USING UPPER-AIR AND LAND SURFACE ANALYSES TO OPTIMIZE THE SURFACE-ATMOSPHERE INTERACTIONS IN GLOBAL NWP

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Nasim Alavi

Francois Roberge
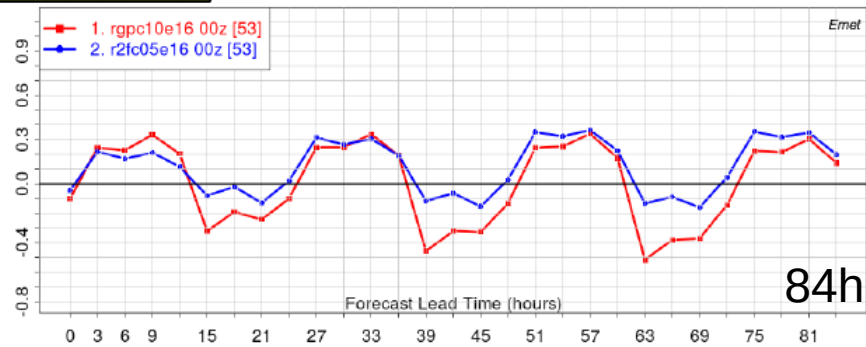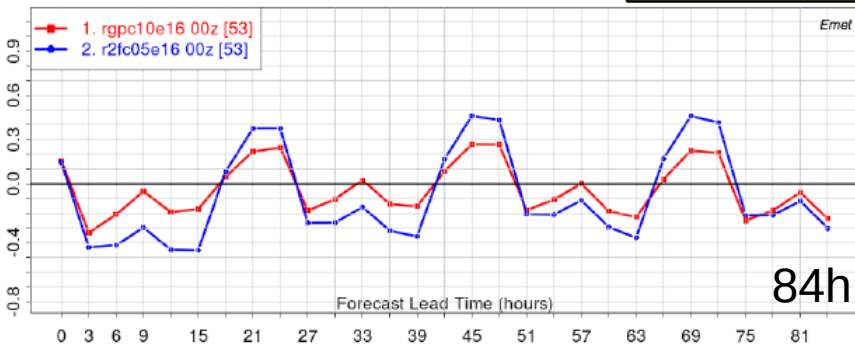
Maria Abrahamowicz

Nicolas Gasset

Canada

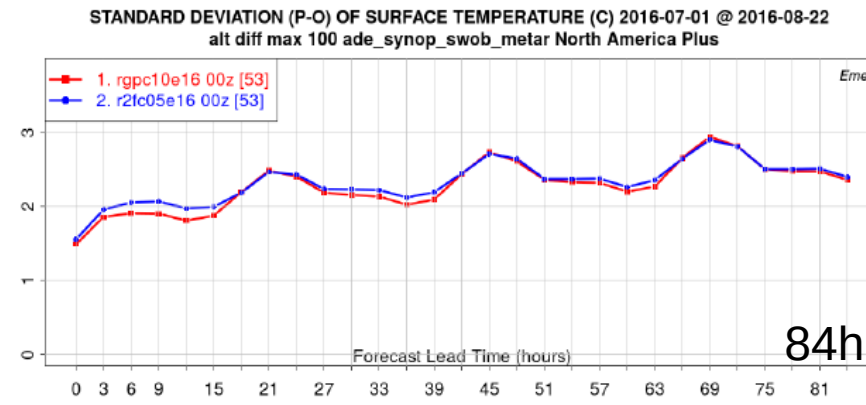# CaLDAS + SVS… positive at the surface

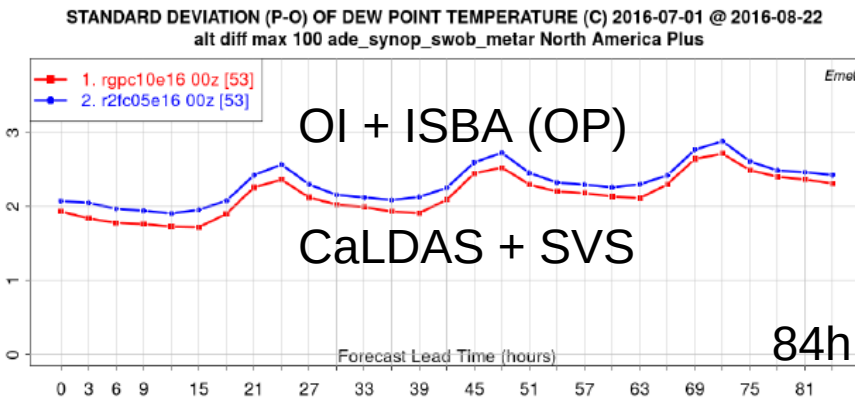Dew point (TD)   **North America Plus**   Temperature (TT)

Regional Deterministic Prediction System (4-day forecasts)
53 cases (00 UTC)

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Canada Canada

CaLDAS + SVS… less positive for upper air

Summer (North America)

UU
stde   bias

UV

T-Td

GZ

TT

**Regional Deterministic
Prediction System
(48-h forecasts)
106 cases (00+12 UTC)**

new
OP
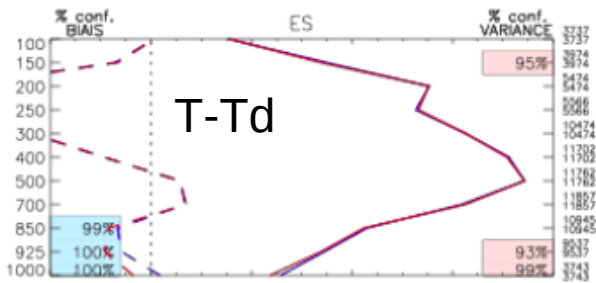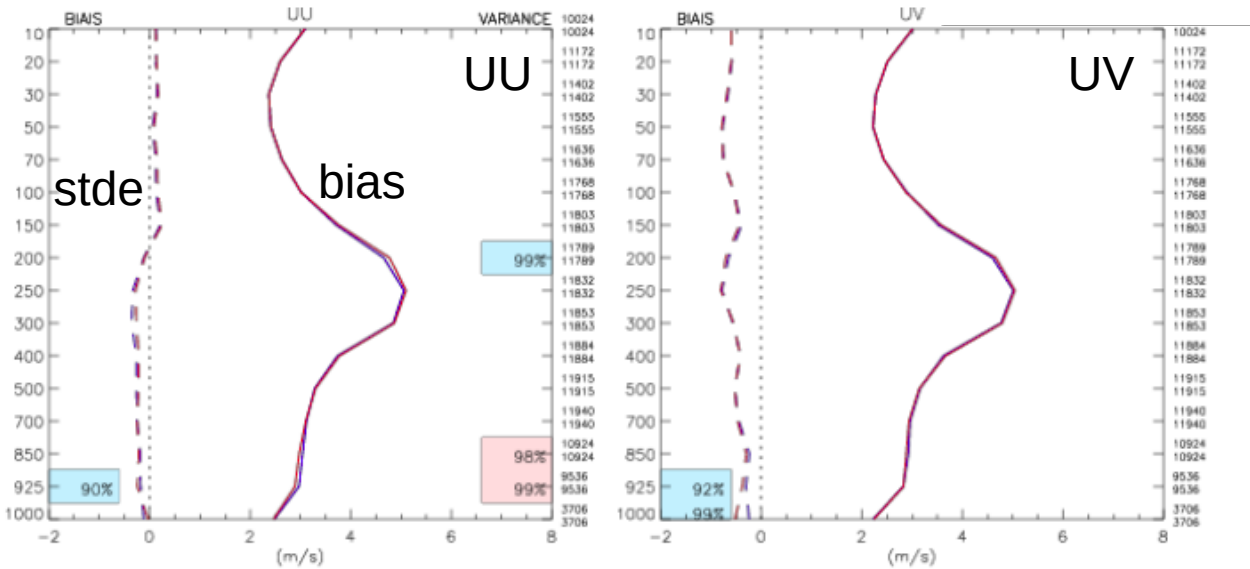
The complex links between surface and atmospheric errors
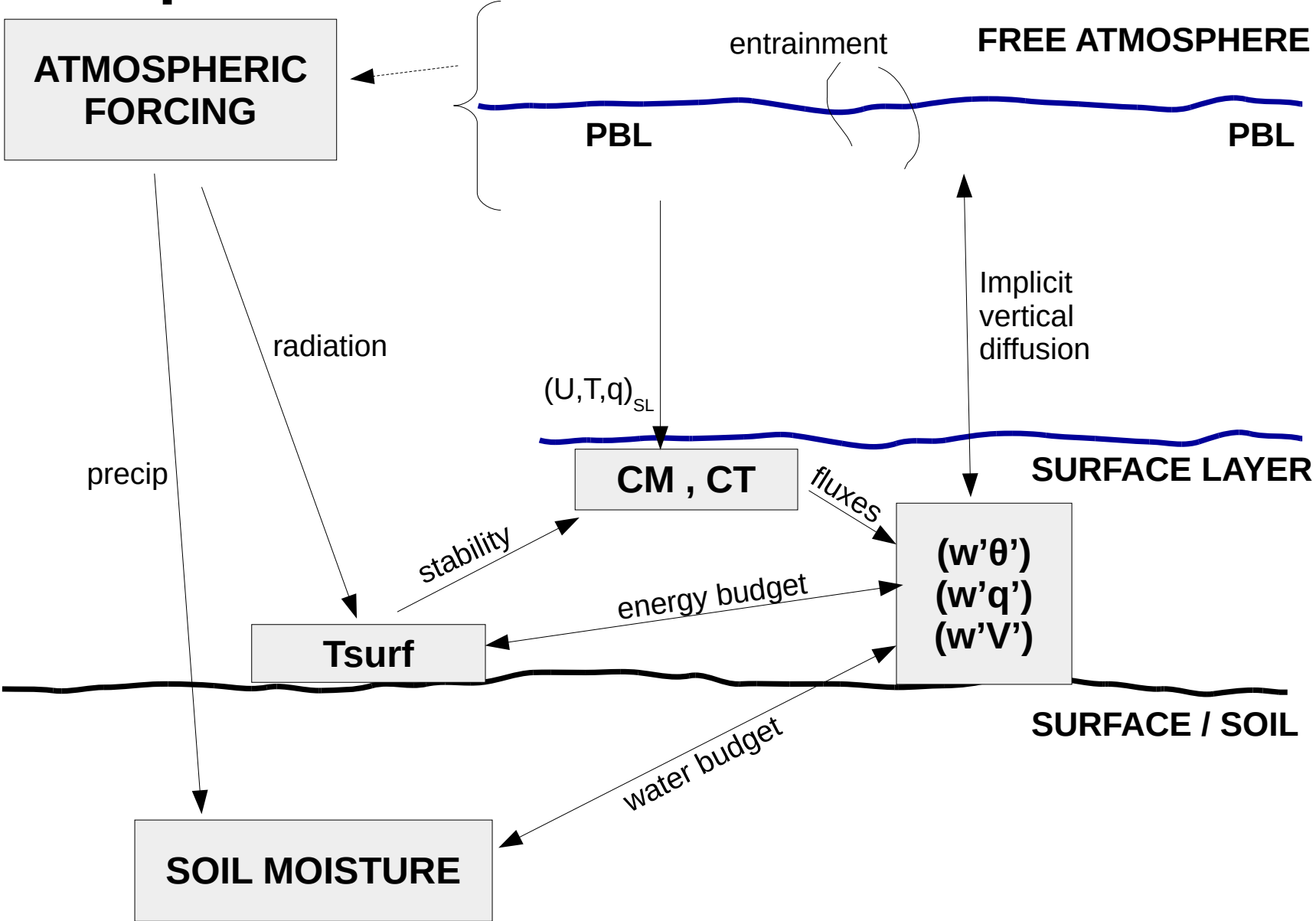
In this study, evaluation against...

EnVAR below 3km

CaLDAS – screen

CaLDAS – land

+ Errors correlations
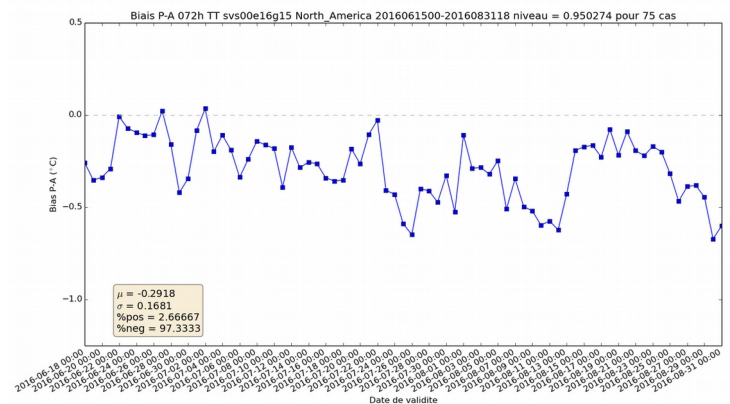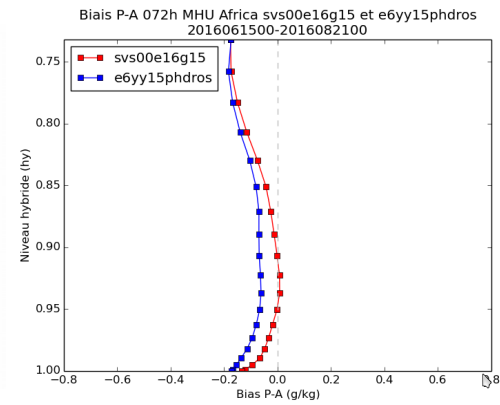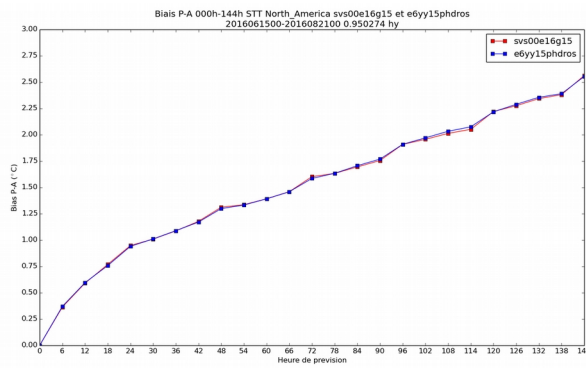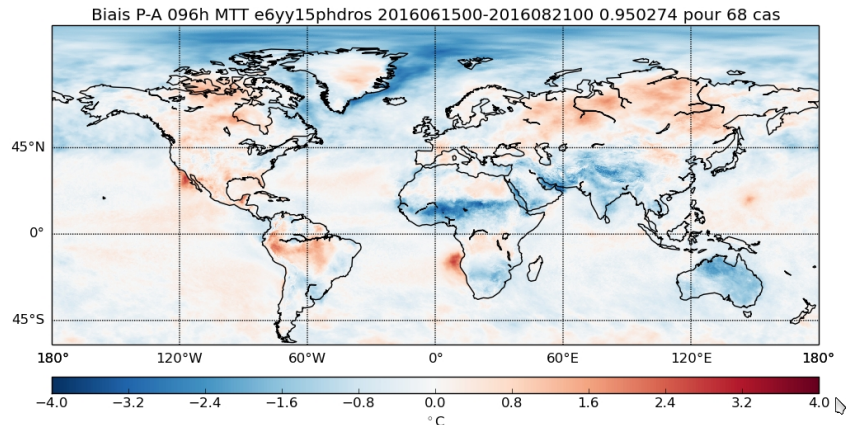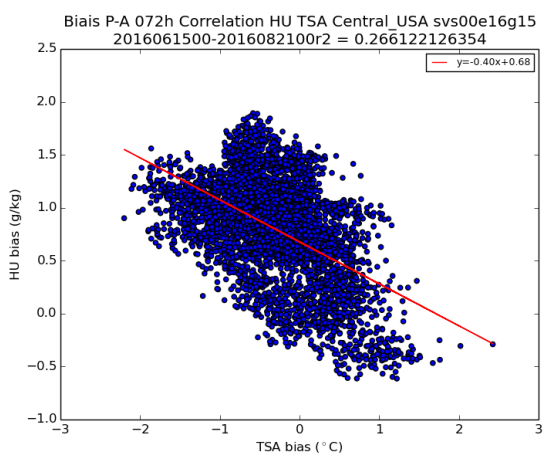
Maps of PBL errors (for humidity here)

Bias of specific humidity
Mean over first km
72-h forecasts
68 cases (00 UTC)

Biais P-A 072h MVHU svs00e16g15
2016061500-2016082100 moyenne verticale = 0.998750-0.889705hy pour 68 cas

(g/kg)

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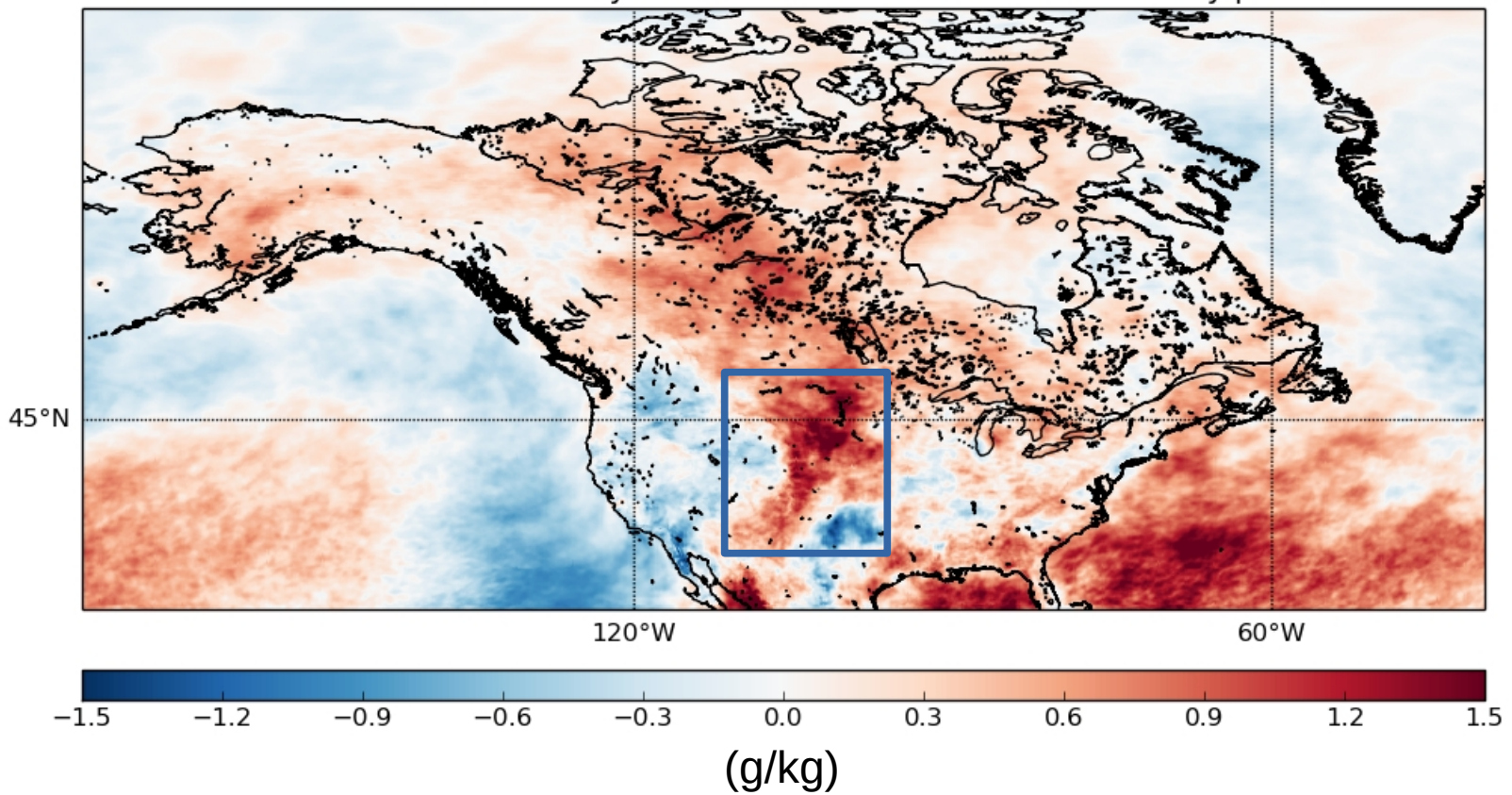
Maps of land surface errors (soil moisture)

Bias of soil moisture
First soil layer (0-5cm)
72-h forecasts
68 cases (00 UTC)

Biais P-A 072h 2016061500-2016083118 level-1

(m3/m3)

Environnement Environment
Canada Canada
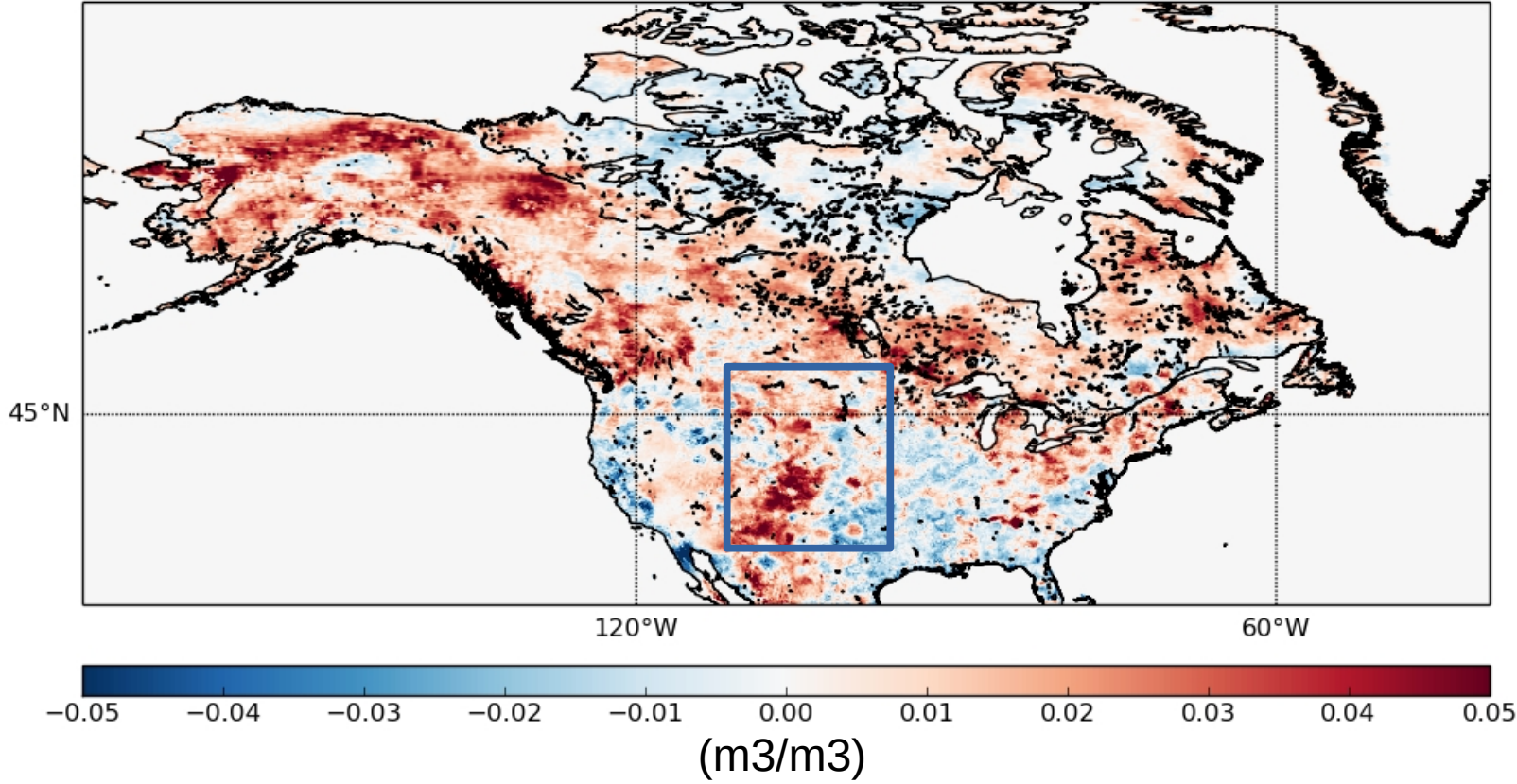
The rapid deterioration of soil moisture

STDE soil moisture forecasts
68 cases (initialized at 00 UTC)
Spatially-averaged over central USA

STD Biais P-A WSOL Central_USA svs00e16g15 2016061500-2016083118

0.07 m3/m3

day

night

Way larger than soil moisture errors from offline modeling (with better atmospheric forcing)

54 hours

144 hours

Bias P-A (°C)

Heure de prevision
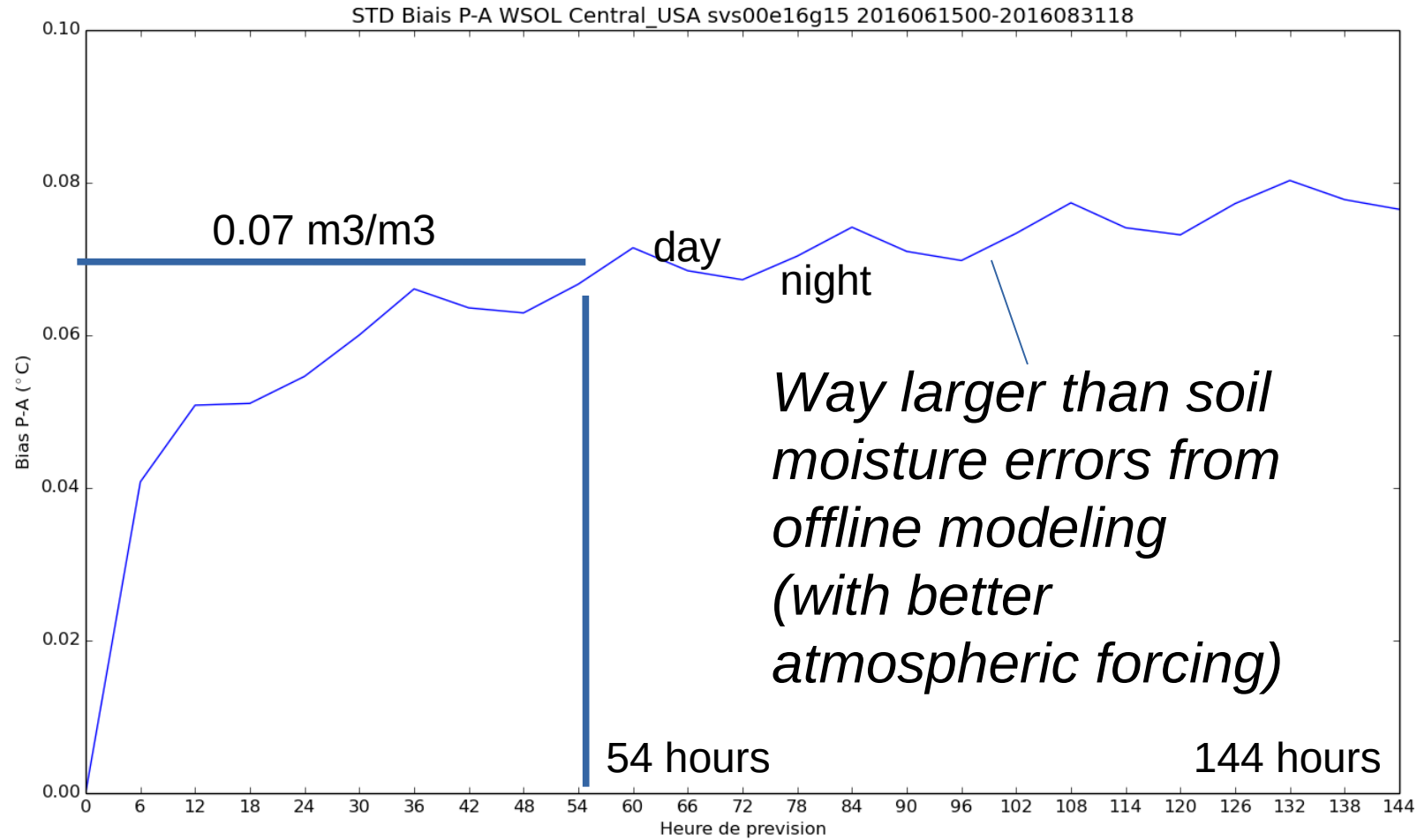
Slow increase of bias for soil moisture

Bias soil moisture forecasts
68 cases (initialized at 00 UTC)
Spatially-averaged over central USA

Biais P-A WSOL Central_USA svs00e16g15 2016061500-2016083118 2

Gradual increase of bias with time

0.01 m3/m3

night   day

"0" line

Smaller values than STDE

144 hours

Bias P-A (°C)

Heure de prevision
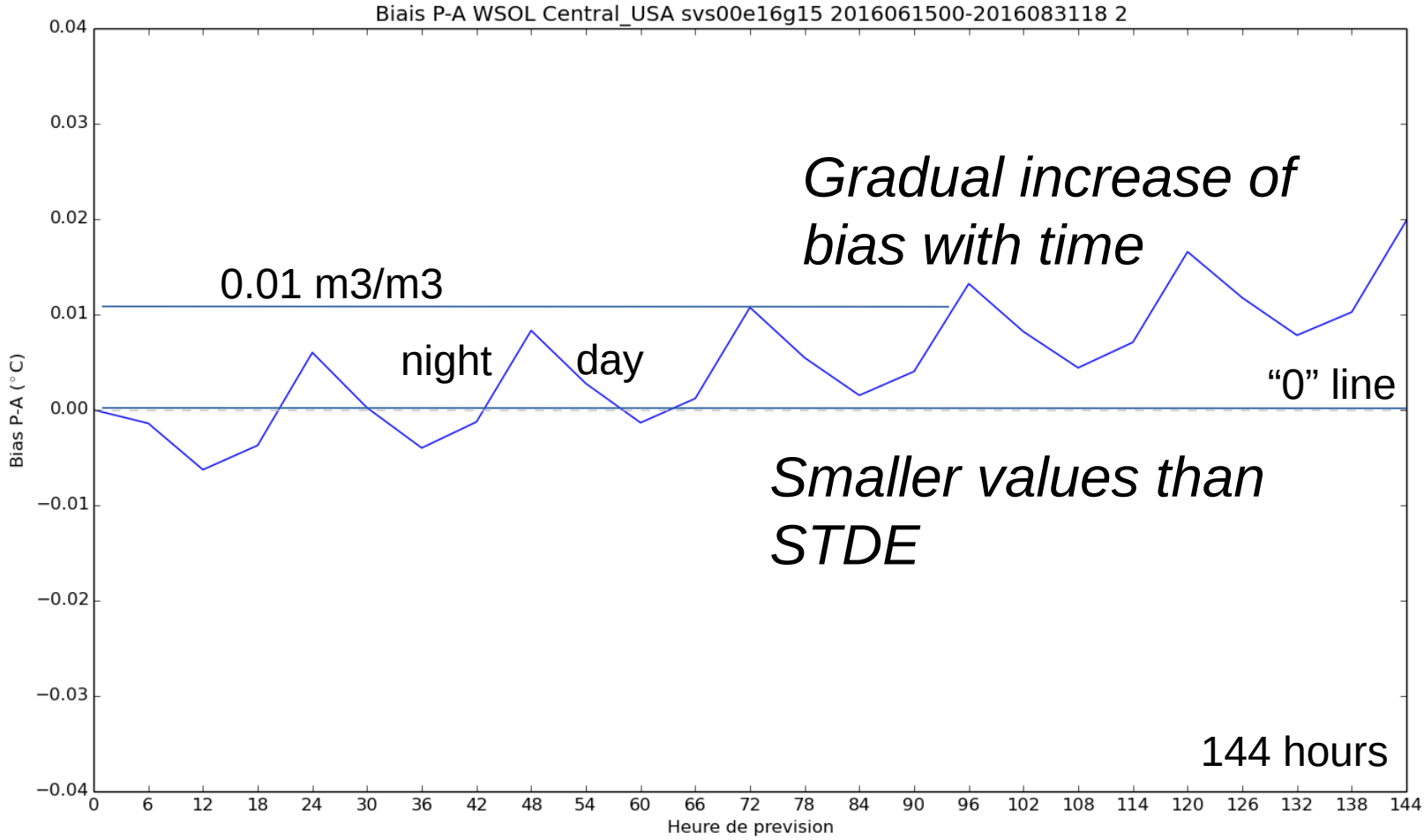
PBL errors relatively well correlated with surface temperature errors

Biais P-A 072h Correlation HU TSA Central_USA svs00e16g15
2016061500-2016082100r2 = 0.266122126354

Specific humidity mean error Averaged over lowest 1 km (g/kg)

Mostly cold and humid

Averaged over central USA domain

$y=-0.40x+0.68$

HU bias (g/kg)

TSA bias (°C)

Surface temperature error (K)

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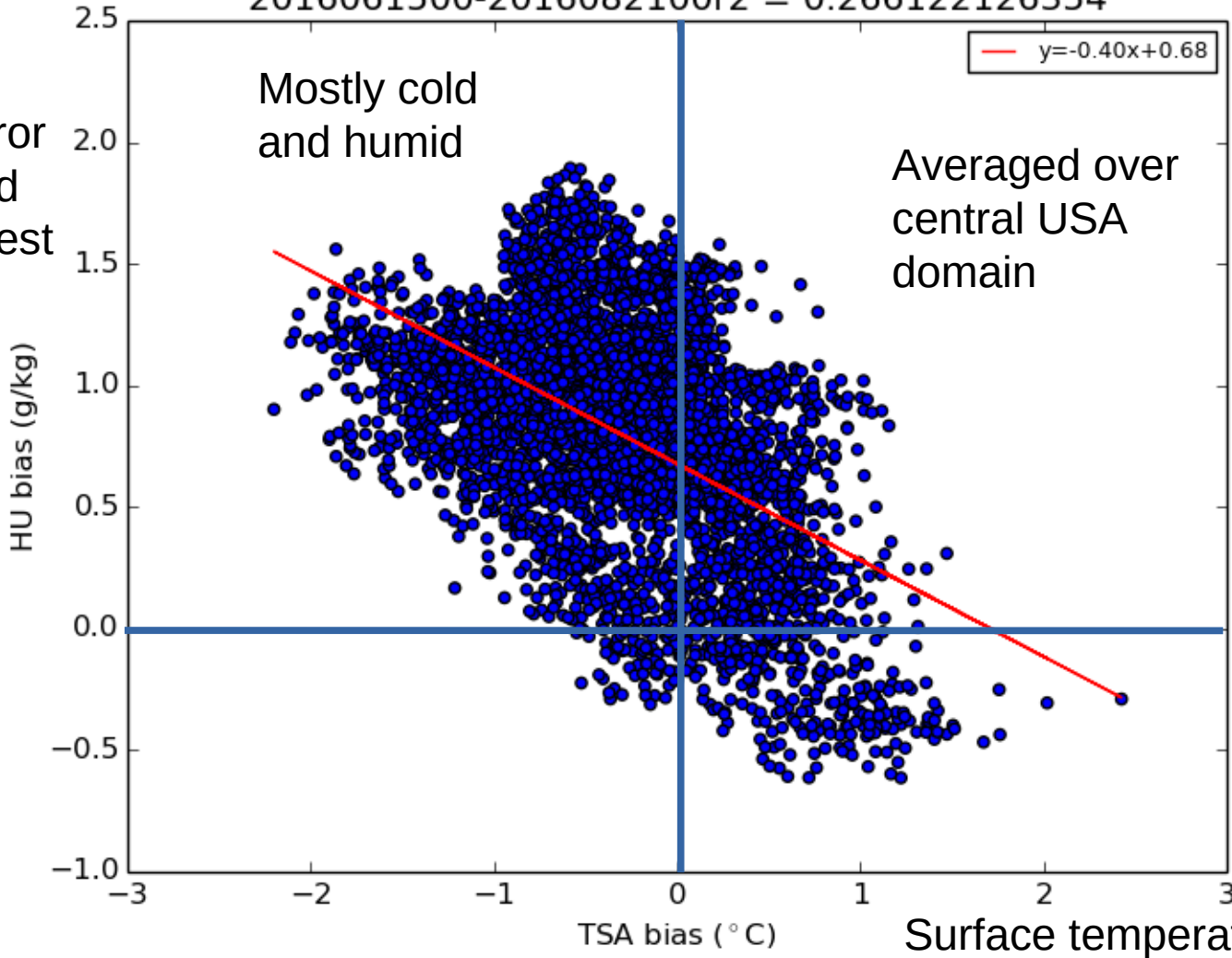
... but not that well with soil moisture errors

Biais P-A 072h Correlation HU WSOL Central_USA svs00e16g15
2016061500-2016082100r2 = 0.0113364178586

Specific humidity mean error Averaged over lowest 1 km (g/kg)

Averaged over central USA domain

Mostly humid and humid

y=-0.01x+0.81

HU bias (g/kg)

WSOL bias (dm3/m3)
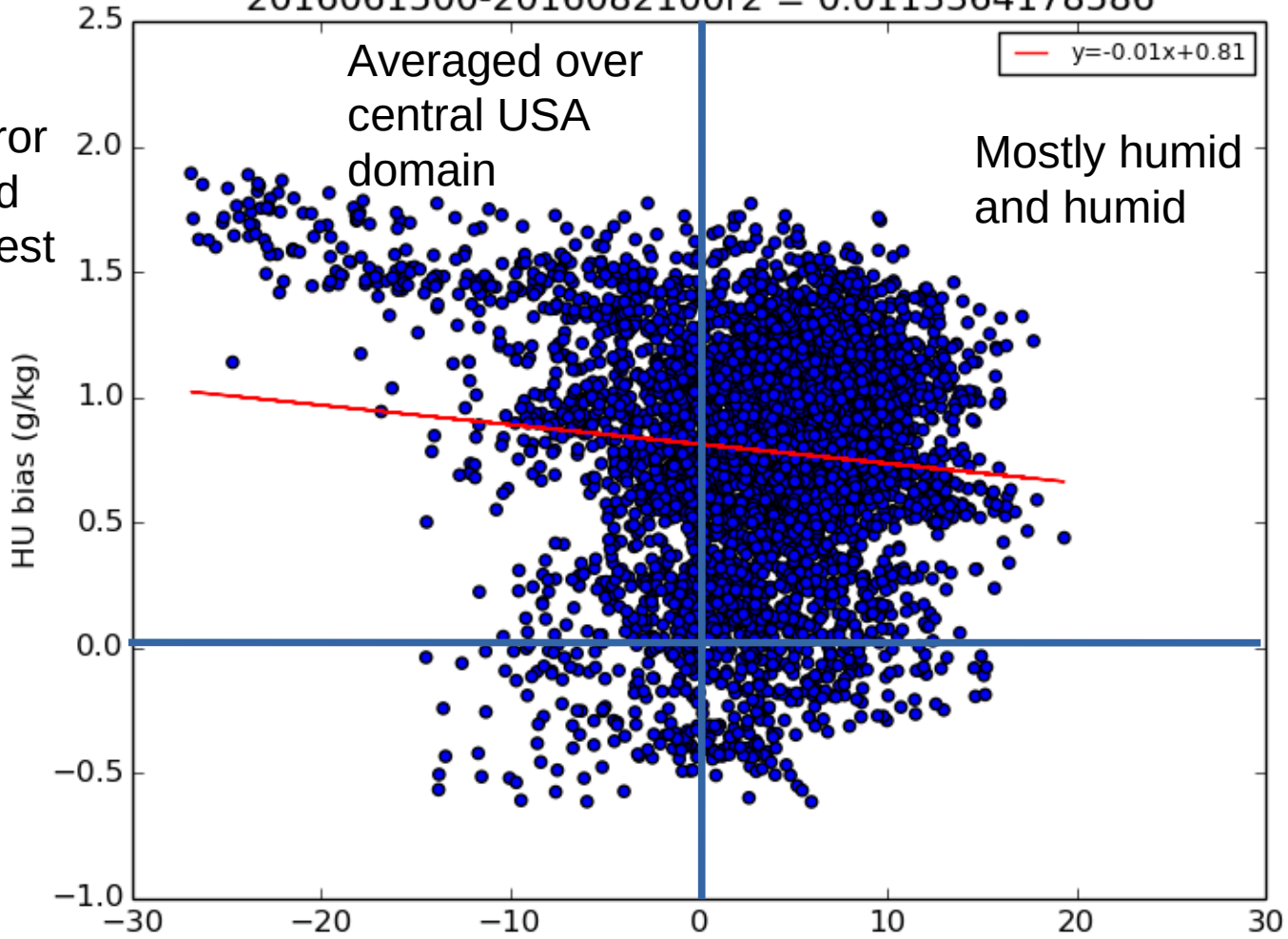
Soil moisture error, first soil layer (m3/m3)

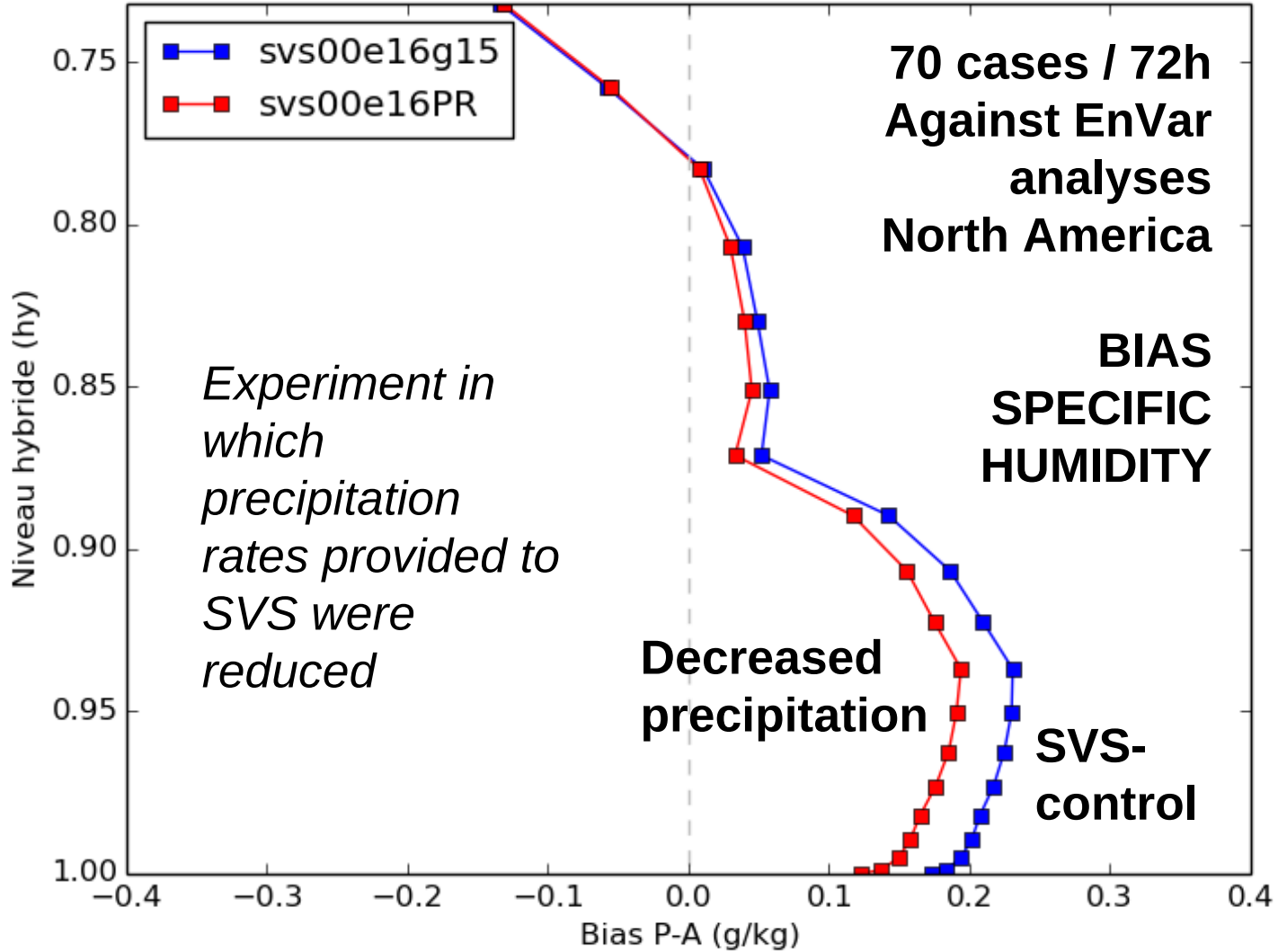Environnement Environment
Canada Canada

So...

Soil moisture not well predicted (even at short range)

PBL biases do not depend much on soil moisture errors

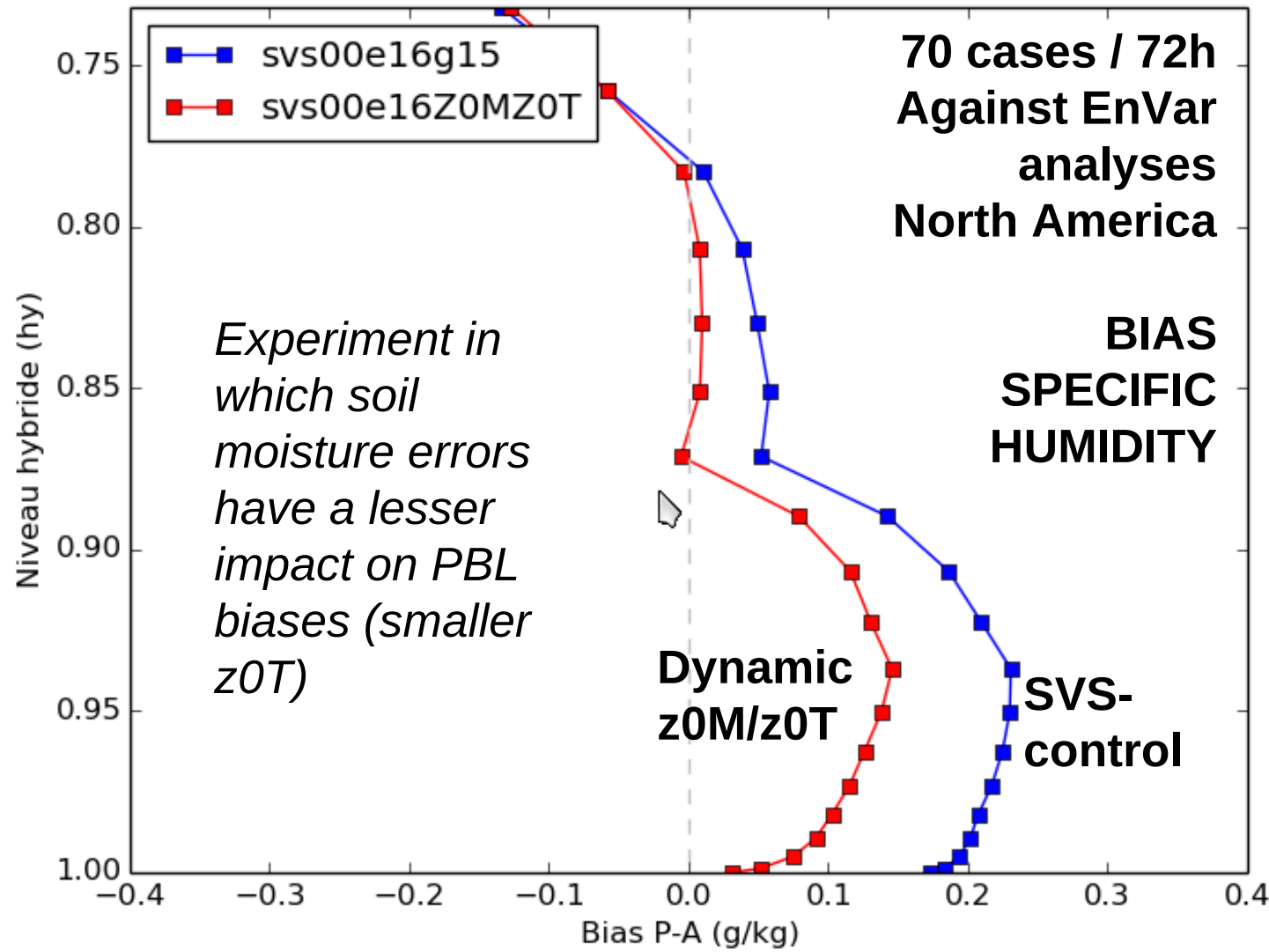*Implications on actions required to improved predicted PBL*

Impact of decreasing precipitation

Biais P-A 072h MHU North_America svs00e16g15 et svs00e16PR
2016072500-2016072600

Impact of dynamic z0M / z0T

Biais P-A 072h MHU North_America svs00e16g15 et svs00e16Z0MZ0T
2016072500-2016072600

Final words

Approach to calibrate the land surface scheme and its interaction with the atmosphere

Best results at medium-range might be for wrong reasons (i.e., limiting the damages caused by poor soil moisture forecasts)

Focus should be on improving the predictability of soil moisture, by providing better precipitation fields to the land surface scheme

Stephane Belair, Montreal, 15 July 2019

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