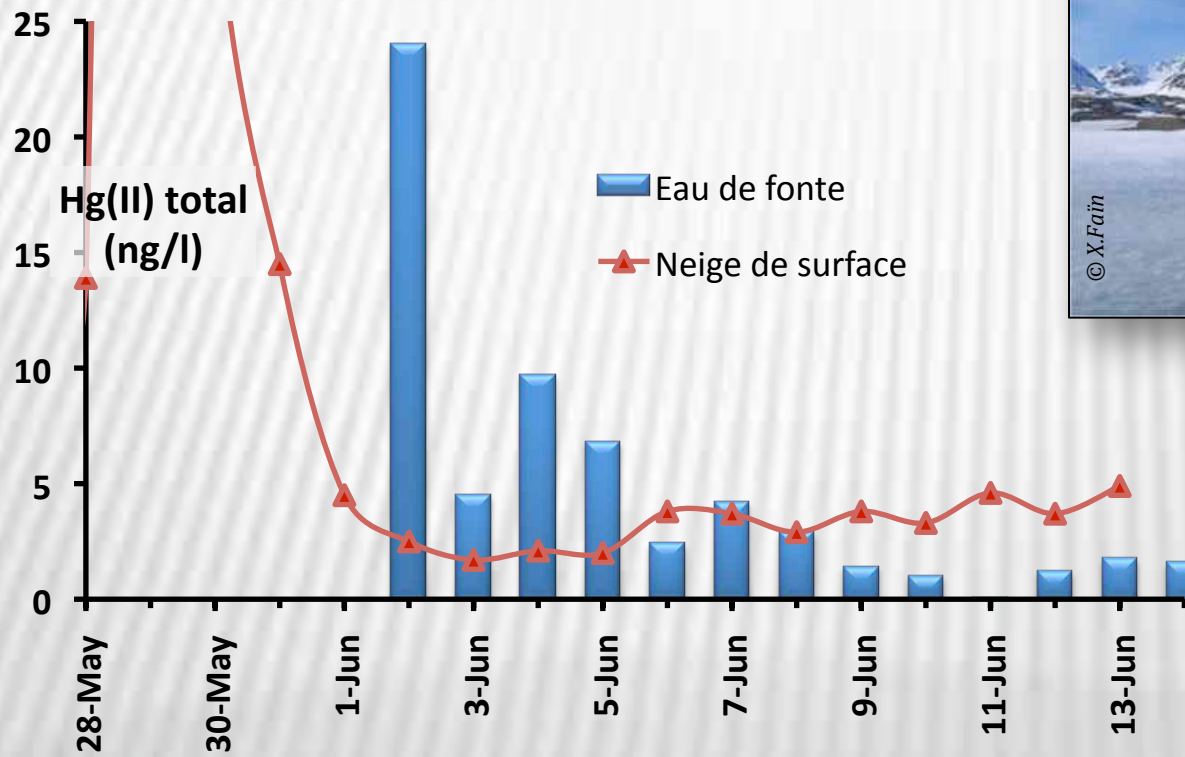


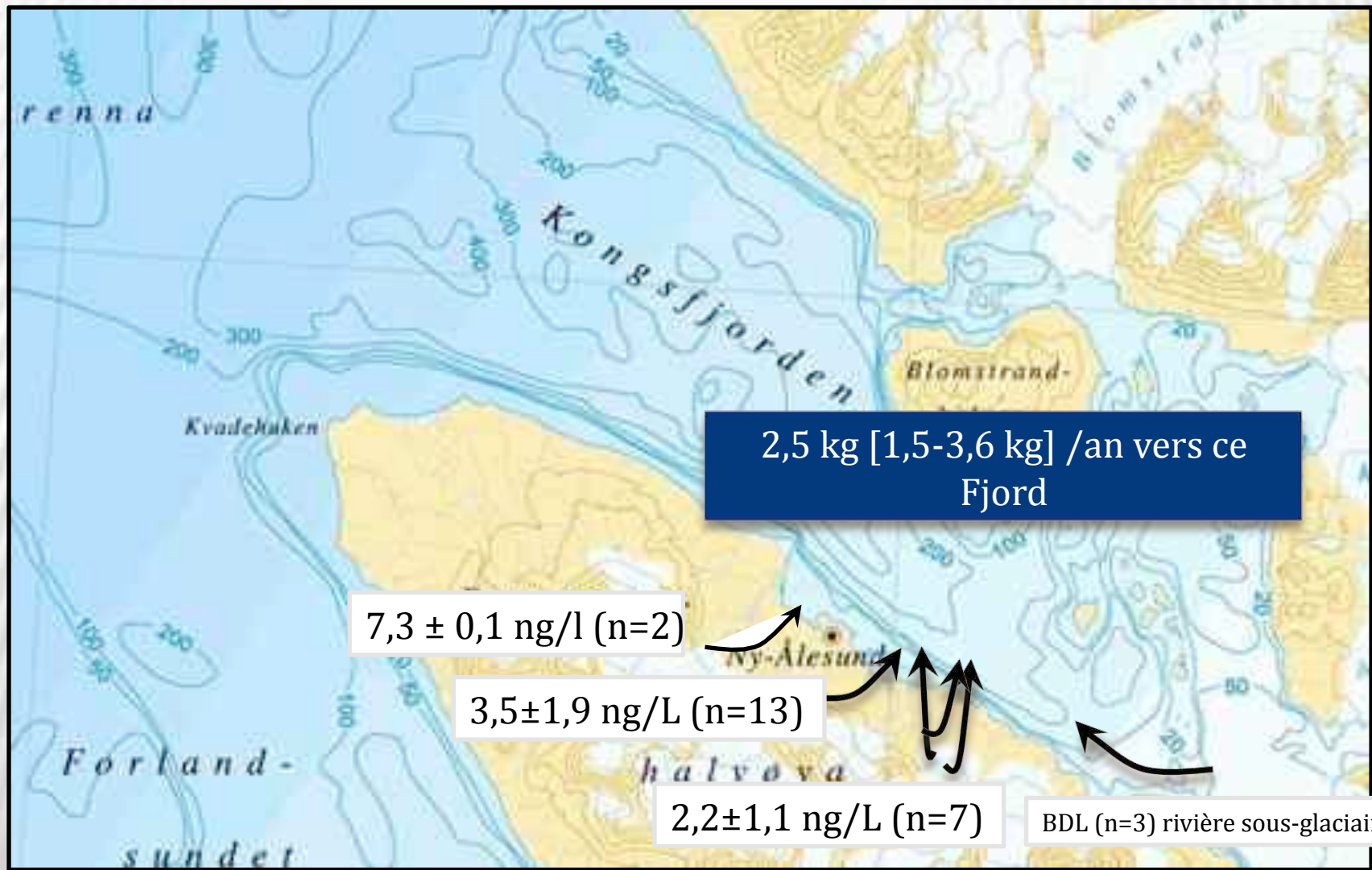
Flux de Hg(0)
en ng/m²/h



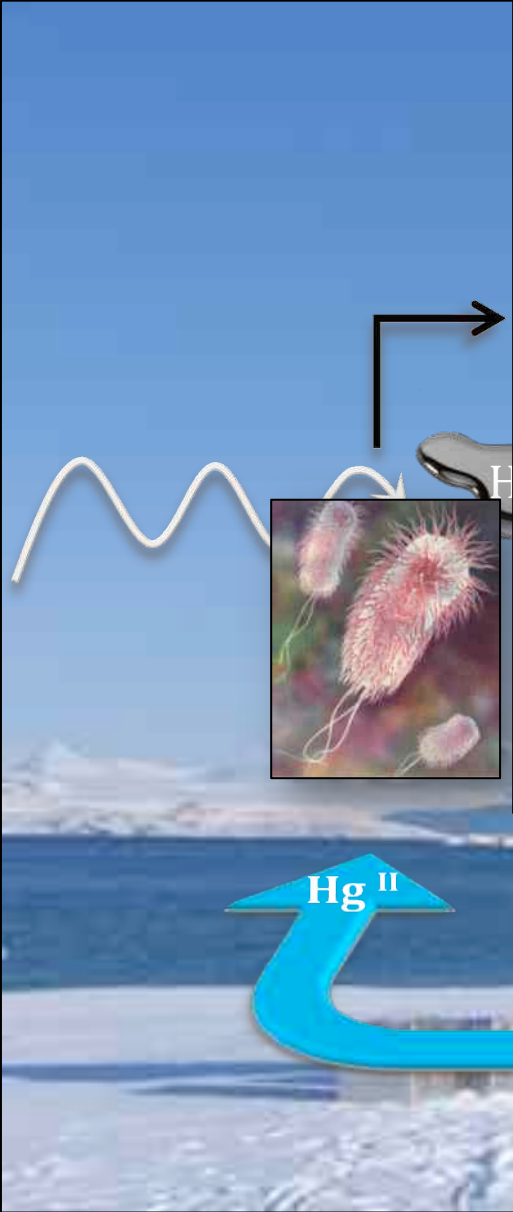
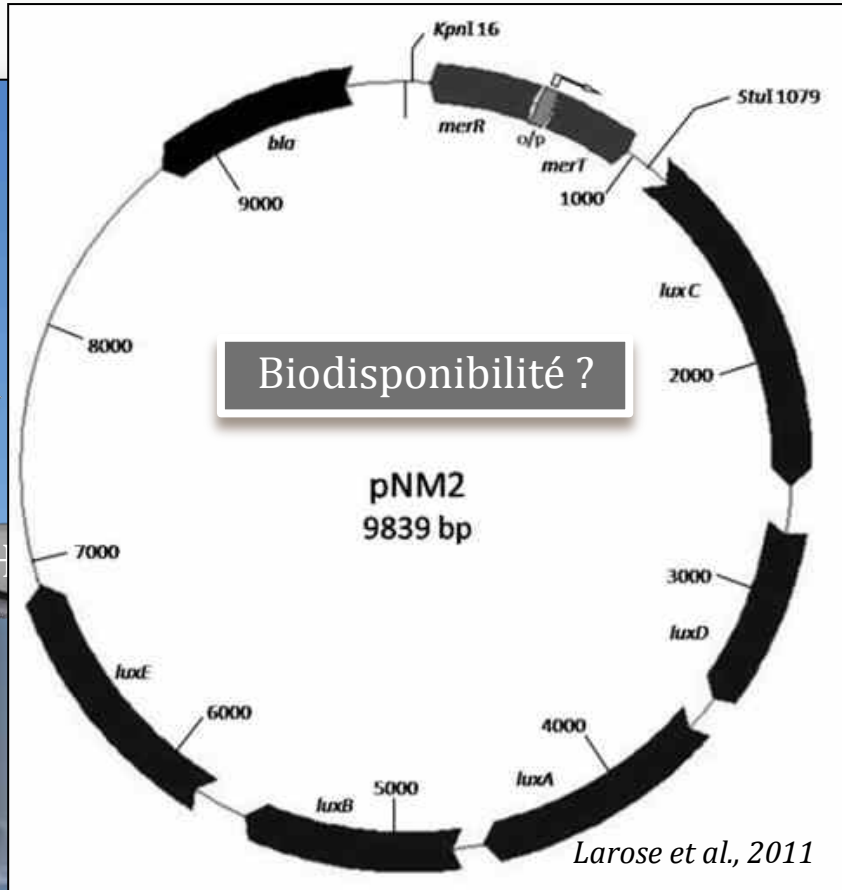
Hg(II) dans la
neige de surface
(ng/l)



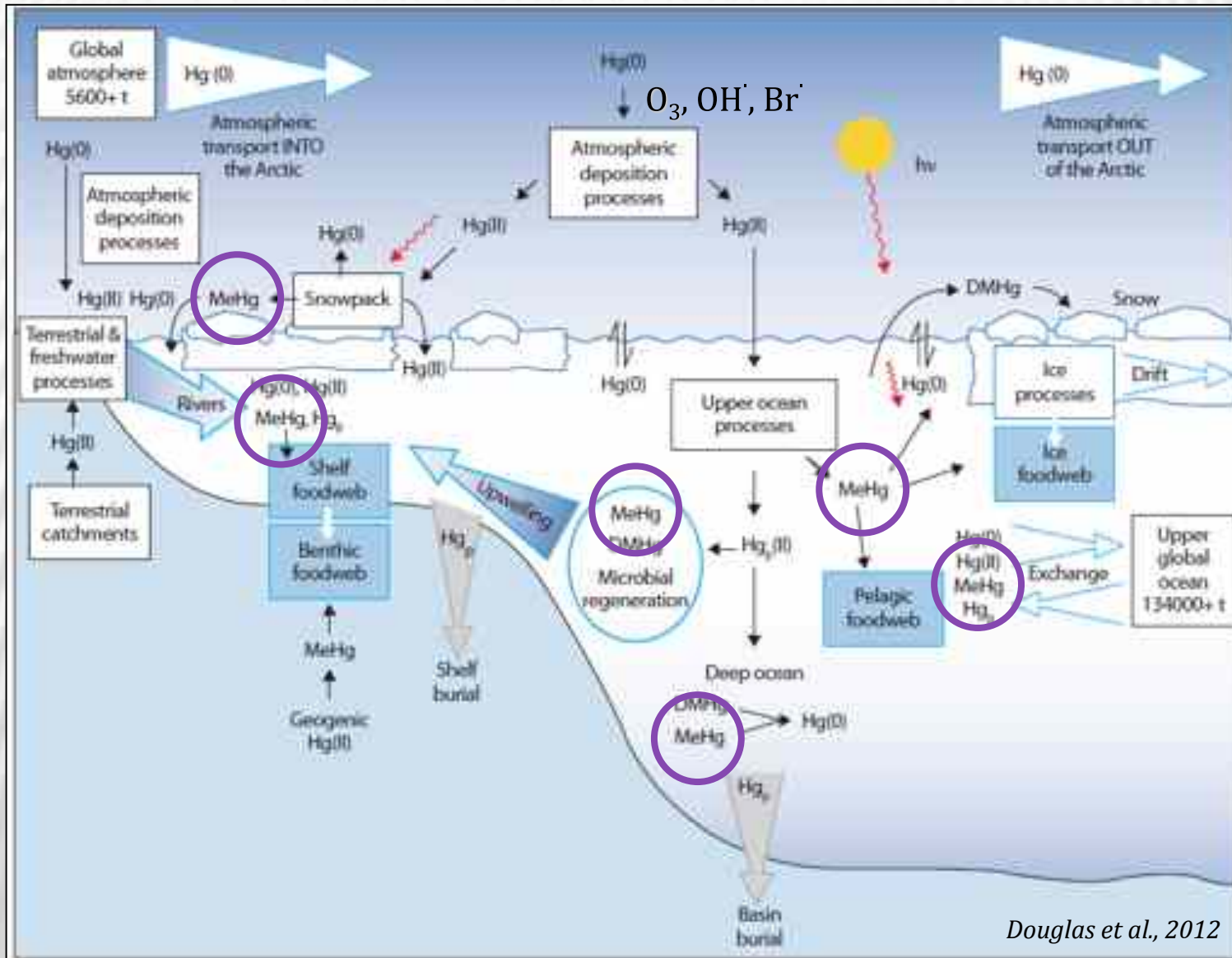




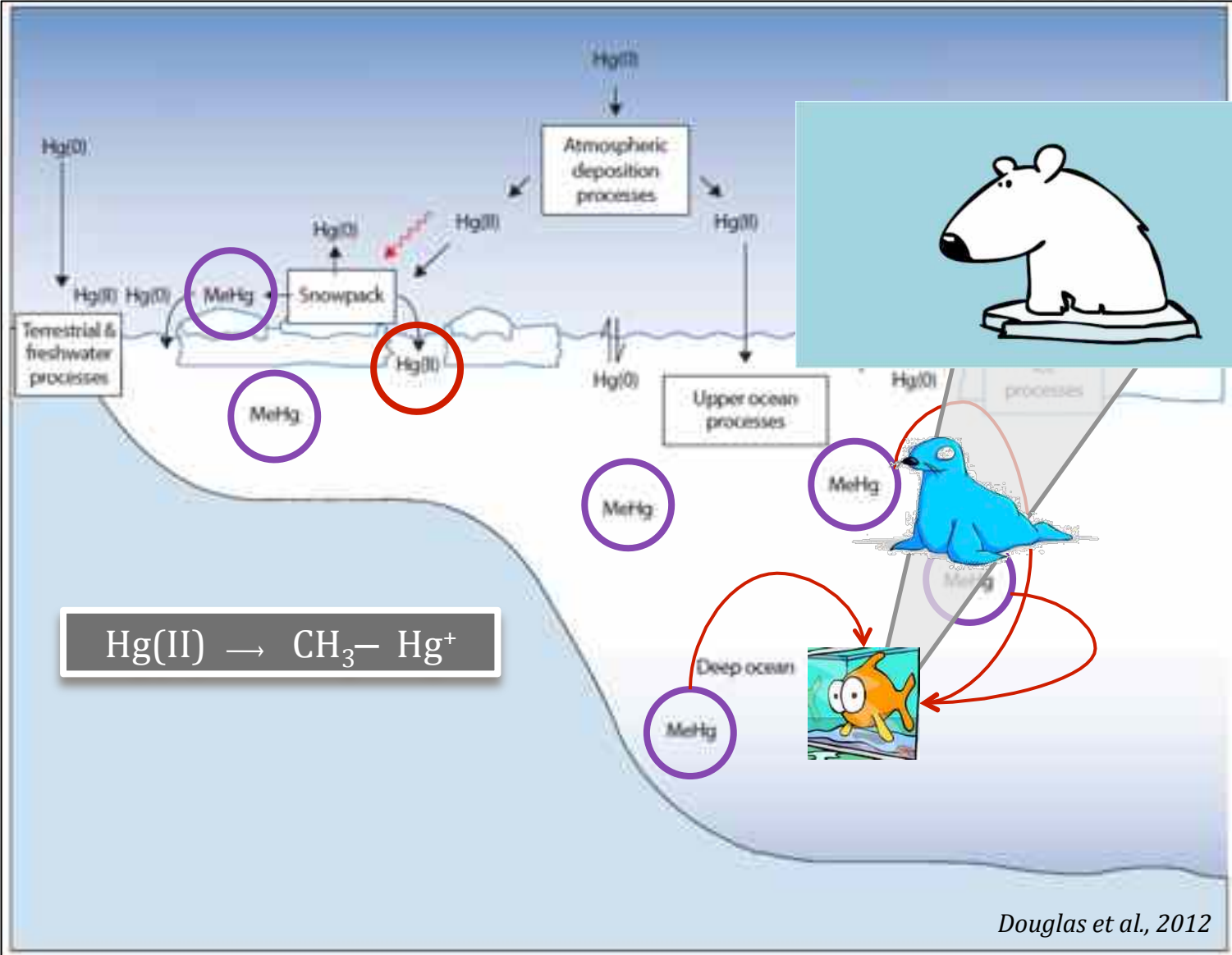
D'après Dommergue et al., 2010



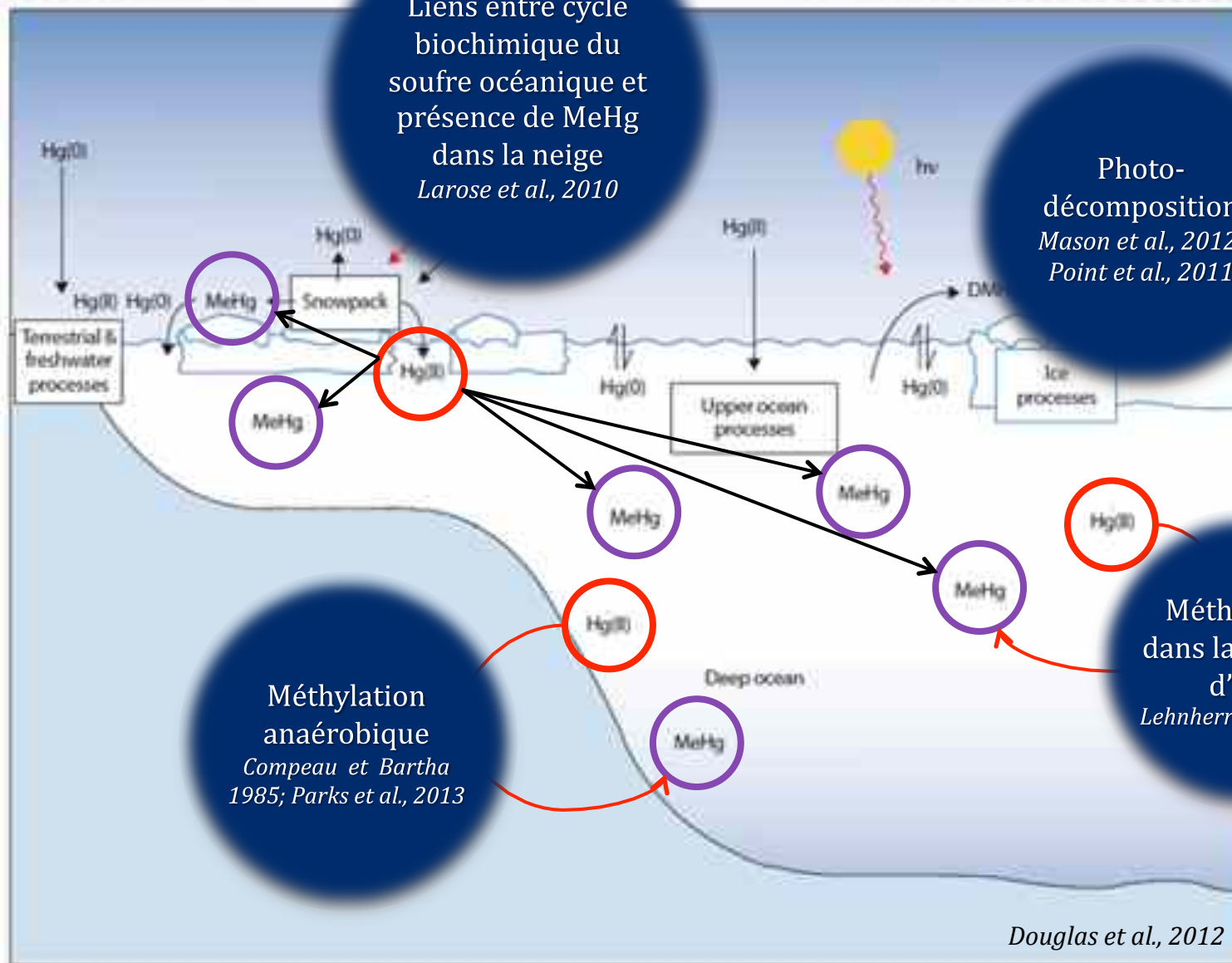
MOBILITÉ ET TRANSFORMATIONS



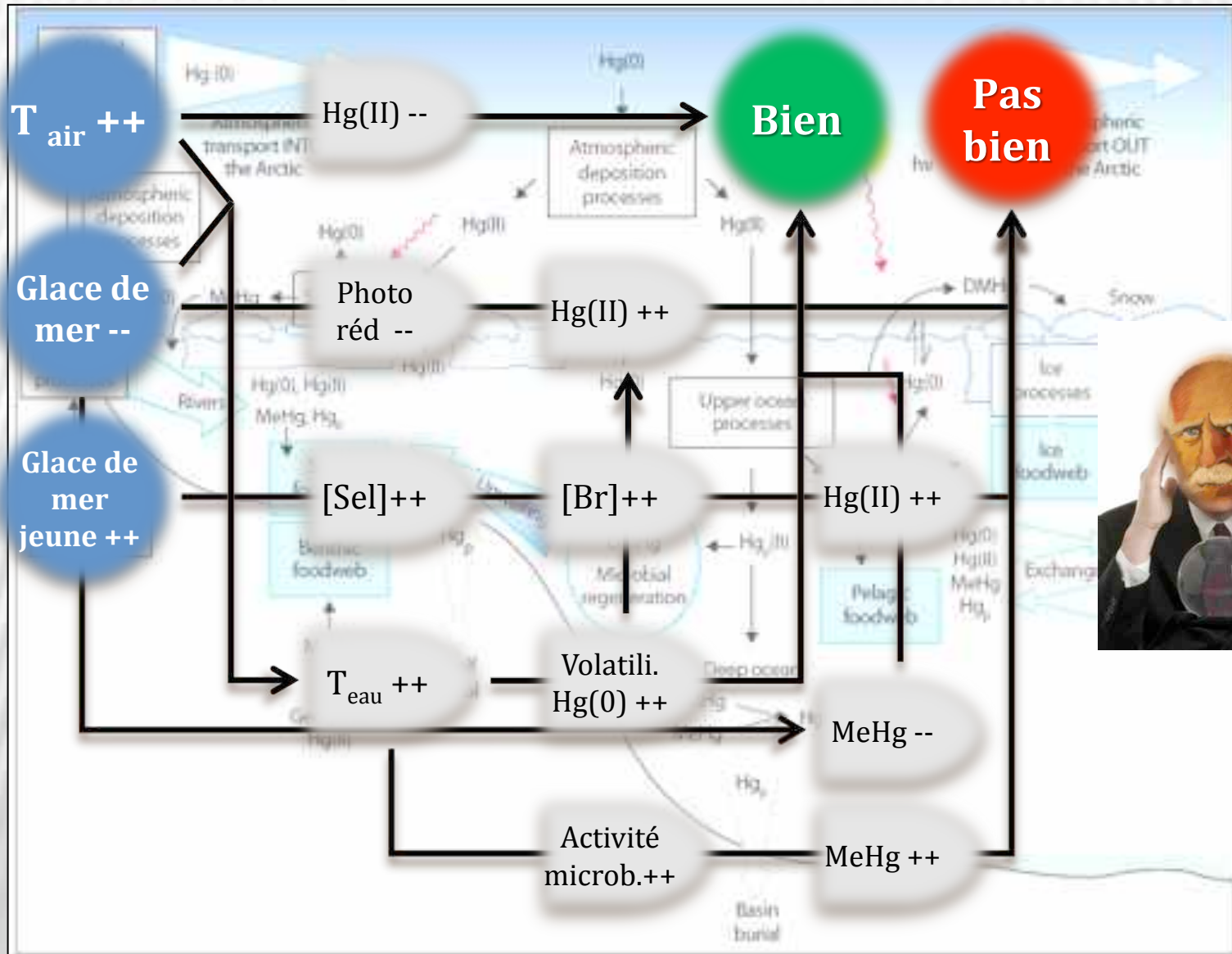
MOBILITÉ ET TRANSFORMATIONS



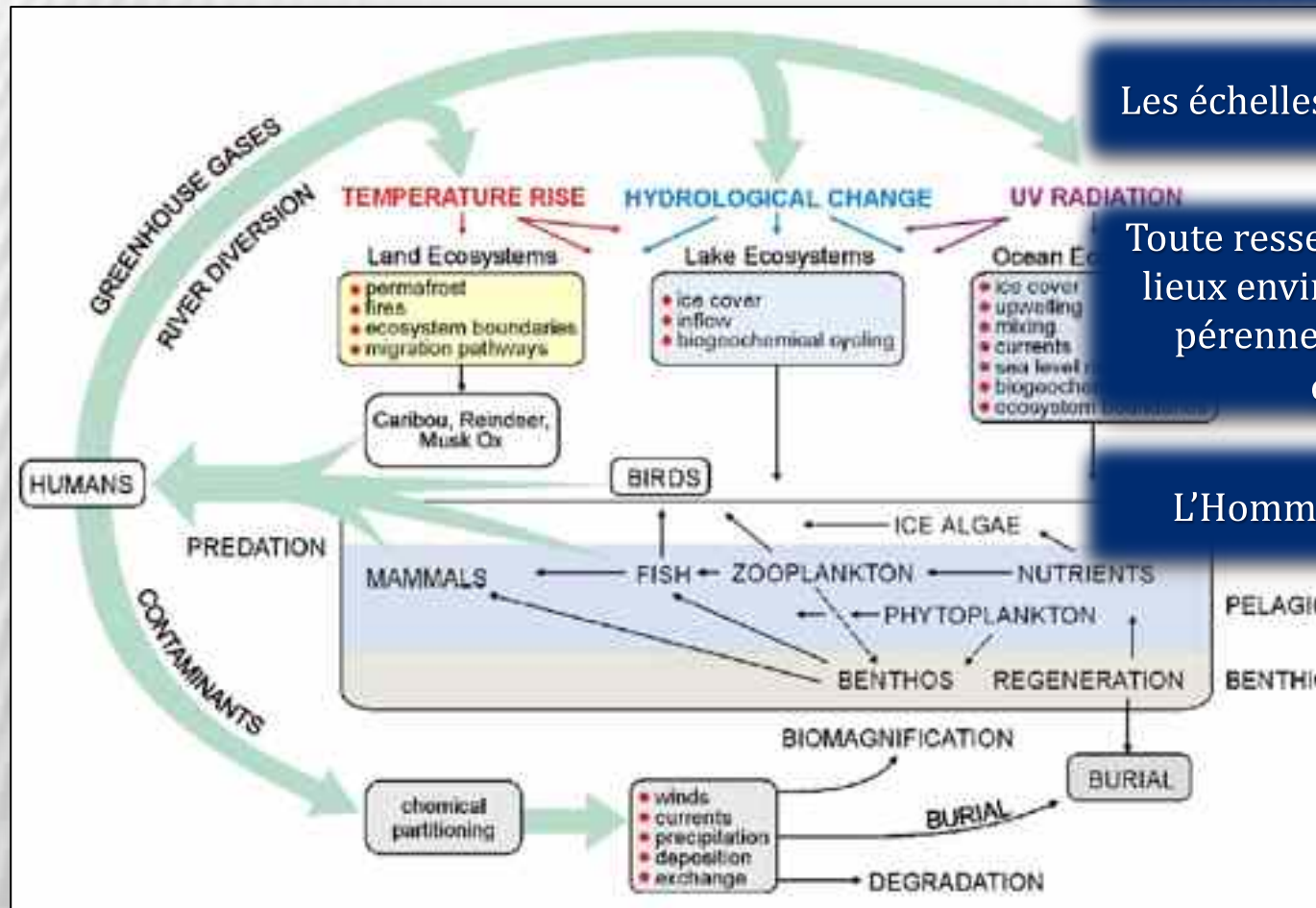
MOBILITÉ ET TRANSFORMATIONS



SPÉCULATIONS ?



CONCLUSIONS



Avoir une vue d'ensemble

Les échelles de temps et d'espace

Toute ressemblance à un état des lieux environnemental fidèle et pérenne ne serait que pure coïncidence

L'Homme, acteur et victime

REMERCIEMENTS

Institut Polaire IPEV: Programmes CHIMERPOL I, I & III et
GMOstral

Programme EC2CO (CNRS/INEE)

Institut Universitaire de France

Région Rhône-Alpes

Fonds France Canada pour la Recherche

Catherine Larose & Tim Vogel,

Alan Le Tressoler, Cédric

