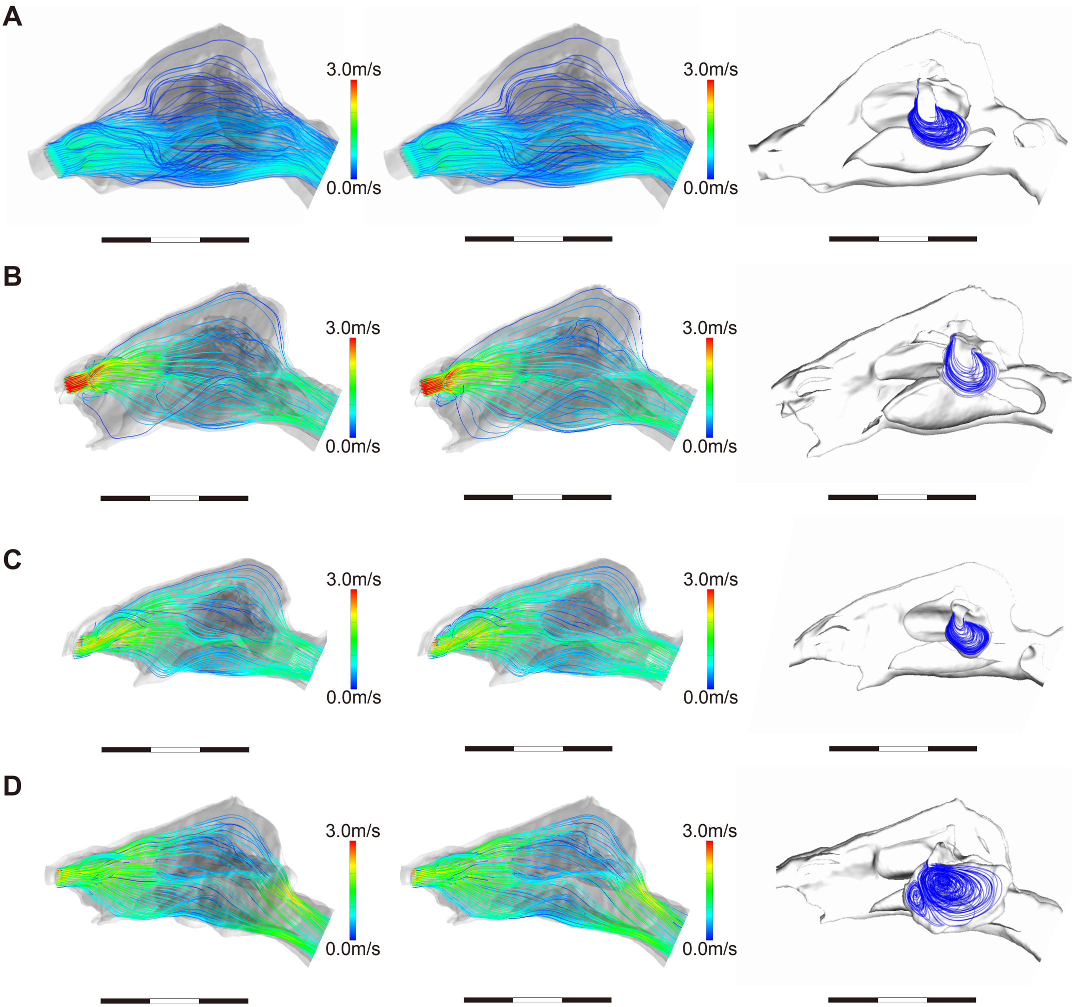

Fig. S1. Airflows and flow velocity in the nasal passage and within the maxillary sinus (MS). (A) Japanese macaque, *Macaca fuscata* (Mff963); (B) *M. fuscata* (Mff1859); (C) *M. fuscata* (Mff2115); (D) rhesus macaque, *M. mulatta* (Mm1701). The airflow was simulated using the normal model (left) and the no-MS model (middle). The streamline indicates the airflow direction, where the number and colour reflect the airflow volume and velocity, respectively. The vortex airflow within the MS (right) was far slower than that in the nasal cavity. The scale is in centimeters.

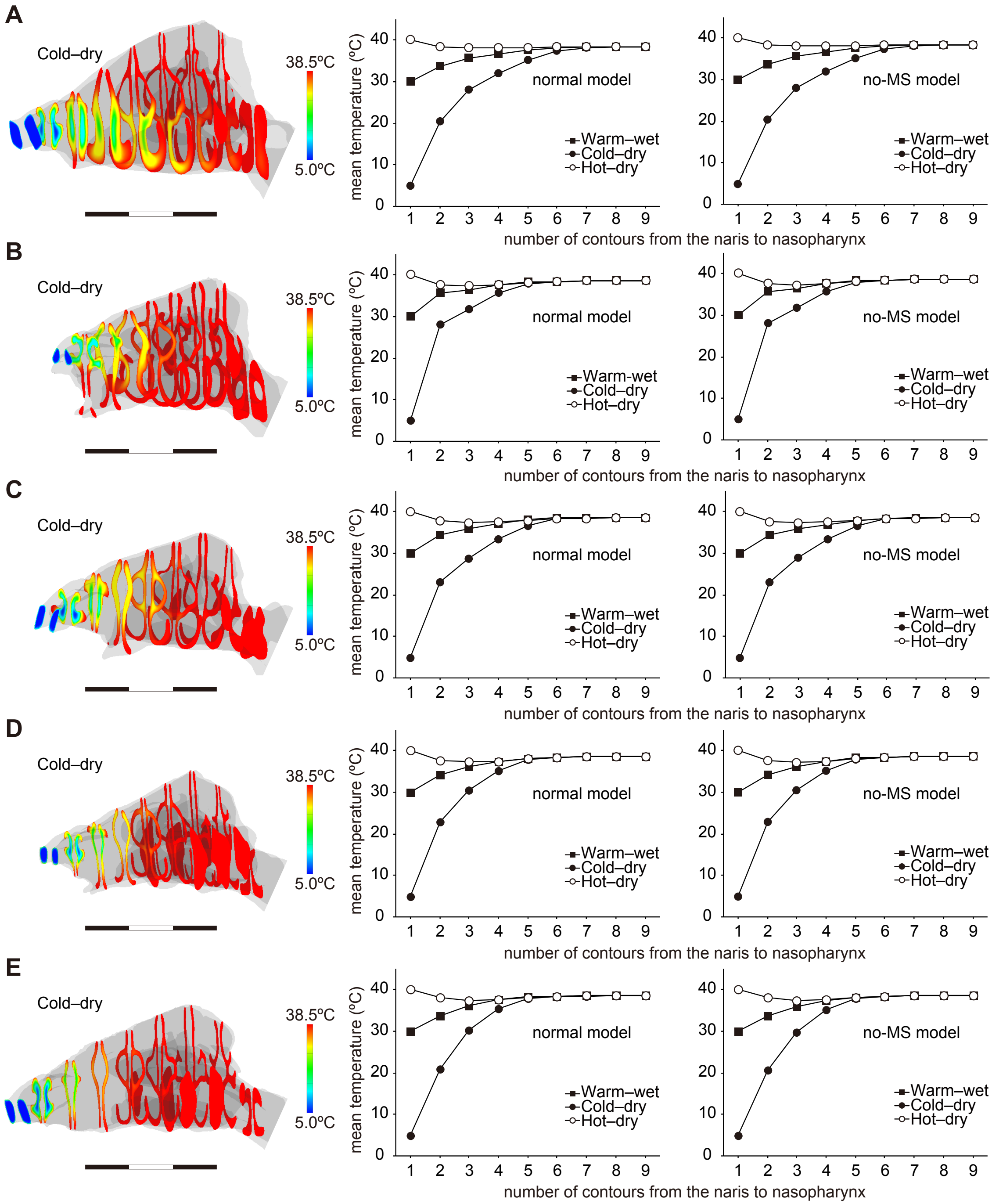

Fig. S2. Temperature distributions in the nasal passage. (A) Japanese macaque, *Macaca fuscata* (Mff963); (B) *M. fuscata* (Mff1859); (C) *M. fuscata* (Mff2115); (D) rhesus macaque, *M. mulatta* (Mm1701); and (E) *M. mulatta* (Mm1715). The mean temperature values for each contour, which were simulated with the normal model (middle) and the no-MS model (right), indicate the performance of adjusting the temperature to 38.5°C.

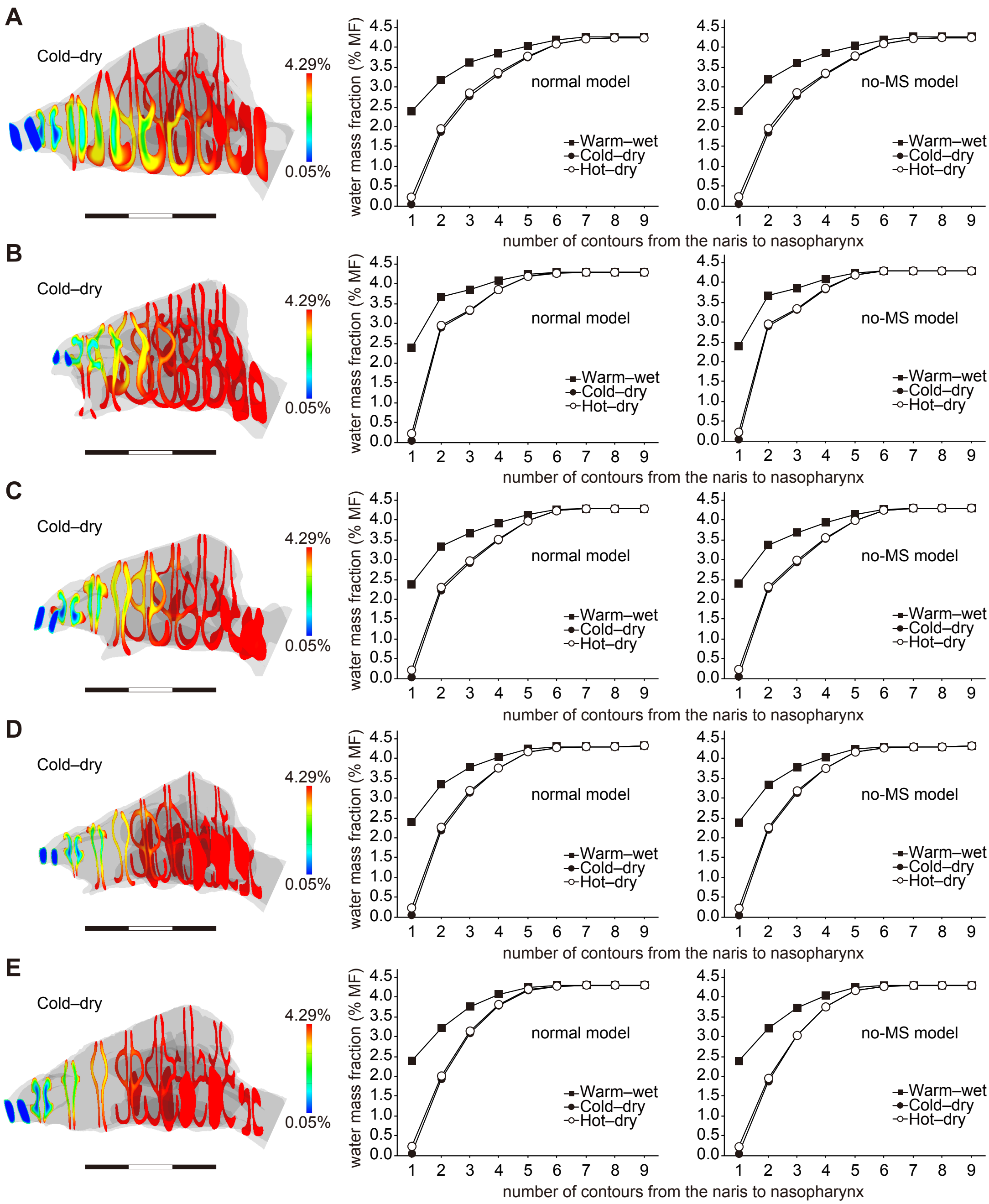

Fig. S3. Water mass distributions in the nasal passage. (A) Japanese macaque, *Macaca fuscata* (Mff963); (B) *M. fuscata* (Mff1859); (C) *M. fuscata* (Mff2115); (D) rhesus macaque, *M. mulatta* (Mm1701); and (E) *M. mulatta* (Mm1715). The mean water mass values for each contour from the nostril to nasopharynx, which were simulated with the normal model (middle) and the no-MS model (right), indicate the performance of water vapor transport in the inhaled air to 4.29% MF. The scale is in centimeters.

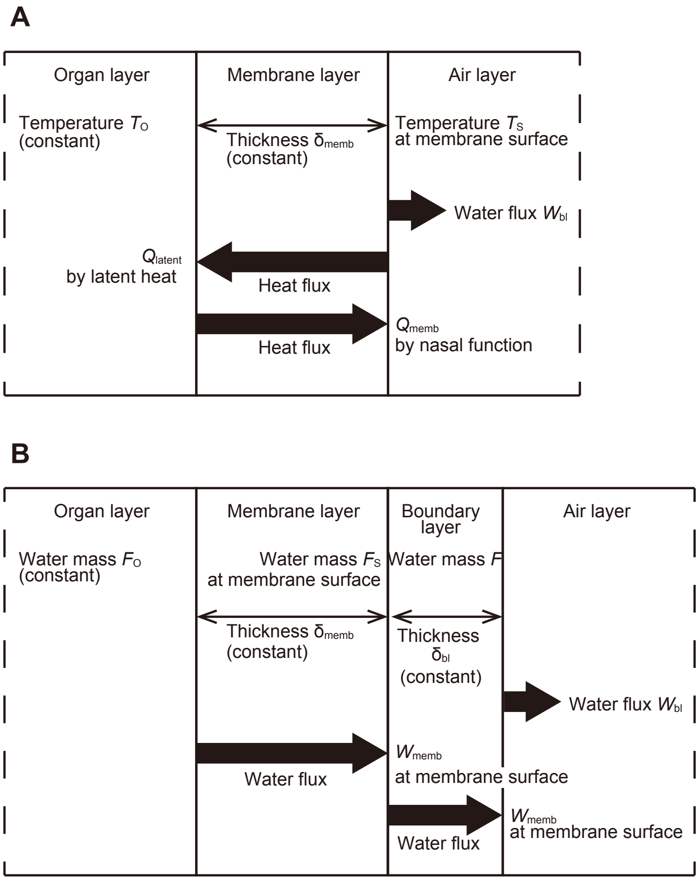

Fig. S4. Wall models of the nasal passage. (A) Model for heat exchange. Q_{memb}, Q_{latent} and W_{bl} indicate the heat flux of the nasal wall function, the heat flux of latent heat and the water flux from the boundary layers in (B), respectively. T_S, T_O and δ_{memb} are the temperature of the surface, the organ layer temperature and the membrane layer thickness, respectively. (B) Model for water exchange. W_{bl} and W_{memb} are the water flux from the boundary layer and the water flux from the organ layer, respectively. F, F_S, F_O and δ_{bl} are the water fraction in the boundary layer, the water fraction on the membrane surface, the water fraction on the organ layer and the boundary layer thickness, respectively.

Table S1. Subjects, scans and estimated respiration parameters.

				scans			respiration parameters			
subjects	sex	BW (kg)	age (yrs)	PRICT #*	resolution (mm/pixel)	interval (mm)	CA (mm^2)	TV (ml)	f (times/s)	FV (m/s)
Japanese macaque, *Macaca fuscata*										
Mff765	female	10.2	28	369	0.225	0.20	74	86.1	0.459	1.070
Mff963	female	6.6	26	374	0.250	0.20	258	54.7	0.514	0.218
Mff1859	female	8.7	9	46	0.263	0.20	122	73.0	0.479	0.572
Mff2115	female	7.9	5	380	0.125	0.20	210	66.0	0.491	0.308
Rhesus monkey, *Macaca mulatta*										
Mm1701	female	6.7	6	394	0.225	0.20	71	55.6	0.512	0.802
Mm1715	male	7.1	6	395	0.250	0.20	131	59.1	0.505	0.455
Savanna monkey, *Chlorocebus aethiops*										
Ca14	male	3.8	23	27	0.200	0.20	116	30.7	0.594	0.314

abbreviations: CA, cross-sectional area at the oropharyngeal level; TV, estimated tidal volume; f, estimated frequency of breath; FV, flow velocity at the pharyngeal level.

* The scans are registered on the website of the Digital Mo phology Museum (DMM) at KUPRI (http://dmm.pri.kyoto-u.ac.jp/archive/).

†estimated using the formula $TV = 7.69\,BW^{1.04}$

‡estimated using the formula $f = 0.84\,BW^{-0.26}$

§calculated using the formula $FV = \dfrac{2f \times TV}{CA}$