Searching for aerosol effects on clouds using MODIS regimes

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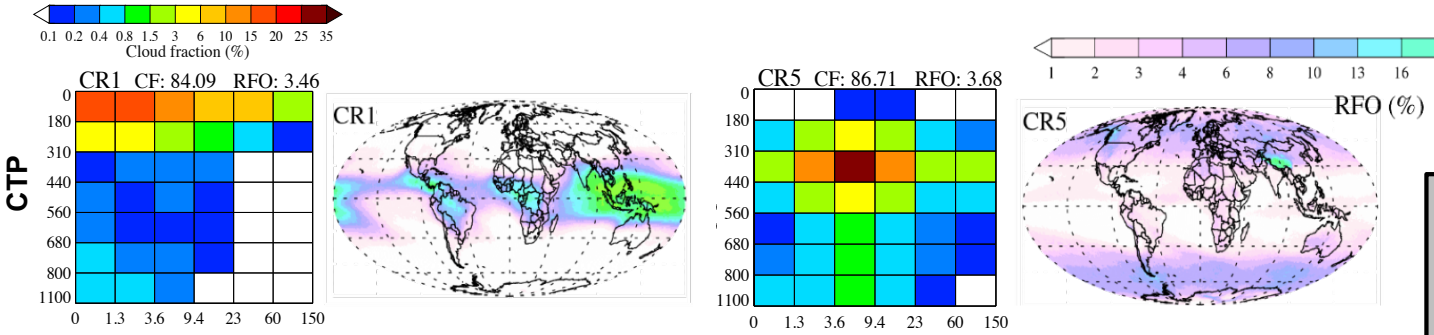
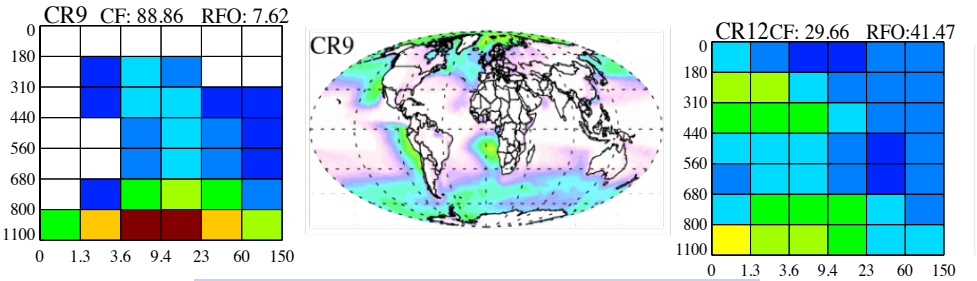
Invigoration (ice and mixed CRs)	1st indirect effect (liquid CRs)	2nd indirect effect (liquid CRs)
• Precipitation increase • CF increase • CTH increase • COT increase • $CRE_{SW,LW}$ increase	• COT increase • CER decrease* • CRE_{SW} increase * also for ice clouds	• Precipitation decrease • CF increase • LWP increase => COT increase • $CRE_{SW,LW}$ increase

CF = Cloud Fraction
CER = Cloud Effective Radius
CTP = Cloud Top Pressure
CTH = Cloud Top Height
COT = Cloud Optical Thickness
LWP = Liquid Water Path
CRE = Cloud Radiative Effect
SW = Shortwave
LW = Longwave.



- *No invigoration seen in precipitation*
- *Invigoration in CF, CTH, CRE*
- *CER decrease over land only*

- *No invigoration in precipitation*
- *Invigoration in CRE*
- *Other signals conflicting*



- *1st indirect effect in CER, COT, CRE*
- *2nd indirect effect in CF, CRE*
- *No 2nd indirect effect in precipitation*

Increases in all variables, except CER for which change is unclear.

A more systematic search for aerosol effects on clouds can be conducted with MODIS Cloud Regimes (CRs). Our near-global study using 12 years of data often finds conflicting signals and consistency with expectations only in select situations.

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