Modélisation de la variabilité et des tendances climatiques en Himalaya pour une meilleure compréhension de leurs impacts sur la cryosphère

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PEDALONS 13.01.2020 "Zoom et climats régionaux"

Cursus universitaire

Expériences personnelles

3 mois en Nouvelle-Zélande

1 an en VVT au Japon

→ Anglais

Auto-entreprise développement web
→ programmation

Passion pour la Science et l'Environnement

Expériences professionnelles

Prépa PCSI/PSI

L3 STPE/Physique
-> recherche plus fondamentale

Supméca Paris
→ ~~ingénieur~~

Stages glaciologie + astrophysique

Stage atmosphère

Master ACSC
→ atmosphère / cryosphère / modélisation

Stage océan + machine learning
→ complémentaire à ma formation
→ soumission d'un papier

Projet de thèse autour de la **modélisation atmosphère/cryosphère** et du **réchauffement climatique**

CMIP6 vers CMIP7

1ère année

- Bibliographie
- Prise en main du LMDZ
- Novembre : réunion atmosphère/orchidée
- Décembre : formation LMDZ
- 1ère simus + comparaisons

2ème année

- Paramétrisation sous-maille
- Développement LMDZ (collaboration avec l'IPSL)
- Comparaison CMIP6
- Terrain Himalaya ?
- Visite BSC ?

3ème année

- Projections futures (+ avec correction de biais ?)
- MAR dans LMDZ ?
- Finalisation de la thèse
- Ecriture du mémoire

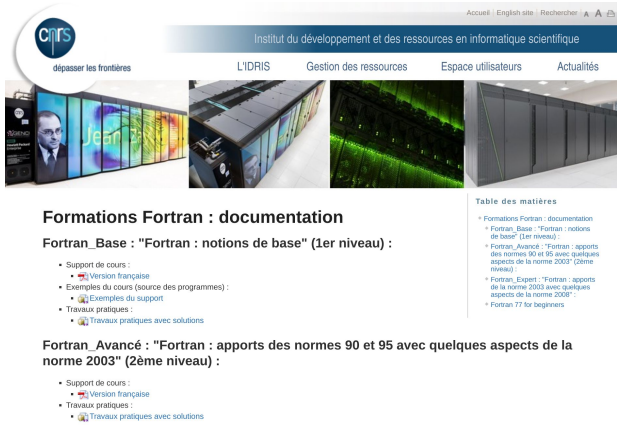
après...

- Post-doc à l'étranger
- Continuer dans la recherche
- Continuer de me spécialiser dans la modélisation atmosphère/cryosphère

For now...

01/10/2019
Start PhD

23-25/10/2019
Formation Fortran Base



14-15/11/2019
Journée de Modélisation des Surfaces Continentales

26-29/11/2019
Formation Fortran Avancé

9-11/12/2019
LMDZ training course

13/01/2020
PEDALONS zoom

14-17/01/2020
IPSL running environment + ORCHIDEE training course

Snow bias in IPSL model CMIP5 versus CMIP6

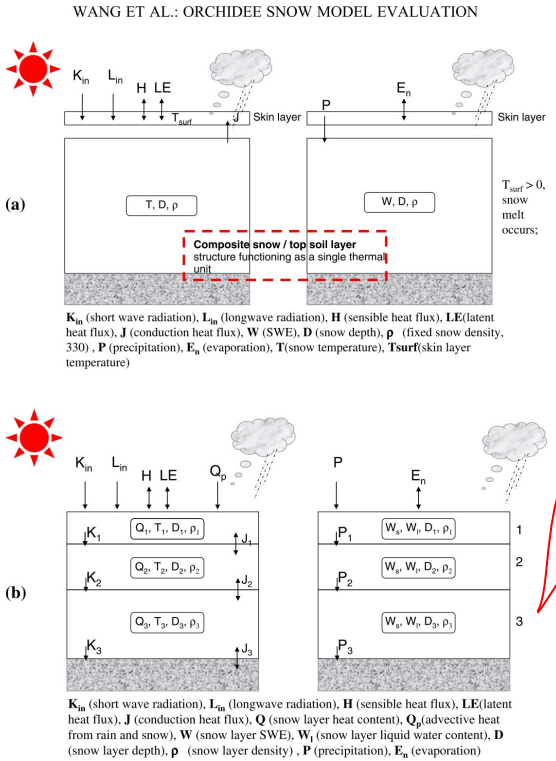


Fig. 1 Wang et al. 2013

CMIP5

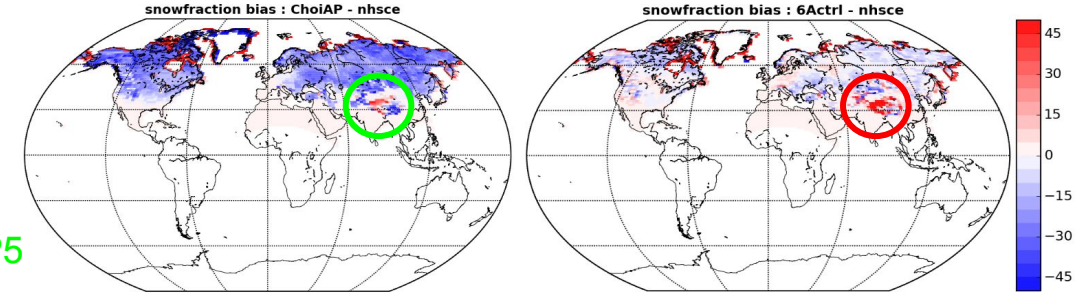


Fig. 6 Cheruy et al., submitted

CMIP6

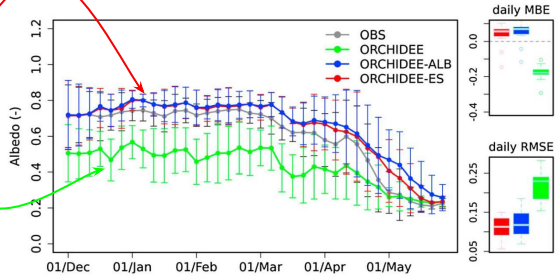


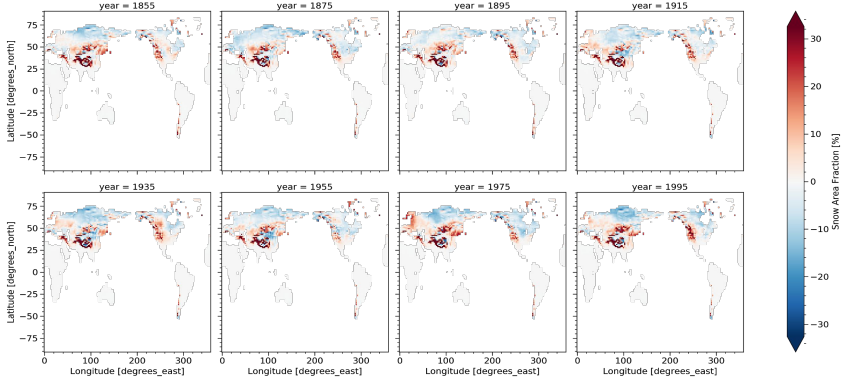
Fig. 5 Wang et al. 2013

"The weaker bias produced by the old snow scheme is consistent with the underestimation of the snow albedo already documented by T. Wang et al. (2013)."

[Cheruy et al., submitted]

Snow bias over Himalaya in IPSL_CM6A_LR_historical

- From when the bias is present and is this present in the ensemble mean?



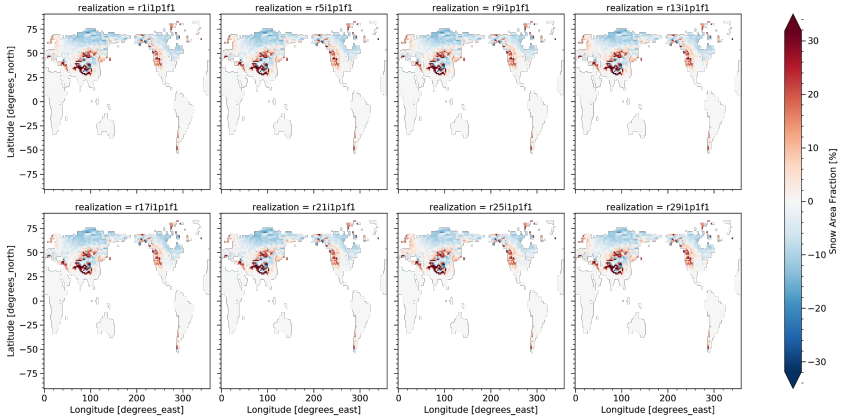
Ensemble mean of the 32 realizations (averaged per year)

-

NOAA-CIRES Twentieth Century Reanalysis (V2c)

→ The bias is always present! Even before the decrease in snow area fraction (20th century).
Similar results with other reanalyses.

- Is this bias present for all members?



Climatology 1979 to 2014 (for each realization)

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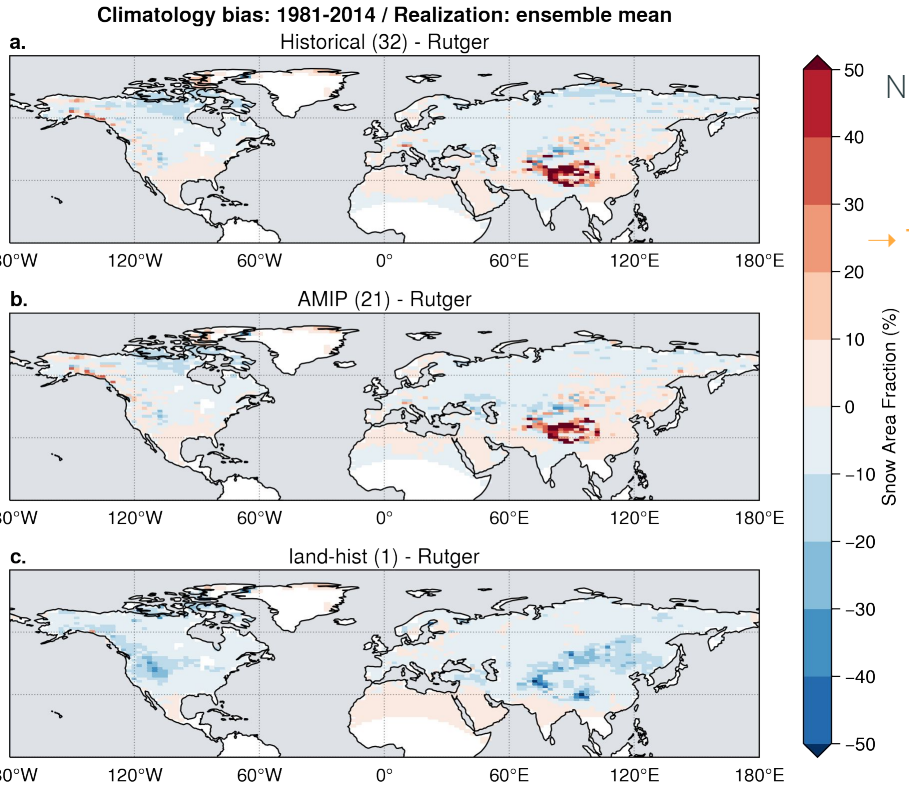
NOAA-CIRES Twentieth Century Reanalysis (V2c)

→ The bias is present for all members!
Similar results with other reanalyses.

Snow bias over Himalaya in IPSL_CM6A_LR_historical

- Is the snow bias over Himalaya present in all experiments: historical, AMIP and land-hist?



Ensemble mean climatology (1981-2014)

-

NOAA Climate Data Record (CDR) of Northern Hemisphere (NH) Snow Cover Extent (SCE), Version 1
(based on satellite-derived maps)

→ The bias is present only in Historical and AMIP, but not in land-hist!

Further analyses:

- Check precipitations (liquid/solid), winds, trends?
- Check HighResMIP / CMIP5 / other models?
- Compare with more:
  - obs (GLACIOCLIM + others? Make a 1D case over Himalaya?)
  - reanalyses (ERA5 not good? [Orsolini et al, 2019], ERA-Iterim, JRA-55, MERRA-2, etc.)
- More bibliography (on reanalyses/obs, Himalaya, physics, etc.)
- Make an analysis on thermodynamic/dynamic changes with analog method [Deser et al., 2016]

Future work?

[Cheruy et al., submitted]

*"The **weakening of the bias** obtained with the **increase in resolution** or with the wind nudging confirm that the regional circulation is an important component of the High-Mountain Asia climate which can be simulated correctly only when using fine resolutions (Sabin et al., 2013; Ménégoz et al., 2014; Krishnan et al., 2019)."*

→ à vérifier avec la nouvelle version du schéma de neige (CMIP6) ? Simu zoomée sur l'Himalaya similaire à celles citées ci-dessus avec nudging pour comparaison avec obs ?

*"It is also a way to better simulate the role of the **orographic barrier** played by the High-Mountain Asia that stops the northward transport of moisture originating from the Indian subcontinent. This barrier explains the dryness of the Tibetan plateau where an excess of moisture flux is simulated at coarse resolution, inducing a **positive bias of snow cover** finally enhanced by surface feedback."*

*"The snow scheme of intermediate complexity implemented in ORCHIDEE leads to a better description of snow cover on the continents. Mountainous regions and in particular the **Tibetan Plateau and High Mountain Asia remain challenging** because radiative feedbacks and an imperfect description of the circulation in these regions at regional scale induce a **strong cold bias**. Further refinements of the snow scheme over complex terrains and of the atmospheric circulation are required to reduce these biases."*

→ paramétrisation sous-maille pour diminuer ce biais dans les simulation non zoomées ?
(schéma de neige, effet orographique, autres ?)