How do the dispersion calculations in the IIAS work?

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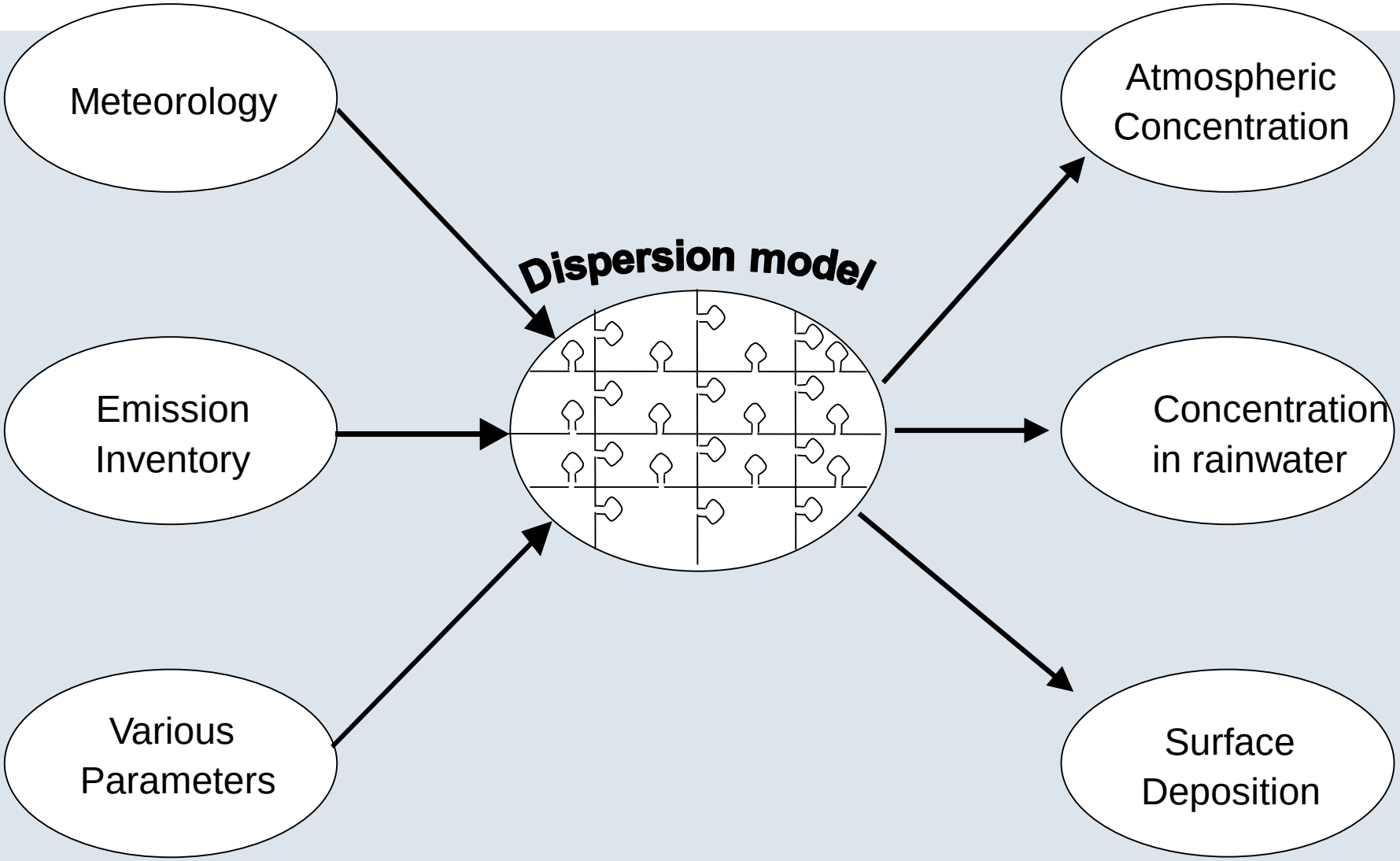
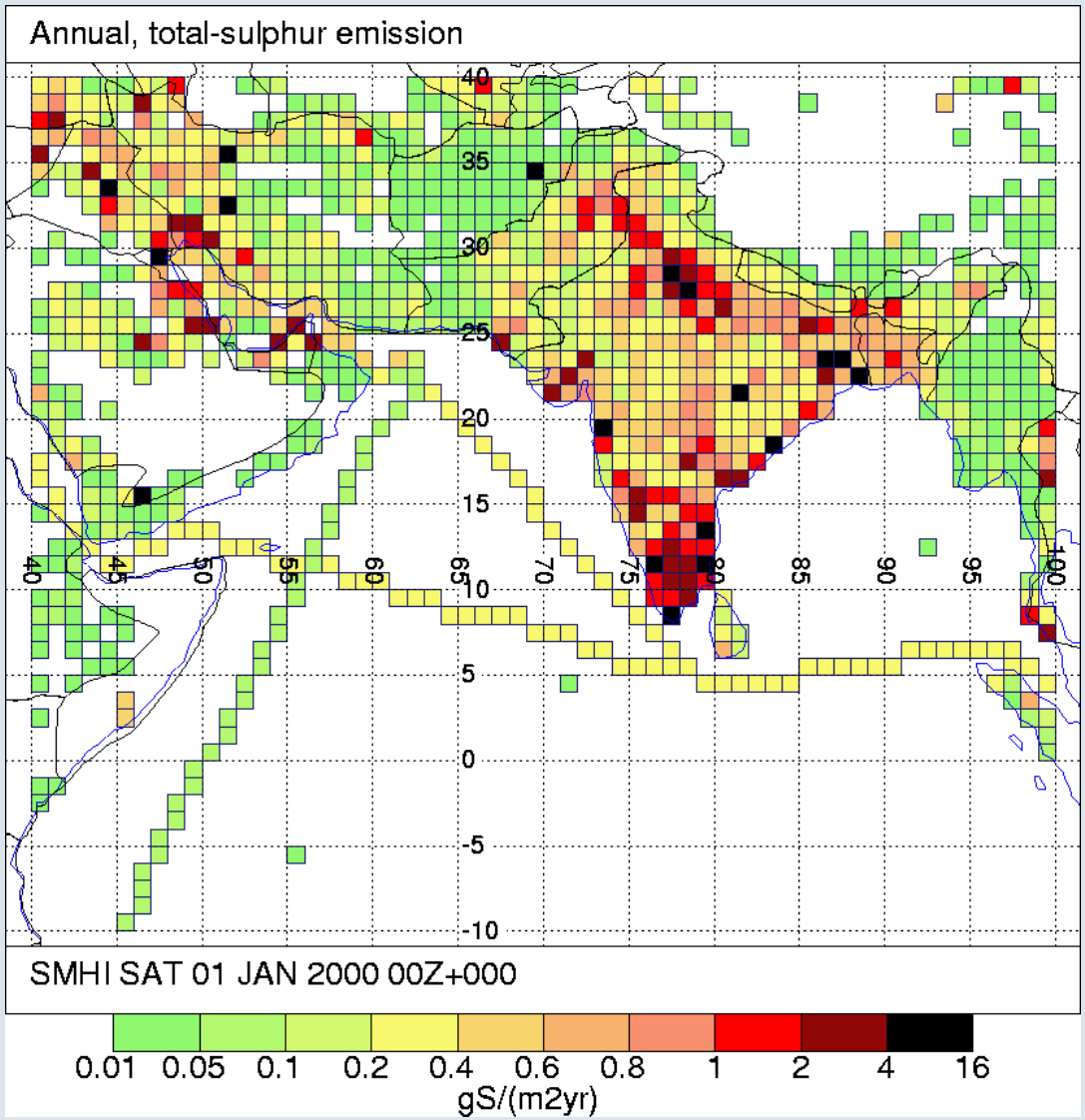
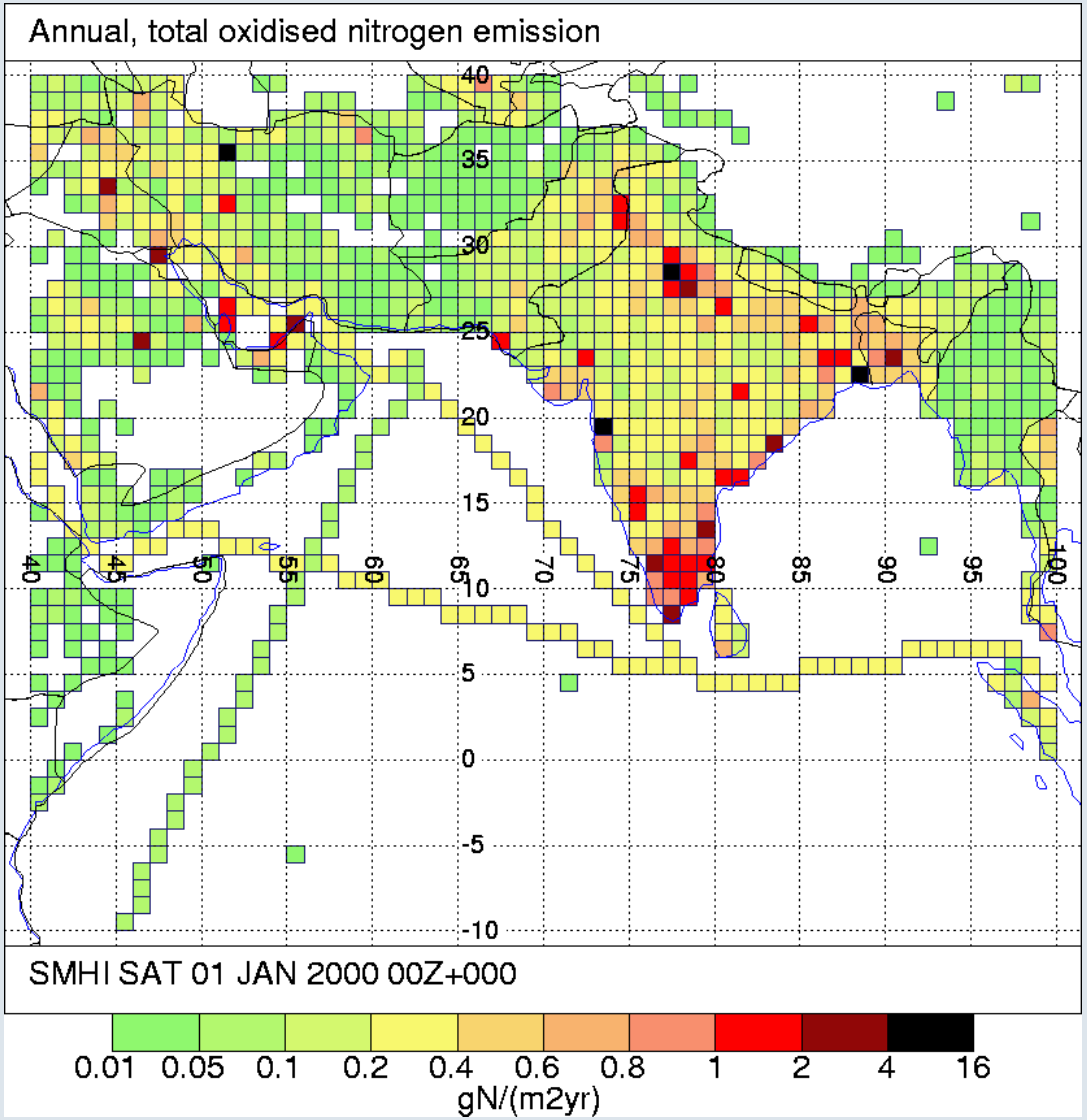
Run a state-of-the-art model, with appropriate input



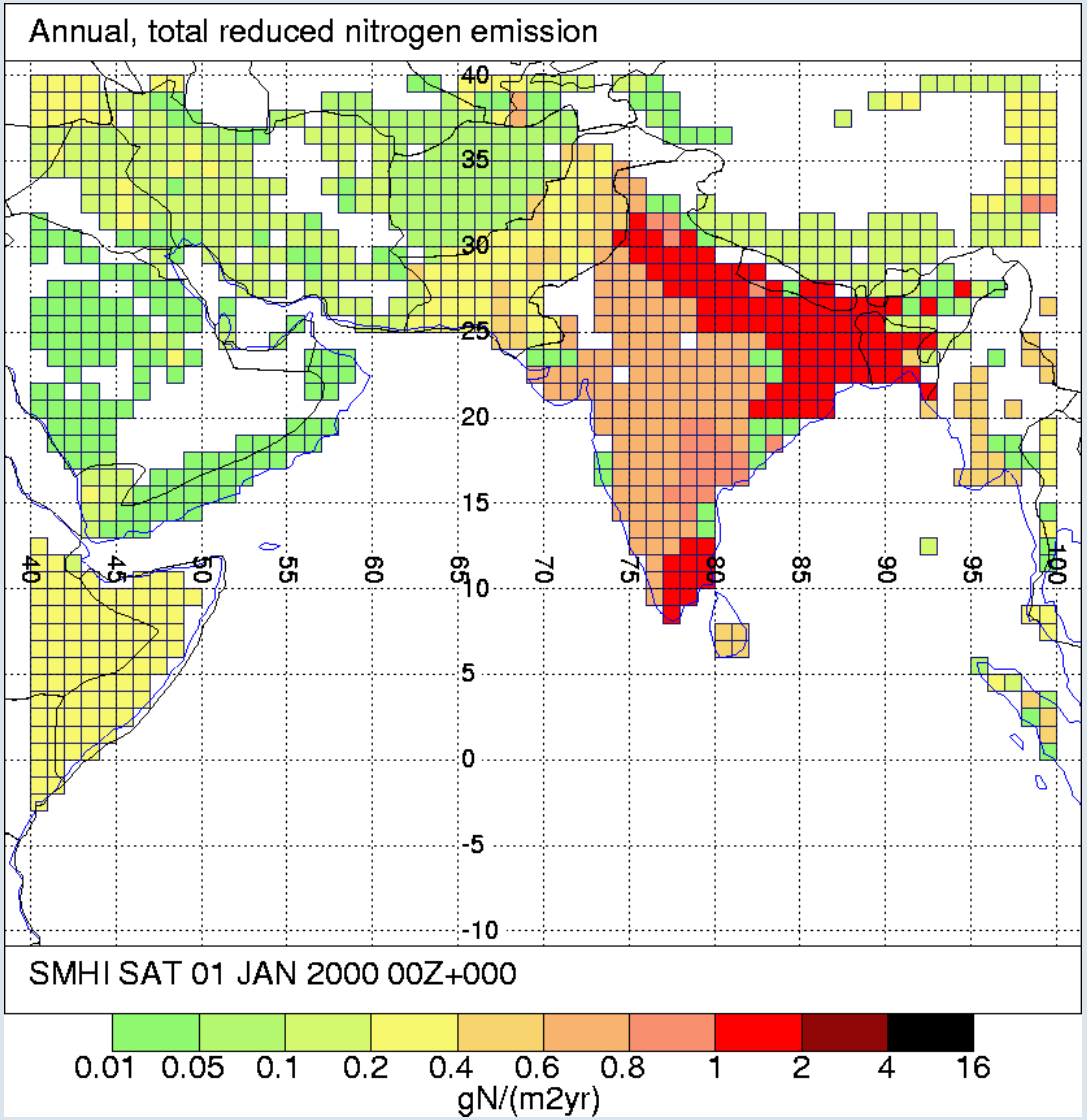
Total emission of anthropogenic sulphur (SO_2 and sulphate) in the model domain. Units g sulphur m^{-2} $year^{-1}$.



Total emission of anthropogenic oxidised nitrogen (NO and NO_2) in the model domain. Units g nitrogen m^{-2} $year^{-1}$.



Total emission of anthropogenic ammonia (NH_3) in the model domain. Units g nitrogen m^{-2} $year^{-1}$.



Vertical distribution of the total SO_X-, NO_X-, and NH_3 emissions in the standard simulations.

	layer 1 (~10 m)	layer 2 (~35 m)	layer 3 (~70 m)	layer 4 (~125 m)	layer 5 (~195 m)
SO_X	70%	20%	5%	3%	2%
NO_X	70%	20%	5%	3%	2%
NH_3	90%	10%	0	0	0

National emissions (from EDGAR 1995 gridded-data)

Fraction of the total emission of primary species in the domain from the South Asian countries under consideration in the present study. (The accuracy of the numbers is far less than indicated in the table.)

Country	Fraction of total SOx emissions in domain	Fraction of total NOx emissions in domain	Fraction of total NH_3 emissions in domain
Bangladesh	2.0 %	3.9 %	5.9 %
Bhutan	0.05 %	0.07 %	0.14 %
India	52.4 %	49.0 %	58.7 %
Iran	10.8 %	9.1 %	4.0 %
Maldives	0.008 %	0.01 %	0.0 %
Nepal	0.51 %	0.79 %	1.8 %
Pakistan	4.9 %	5.9 %	8.5 %
Sri Lanka	0.35 %	0.69 %	0.7 %
Sum:	71.0 %	69.5 %	79.7 %

Divide South Asia into a number of emission regions:

”Small countries” constituate one emission region

Iran and Pakistan constitue two emission regions

India constituates of 10 emission regions

Iran

Pakistan

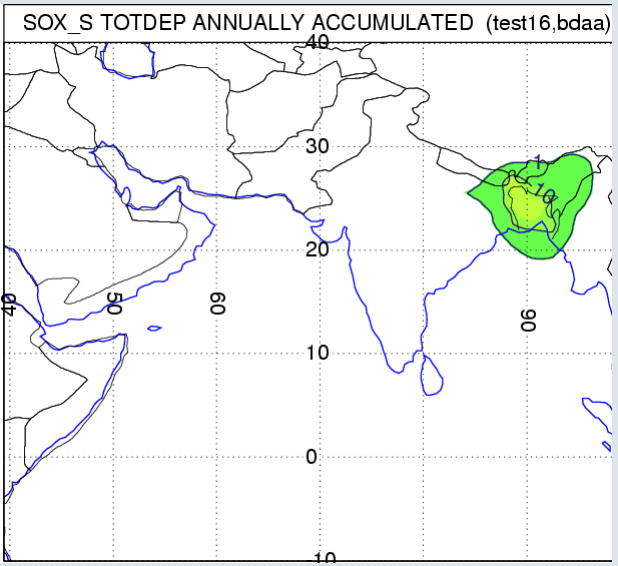
India

Region	code	SO_X emission [kton sulphur $year^{-1}$]	NO_X emission [kton nitrogen $year^{-1}$]	NH_X emission [kton nitrogen $year^{-1}$]
Bangladesh	bdaa	121	121	233
Bhutan	btaa	2.8	2.1	5.7
India Central	incc	242	121	270
India Central-South	incs	666	307	325
India East-Central	inec	178	82	182
India East	inee	77	37	66
India North-Central	innc	427	205	425
India North	innn	192	106	168
India South-East	inse	346	150	250
India South	inss	507	236	166
India South-West	insw	303	151	212
India West-Central	inwc	292	143	268
Iran East	iree	232	114	88
Iran West	irww	433	173	70
Maldives	mvaa	0.5	0.3	0
Nepal	npaa	32	25	73
Pakistan East	pkee	176	100	140
Pakistan West	pkww	128	84	196
Sri Lanka	lkaa	22	22	26
non-South Asia	rest	1788	961	811
Total	tota	6 166	3 137	3 974

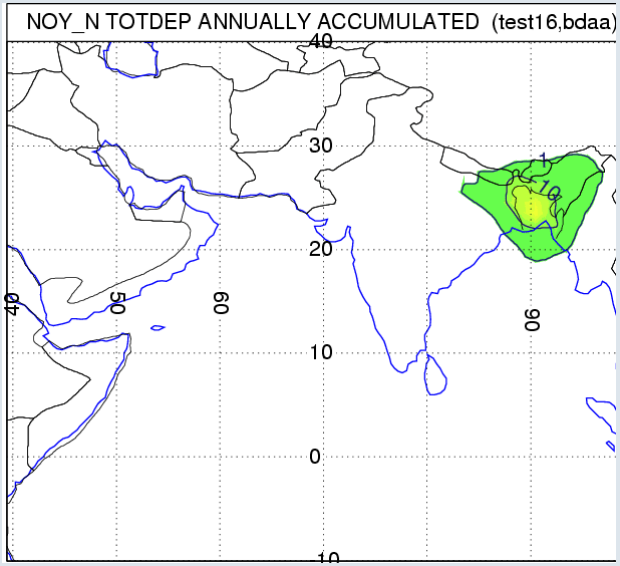
Amount of SO_X, NO_X, and NH_3 emitted in the different "target regions" of the model domain. (The multitude of significant digits in each entry should not be taken as accuracy of the emission inventory, rather what falls out from our area-wise splitting of the emissions.)

Run one emission region at a time:

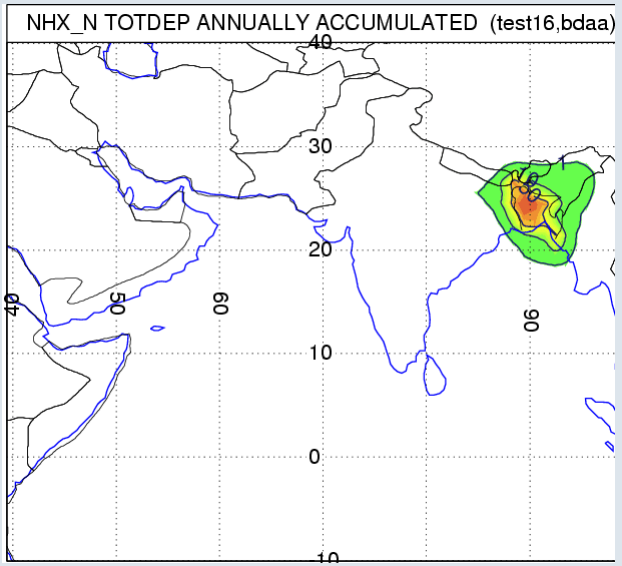
Annually accumulated total sulphur deposition

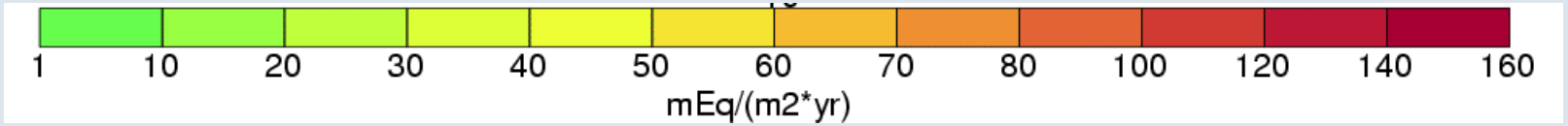


Annually accumulated total NOX deposition



Annually accumulated total NHX deposition

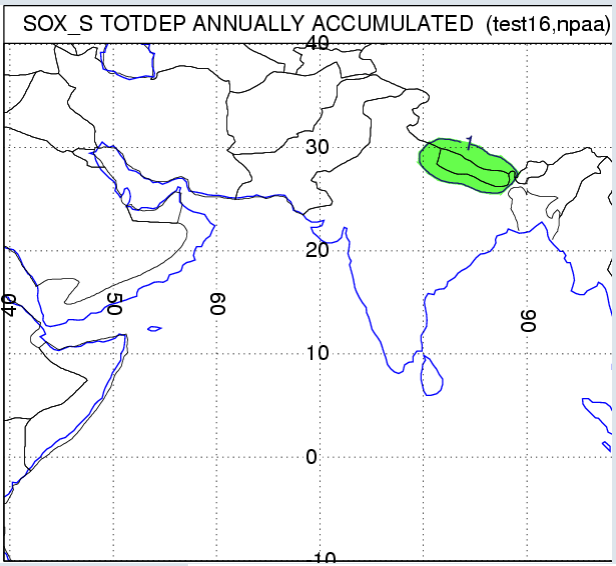




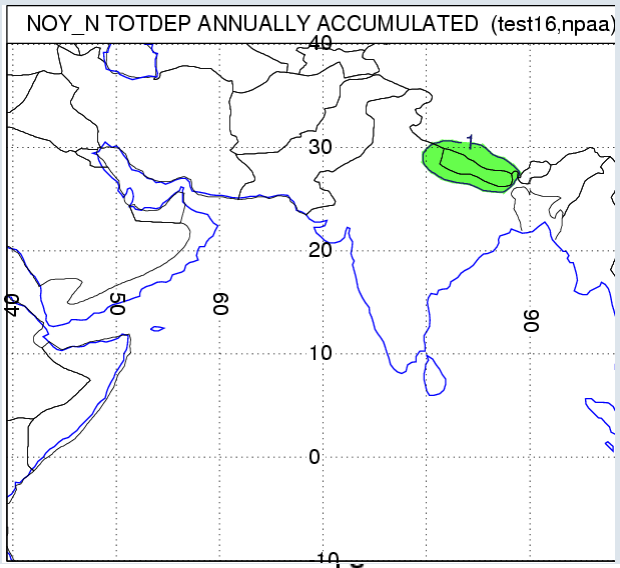
Bangladesh

SMHI

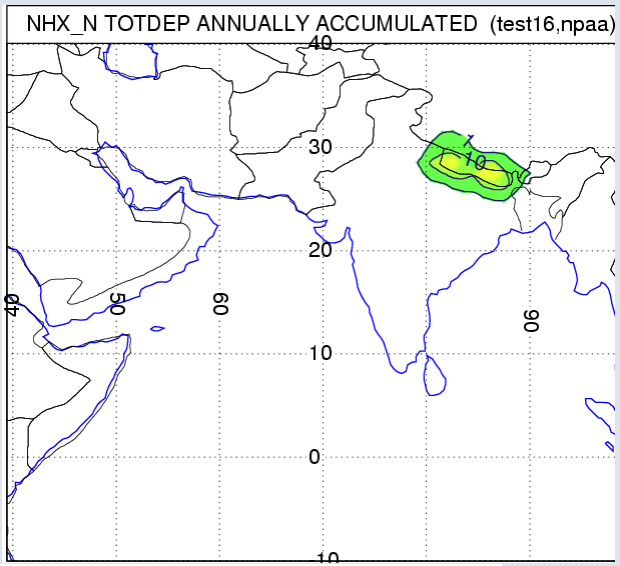
Annually accumulated total sulphur deposition

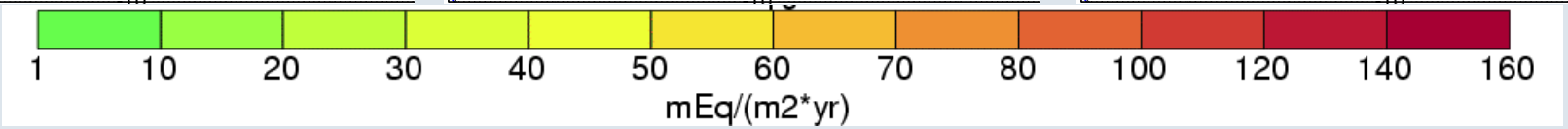


Annually accumulated total NOX- deposition



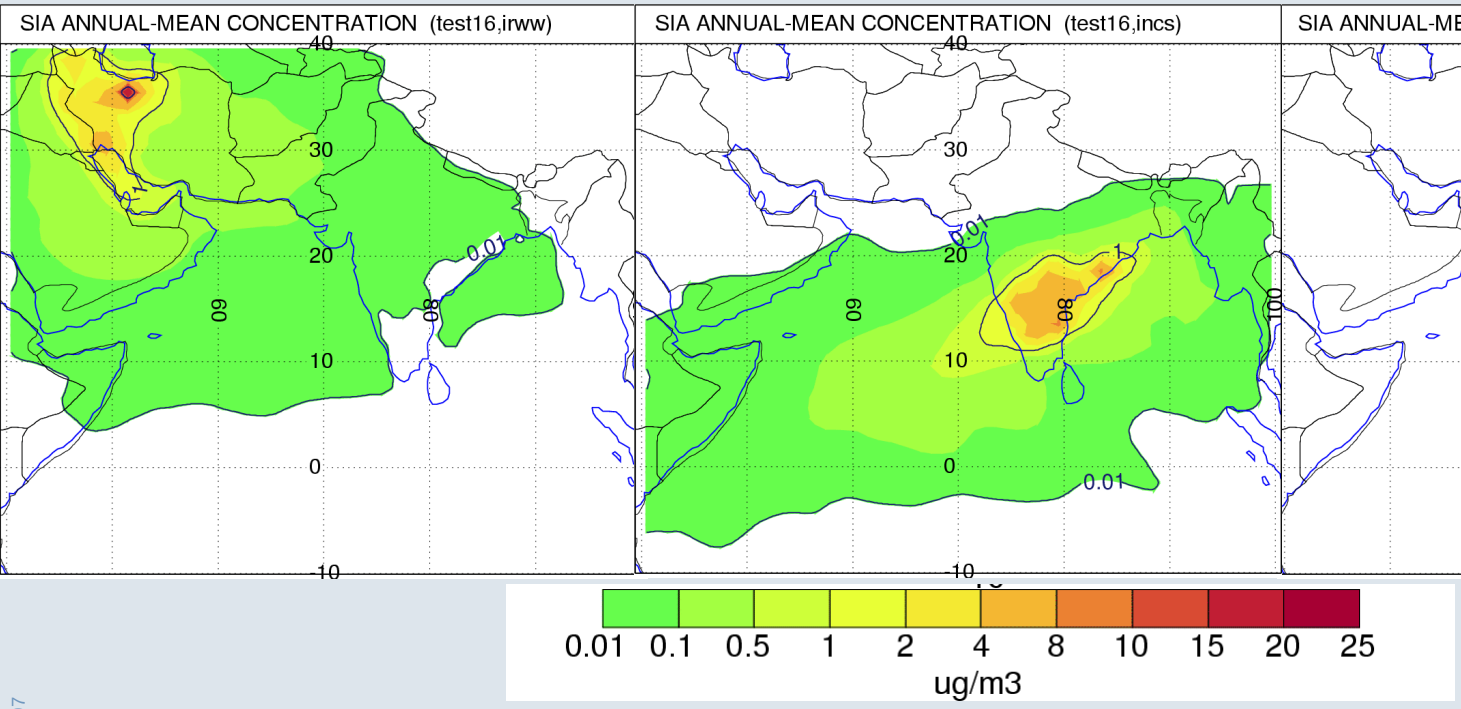
Annually accumulated total NHX- deposition





Nepal

The same is done for PM2.5 (SIA) concentration…



Iran ’irww’
(western Iran)

India ’incs’
(Andra Pradesh, Karnataka, Goa)

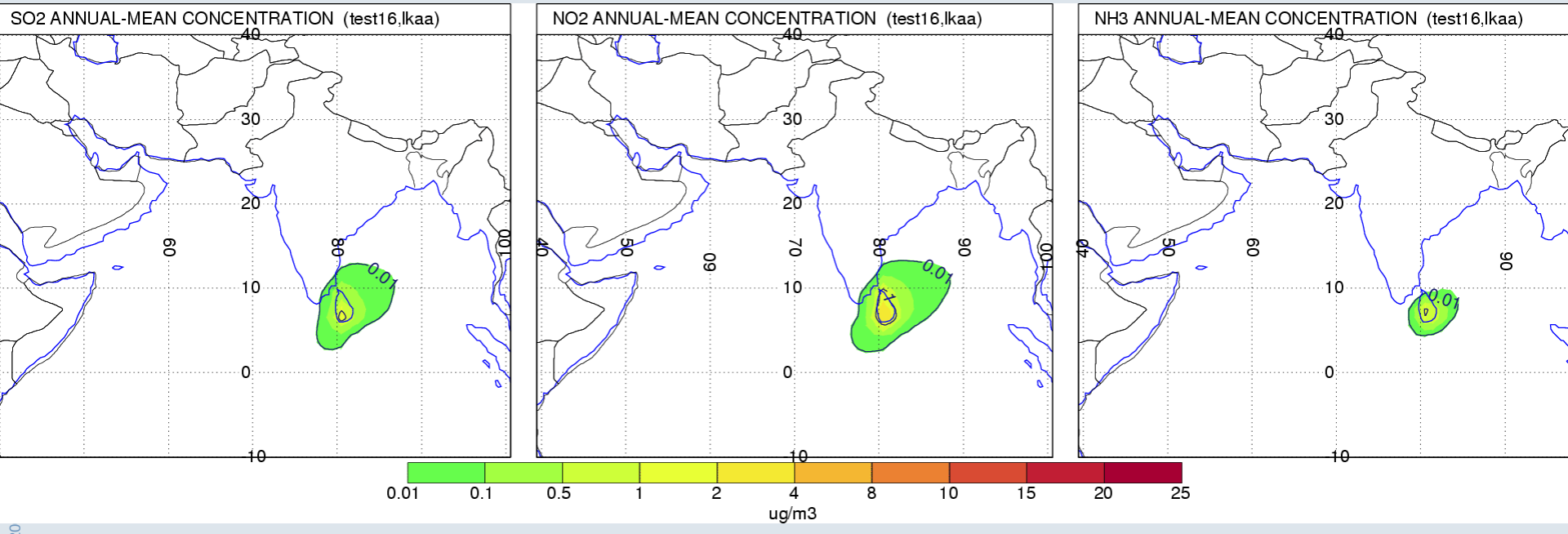
Bhutan
’btaa’

…and for SO_2, NO_2, NH_3 concentration…

Annual-mean SO_2 concentration

Annual-mean NO_2 concentration

Annual-mean NH_3 concentration



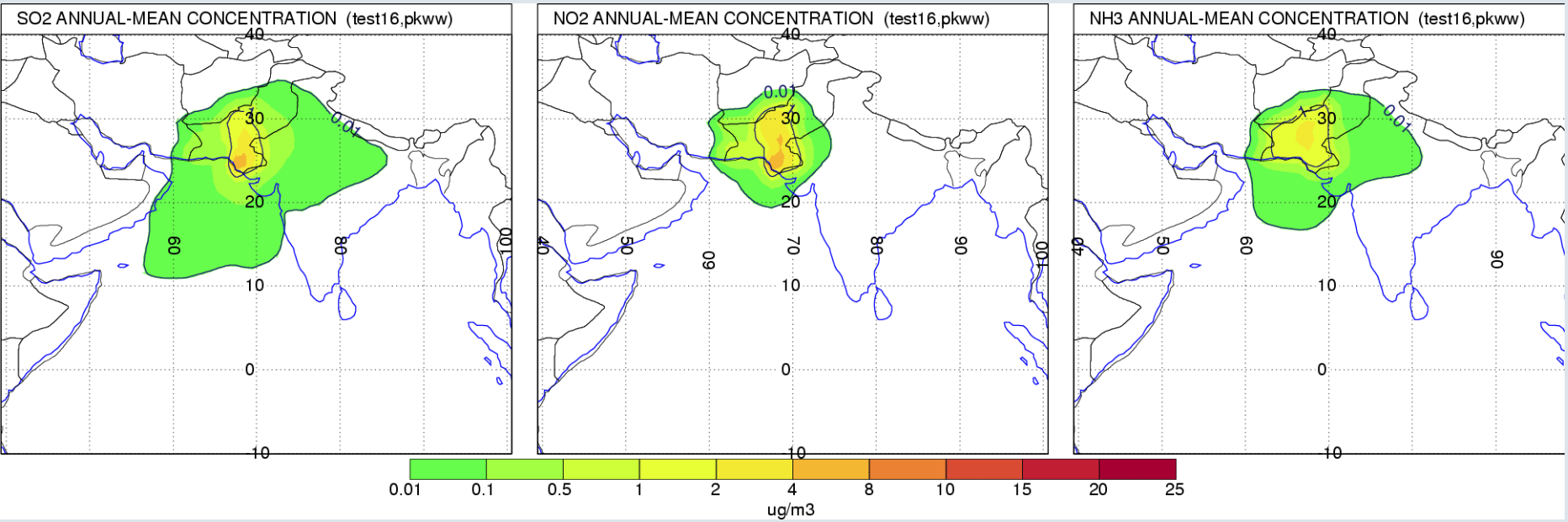
Sri Lanka

SMHI

Annual-mean SO_2 concentration

Annual-mean NO_2 concentration

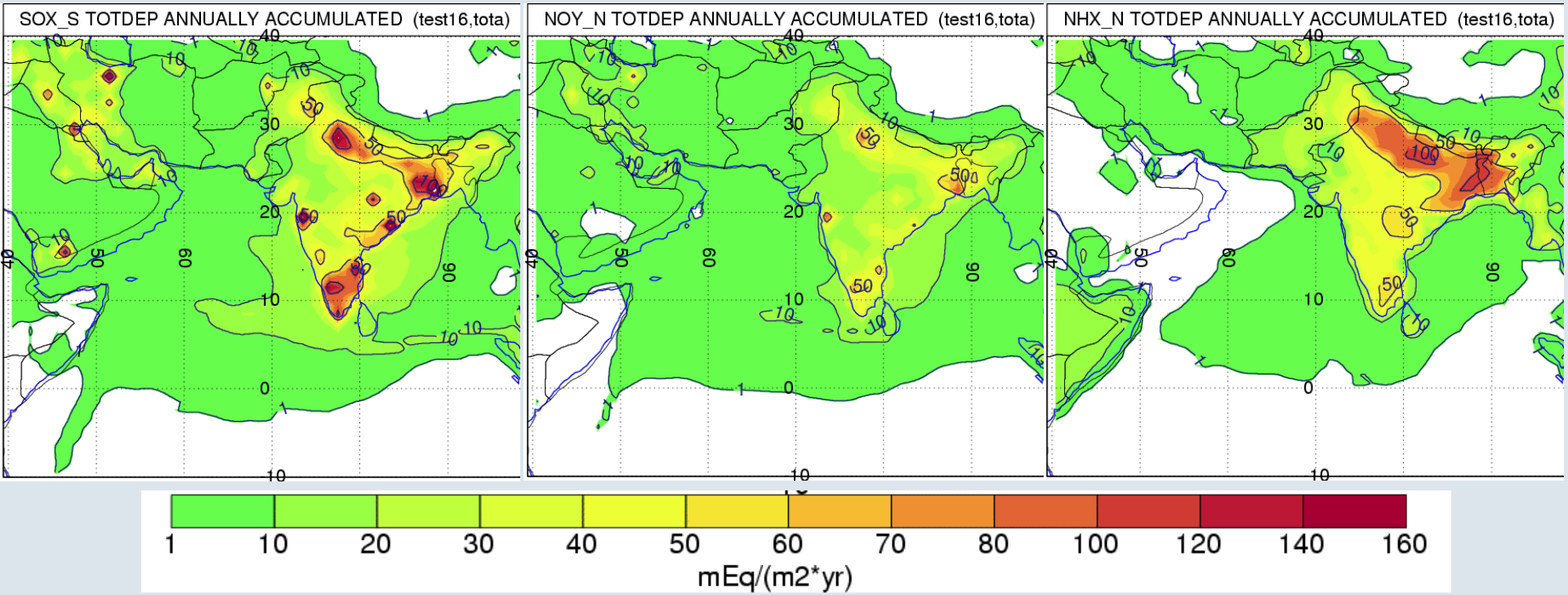
Annual-mean NH_3 concentration



Pakistan (west)

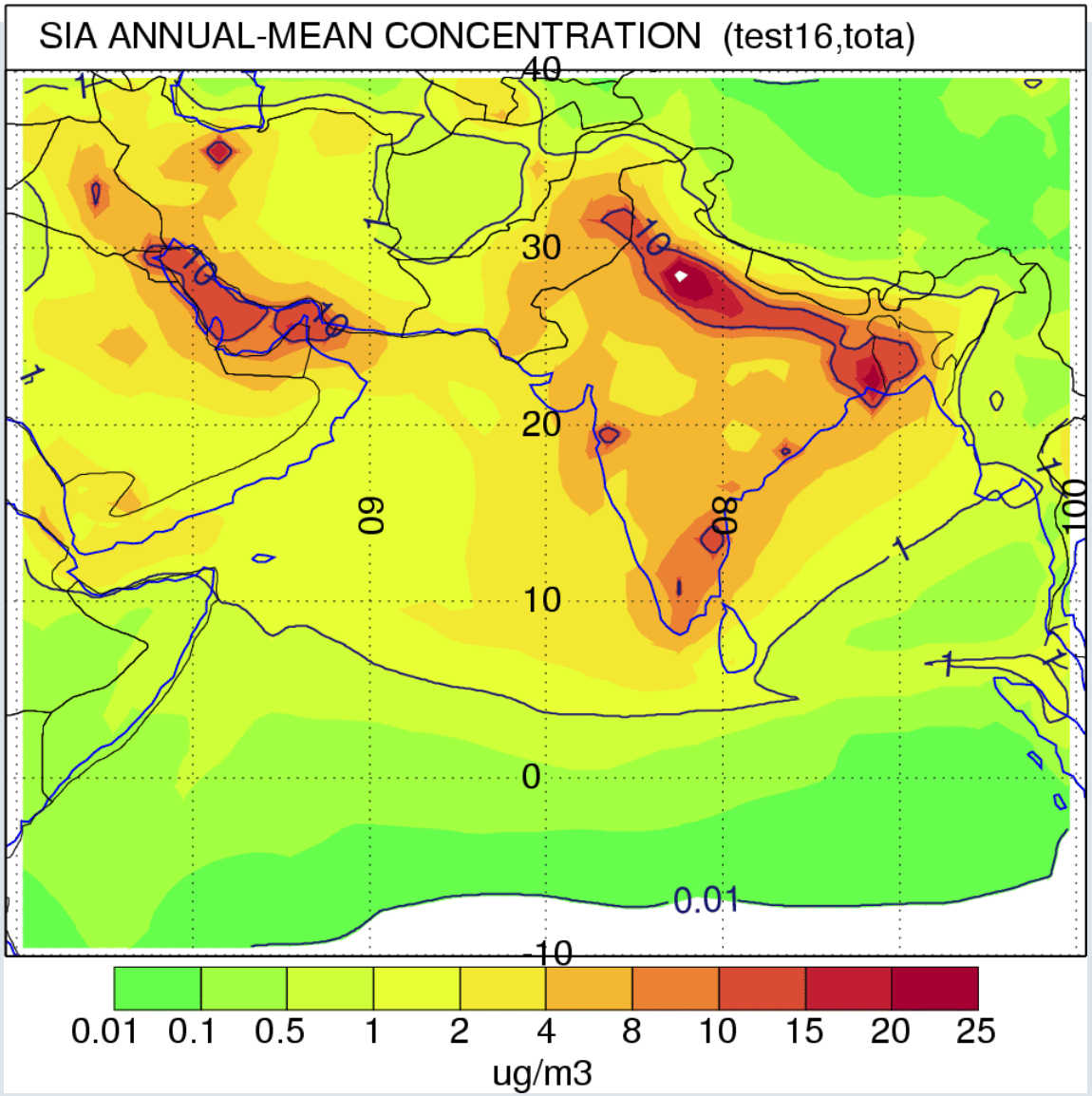
The results are added to form the total amounts:

Total (wet +dry) deposition

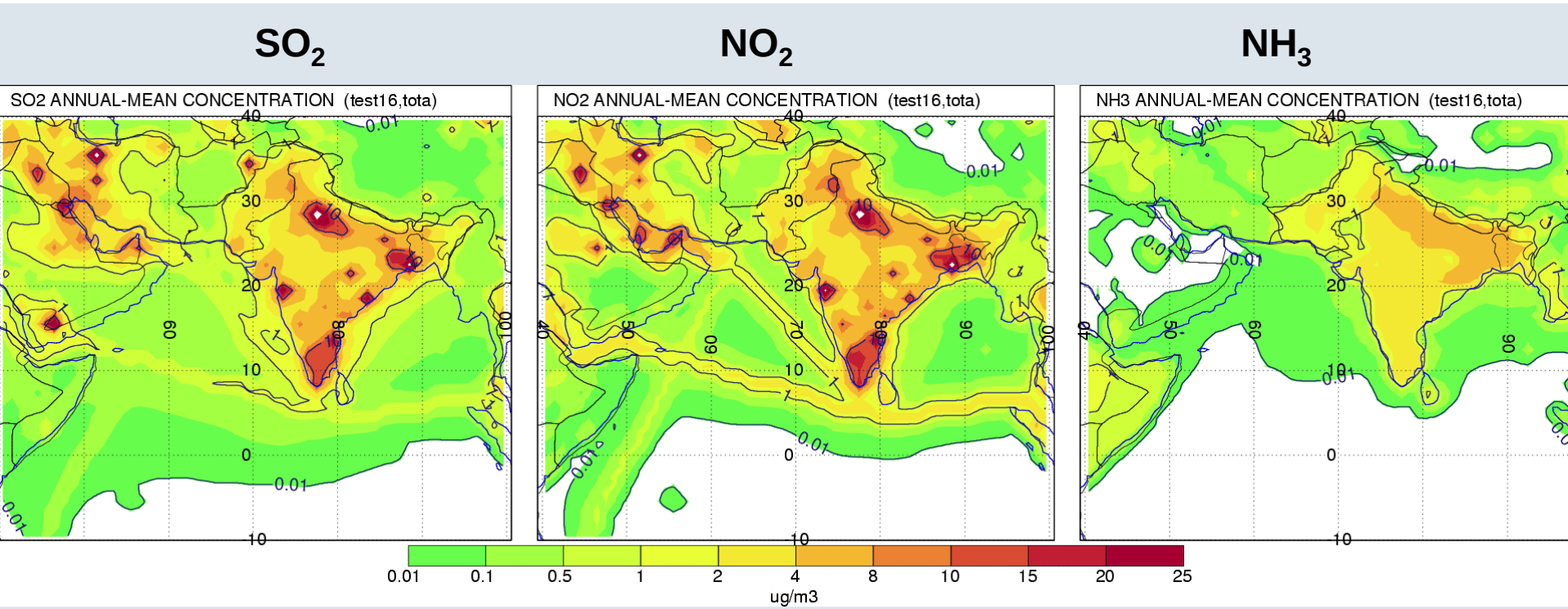


Total sulphur-, oxidised nitrogen-, and reduced nitrogen deposition in South Asia using gridded emissions from EDGAR valid for 1995

Total concentration of secondary inorganic aerosols (SIA) in the model domain. (SIA is ~50% of PM2.5.)



… concentration of gases close to the ground



Annual-mean SO_2, NO_2, and NH_3 concentration in South Asia using gridded emissions from EDGAR valid for 1995

In the interface, you can change emissions (from standard values) to create new depositions anc concentratins etc.

The deposition/concentration in each gridpoint is given by:

$$\left((\text{new emission}) \times \frac{\text{deposition/concentration}}{\text{reference emission}}\right)_{region1} +$$

$$\left((\text{new emission}) \times \frac{\text{deposition/concentration}}{\text{reference emission}}\right)_{region2} +$$

$$\left((\text{new emission}) \times \frac{\text{deposition/concentration}}{\text{reference emission}}\right)_{region3} +$$

$$\ldots + \ldots + \ldots$$

$$\left((\text{new emission}) \times \frac{\text{deposition/concentration}}{\text{reference emission}}\right)_{region20}$$

The concentration and depositon data is used together with dose-response relationships to evaluate the effects of air pollution.